ROLE OF DEMOGRAPHIC AND SOCIAL FACTORS IN FORMATION AND DEVELOPMENT OF HIGHER EDUCATION ATTAINMENT IN LATVIA

Demogrāfisko un sociālo faktoru loma iedzīvotāju augstākās izglītības līmeņa veidošanā un attīstībā Latvijā

A thesis submitted for the degree of
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Author:

Zane Cunska
Doctoral student
Demography doctoral study programme
Chair of Statistics and Demography
Faculty of Economics and Management
University of Latvia
(Student ID. Dokt030121)

Supervisor:

Dr.h.oec., professor Juris Krūmiņš

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GLOSSARY OF TERMS AND DEFINITIONS

CSB	Central Statistical Bureau
Cohort	A group of individuals that enter higher education on the same academic year *(in the context of this work)*
Education path	A course or order of education programmes a person is undertaking over his/her life course; synonym "education career". In a narrower sense used in this paper as a way through higher education over a certain period of time.
Educational demographics	Or "demography of education": field of studies in demography, concentrating on analysis of education as a demographic variable.
EU	European Union
EUROPOP2008	Eurostat population projections 2008
Higher education / HE	See "Tertiary education"
Higher education population	Or "student population": the population undertaking studies in (Latvian) higher education institutions.
ISCED	International Standard Classification of Education. This research uses ISCED1997 classification. The new ISCED2011 classification is under development in UNESCO working group. The new classification is expected to be adopted in 2011 UNESCO General Conference and will foresee more detailed level disaggregation at tertiary education level, hence better representing the needs of modern education classification. Source: www.uis.unesco.org/Education/Pages/international-standard-classification-of-education.aspx.
LFS	Labour Force Survey
LU	University of Latvia
LUIS	University of Latvia Information System (Latvijas Universitātes Informatīvā Sistēma); the LU student register database
MSLT	Multi status life tables
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment (OECD programme)
School life expectancy	The total number of years of schooling which a child of a certain age can expect to receive in the future, assuming that the probability of him or her being enrolled in school at any particular age is equal to the current enrolment ratio for that age. This indicator shows the overall level of development of an educational system in terms of the number of years of education that a child can expect to achieve. *Source: http://www.uis.unesco.org/i_pages/indspec/tecspe_sle.htm*

Schooling time expectancy in tertiary education	*In the context of this work:* time in years a person, entering higher education institution, is expected to study.
Secondary education	ISCED97 Level 3, in Latvian *"vidējā izglītība"* .
Social mobility	Movement of individuals, families, or groups through a system of social hierarchy or stratification. If such mobility involves a change in position, especially in occupation, but no change in social class, it is called "horizontal mobility." An example would be a person who moves from a managerial position in one company to a similar position in another. If, however, the move involves a change in social class, it is called "vertical mobility" and involves either "upward mobility" or "downward mobility." *Source: Britannica online dictionary*
Study field	In the context of this research, study field or study area is defined according to Republic of Latvia Ministry of Education and Science classification (LR IZM klasifikators, LR MK 2008.gada 2.decembra noteikumi Nr.990, 2. pielikums) 3rd digit classification level. It establishes 10 education thematic groups or fields. Each of the groups can be disaggregated more at the 4th digit level.
Tertiary education	Or "Higher education" Programmes with an educational content more advanced than what is offered at ISCED (1997) levels 3 and 4. The first stage of tertiary education, ISCED level 5, covers level 5A, composed of largely theoretically based programmes intended to provide sufficient qualifications for gaining entry to advanced research programmes and professions with high skill requirements; and level 5B, where programmes are generally more practical, technical and/or occupationally specific. The second stage of tertiary education, ISCED level 6, comprises programmes devoted to advanced study and original research, and leading to the award of an advanced research qualification. *Source: UNESCO Institute of Statistics Online Education Glossary (available at http://www.uis.unesco.org/glossary/)* In this work terms 'tertiary education' and 'higher education' are used as synonyms, as suggested by the World Bank (*http://web.worldbank.org/*), and used often by researchers (e.g. Hazans et al, 2003). (Alternatively, sometimes term 'Higher Education' refers only to the academic strands of tertiary education, namely ISCED 5A and 6 (e.g. Bihonnek et al, 2010), but this approach is not taken in this work)
UN	United Nations
VID	Vienna Institute of Demography

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INTRODUCTION

The debate on the importance of the connection between demographic and educational characteristics is among central discussions of demographers in latest years. While education has always been among core demographic factors and accounted in population censuses in Latvia since 1920, the factor's importance has grown. The fact that Vienna Institute of Demography (VID) 2010 Yearbook is a special issue on "Education and demography" (Vienna Yearbook of Population Research 2010) is alone an indicator of the actuality of the topic. Furthermore scholars are considering calling the discipline "Educational Demography", or "Demography of Education", analogous to the well-established field "Economics of Education". However the terminology, researchers seem to reach consensus that education is an important source of heterogeneity for most processes that population statistics and projections are commonly used for.

With better statistics and registers over time the demographic discipline has developed: the emphasis from quantitative population indicators (such as total population, births, deaths, marriages) has moved more to its qualitative composition (i.e., the traditional indicators stratified e.g. by education level). While being a rather controversial issue, it is innovative approach to push the borders of traditional demography further and perceive education variable as a full member of demographic covariate family, and moving even beyond that – looking at what effects demographic developments have on the education sector. Wolfgang Lutz, one of the leading demography scholars as of today, is probably the most active advocate of inclusion of education among indispensable variables of demographic analysis. He suggests (Lutz et al, 2009:3033) that education should routinely and explicitly be included in any demographic analysis in the same way that age and sex are. It is argued that educational attainment is a well-specified and almost universally observed independent source of population heterogeneity at the individual level: "It has long been established in demography that education is one of the most important if not the single most important covariate of both fertility and mortality/health, second only to the demographic core dimensions of age and sex."[1] In 1999 (Lutz, Goujon and Doblhammer-Reiter, 1999) authors discuss criteria for dimensions that should be routinely included in any demographic analysis and find that the only three dimensions that meet all three criteria (interesting in its own,

[1] Sola schola et sanitate: human capital as the root cause and priority for international development? Wolfgang Lutz, doi: 10.1098/rstb.2009.0156, Phil. Trans. R. Soc. B 27 October 2009 vol. 364 no. 1532 3031-3047; p 3033

relevant source of demographic heterogeneity and properly definable and measurable) are age, gender and educational attainment. To support his argument even more, Lutz undermines and challenges the traditional interpretation of age as a chronological measure and gender as an unambiguous distinction between two biologically different population groups. He claims that "in 21st century demography traditional age and gender distinctions are in the process of losing their previously unquestioned 'natural' and absolute deterministic power, while at the same time educational attainment is increasingly recognised as a key determinant of our behaviour and our fate with significant educational differentials from cradle to grave" (Lutz, 2010:10). The author of this thesis shares the affinity for education dimension and proves that education has a major impact on population demographic behaviour. This perception is challenged by the argument that both age and gender are natural inherent covariates whereas education is a purely social construction. The real debate is contained in the belief whether education actually does anything to change people's minds and hence causes them to behave differently, or if it is only a reflection of social status and exhibits only a signalling function. If causality, i.e. a real effect, exists (and the author believes so based on substantial empirical evidence), education does change population behaviour and education by itself therefore deserves being researched in a demographic context. Then again, at some level it does not really matter if education causes demographic heterogeneity or whether it is only a signal, as long as it is consistent and allows for stratification. Having said that, the population of education itself – the students or students to be – is a significant subpopulation deserving demographers' attention. Chapter 1 of the thesis goes forward to position education in demographic analysis.

The period of acquiring education is an important part of the life cycle and affects parallel careers' developments, like family formation and work. The shape of the demographic life cycle is of fundamental interest, which demographers recognize through extensive efforts to estimate, describe and interpret the age-shapes of fertility, mortality, marriage, divorce, and migration. These age-shapes are influenced by biology, culture, socio-economic status, economic constraints and individual choice. Similarly, the shape of the education life cycle is of fundamental interest in its own right, and its shape is influenced by the same set of factors.

Year 2011 marks 20 years since Latvia regained its independence that brought along changes in any single sphere of peoples' lives, including education. The most noticeable trend in higher education in Latvia in recent decades (since 1995, to be punctual) appears to be its expansion, often referred to as the "massification" of higher education. This definition is not precise though. Referring to the classical work of Martin Trow back in 1974 (Trow, 1974:63-

65) and subsequent papers, the higher education system in Latvia along with other Western European countries have developed further to enter the phase of universal higher education[2]. Indeed, the enrolment ratio is about to reach the threshold of notational 50 percent of the age group, and by other Trow criteria the system has reached the characteristics of universal higher education. Acquiring higher education is seen more and more as an obligation rather than right. Children discontinuing education after secondary school are increasingly viewed as backsliders, and more labour market positions tend to be reserved for university graduates. More to that, institutions marked by universal access "prepare large numbers of people for life in the advanced industrial society". A very important implication for demographic purposes, increasingly observed in Latvian society, is that with the transformation from mass to universal higher education, the actual education career change: instead of direct access from secondary school to university, the education acquisition process becomes more diverse – interruptions between degrees, joining work and studies, softening borders between formal education and other forms of learning. It is of critical importance to realize that the 'new' system is not just a multiplication of the previous, but a different one; and to understand its new characteristics. This thesis contributes to the knowledge by exploring length of university studies and gender differences in Latvia. It provides a demographic model for analysing the study life cycle in higher education with expansion opportunities to general education system.

By the early 2000s the number of students per ten thousand inhabitants more than tripled as compared to early 1990s. So far the growth in enrolment rates has been related to both positive demographic trends in the respective population cohorts and increase of accessibility of higher education (via access to study loans, wide selection of study forms and programmes). Demographic development though poses growing concerns about the future of higher education in all developed countries. Most European countries are facing an unprecedented population aging. Depopulation is hitting especially hard the Eastern European countries, including Latvia. By 2050 significant expansion of young-age population is not projected in any European country (Zvidrins and Vitolins, 2005; Eurostat, EUROPOP2008). Quite the opposite – the size of younger cohorts is shrinking. As a consequence, the impact of the demographic decline on the education system is inevitable. It is therefore necessary to interpret and understand the demographic processes, which are currently so evidently affecting our societies.

[2] M.Trow describes development of higher education systems in three phases – elite, mass and universal higher education system. The phases are defined by enrolment prevalence in young age groups, but also by attitudes towards access, functions of higher education, curriculum and forms of instruction, student career setups, as well as other institutional and political factors.

Population projections for the EU countries reveal the demographic situation: in many countries, including Latvia, the share of the elderly population is increasing but share of youth population shrinking. Populations in the EU countries fail to reproduce themselves over a prolonged period with a 1.53 fertility rate (2006, EU27), and 1.35 in Latvia that is clearly below replacement rate of 2.1 (Zvidrins, 2007). European universities, which traditionally educate students aged 18 to 24 years, will in the future be affected by reduced size of the traditional target group. In fact, in Latvia this effect already started to be seen from the 2009/2010 academic year. Higher educations systems in all European countries will feel the impact. As discussed above, Latvia experienced a significant growth of education sector in earlier years and is especially under risk. This thesis develops projections of the higher education sector development by assessing possible scenarios of enrolment development.

The prosperous growth of higher education sector was disturbed also by the crisis that started in 2008 in US financial markets and is still causing severe implications on Latvian economy – budgetary cuts in all spheres, unemployment and emigration. Accordingly Latvian higher education and science have suffered from budgetary cuts, and even more importantly – from brain drain. Emigration was an issue already before the beginning of crisis (especially after EU accession), but Latvia has experienced the biggest in EU output drops and associated massive layoffs, causing the second departure wave. The real volume[3] of emigrants could be as high as 200 of even 250 thousand people (Hazans, 2011). The 2011 census would reveal the actual situation. Studying abroad also becomes more common representing the globalisation of education with increasing international competition between universities and students searching for better cost to quality ratio. The current research work does not directly account for crisis effects on emigration; accordingly the projections of declining enrolment may turn out to be even harsher.

Demographic processes are inert. Societies change along cohort lines, and it takes decades for the better-educated or otherwise different younger cohorts to make it up to the age of labour market participation. Someone born this year will at earliest be part of the workforce in 15 years, and someone taking up studies in university this year, will only make use of the acquired skills at earliest three years from now. Processes that policy affects now have implications in long term. Accordingly, demographic questions are seldom on the shortlist of governments' programmes, crowded out by more acute decision-requiring issues, like inflation, budget deficits, balance of payments etc. The author argues that social policy, including demographic policy, needs immediate actions in Latvia, and for that one has to

[3] The real volume here refers to the actual number of people that has left Latvia (including those working without employment contracts, children going together with parents, student going to study abroad), in contrast to registered emigration of tiny 4 to 7 thousand longterm emigrants registered per year in the last years.

comprehend the education cycle and socio-economic conditions that determine educational choice. Casual evidence indicates significant gender differences that have to be understood.

Educated people are an important precondition for dynamic state and regional development. It is a general perception in Latvia that human resources represent its key (and perhaps only) resource endowment, and increased education level and skills acquisition should be promoted by all means. Education, being a quality indicator of country's human capital, needs to be paid particular attention.

Importance of higher education in comparison to lower levels of education. Any education level above secondary school has somewhat special status compared to lower levels of education, which determines the reason for analysis in demographic context. *Firstly*, because usually university or college studies are the first conscious investment decision a person makes. In Latvia and most other developed countries primary education is compulsory, and secondary with a vocational education option is a standard. With the graduation from secondary school, individuals have to make the first dedicated choice – to study or to work, and if study – what to learn and where. Therefore it constitutes the first investment and first truly independent step in one's life course. *Secondly*, tertiary education gives the first profession and prepares persons for labour market. Even though general and, especially, vocational secondary education provides skills for work, the higher education enables to be independent, creative and innovative at higher level than secondary education. This affects the labour market and is of particular interests to labour economists. *Thirdly*, higher education students are an heterogeneous population group, interesting for demographic research in itself. *Finally*, education is a separate economics sector with high export potential of its higher education segment. It is a very important issue for competitiveness and more generally for economic structure.

Altogether these four reasons mean that higher education choices and the student population are important not only for demographers' interest, but also in policy-making context. It is in the state responsibility and in its interests to influence the processes.

The aim of the thesis therefore is to document the interaction between demographic characteristics and higher education in Latvia with emphasis on gender issues and socio-economic background; and develop a model for analysing the higher education lifecycle.

The research object is the higher education population in Latvia – the population undertaking studies in Latvian higher education institutions.

The following ***research questions*** are raised:

- What are the links and their theoretical foundations between education as a demographic characteristic and other demographic variables?
- How can Latvian higher education population be described in demographic terms – what is the gender structure and socio-economic situation of Latvian students?
- What is an appropriate demographic model for analysis of higher education lifecycle in Latvia?
- Do gender differences exist in higher education lifecycles in Latvia?
- What awaits Latvian higher education system in the following decades?

To answer the research questions, the following ***tasks of the thesis*** are formulated: (1) to describe ways how educational characteristics affect demographic processes and vice versa; (2) to analyse population of Latvia with respect to the level of education; family background, socio-economic and demographic situation of Latvian higher education population (including dynamics, age and gender structure); (3) to study the gender specific patterns and length of enrolment in higher education in Latvia by constructing multistate model to analyse student life course through the higher education system and test the model on data for higher education in Latvia; (4) to project higher education enrolment in Latvia for middle term; (5) develop suggestions for higher education system development and analysis methods.

The following ***hypotheses*** are formulated to be defended in this dissertation:

1. Education is a source of heterogeneity in the society. Population groups are significantly different if stratified by the level of education;
2. The current statistics about higher education enrolment, progression, attainment and outcomes in Latvia is insufficient for comprehensive and in-depth analysis and should be developed;
3. Population education structure and attainment in Latvia has significantly changed over previous two decades;
4. The study paths in higher education are highly influenced by student gender, family background and parental socio-economic status;
5. Study paths, dropouts and attainment in higher education differ between males and females;

6. Demographic development in Latvia will have negative impact on tertiary enrolment in the future years.

Novelty

The thesis contributes to the existing literature by (1) developing and adapting three specifications of multistate model, that has not been used in education research, for analysing higher education life-path, applicable to Latvia and possibly other countries; (2) providing analysis of student population socio-economic and gender structure in Latvia; (3) offering a set of three alternative scenarios of possible tertiary enrolment numbers till 2020; (4) summarizing the findings of empirical and theoretical links between education and other demographic variables; (5) providing suggestions for future higher education system formation and data requirements for future research, based on the expected demographic situation and student education paths choices.

Limitations

If not stated otherwise *higher education* in terms of this thesis is the tertiary education according to the International Standard Classification of Education (ISCED 1997) (see Appendix A1), ISCED Level 5 (first stage of tertiary education, both 5A and 5B) and Level 6 (second stage of tertiary education). According to Latvian education classification[4], these are levels 4 and 5, or 41 to 51 in two digit classification - all higher education levels. Where education fields are analysed, the classification is provided.

The interest mainly lies with the student body in Latvian higher education. Faculty and staff in higher education and the demographic aspects associated with them are outside the scope of this thesis. Likewise – even acknowledging its importance – the thesis does not concentrate and analyse study quality and labour market career. Only the formal education career is modelled, any kind of informal education and qualification trainings are not the object of the thesis and are only marginally mentioned. The author does not explicitly study lifelong learning, the issue only being marginally touched along with age structure analysis of student population

The thesis covers time period between 1991 and 2010. Database for multistate modelling covers the period from 2002 to 2010. The surveys refer to the year 2006, 2008 and 2009.

[4] 04.04.2006. MK noteikumi Nr.267 "Noteikumi par Latvijas izglītības klasifikāciju" ("LV", 58 (3426), 11.04.2006.) [spēkā ar 12.04.2006.]

Where data on Latvian total population is used, the author uses official Latvian CSB data, based on Latvian population register. This data does not fully account for emigration. The provisional results of 2011 census suggests that information has been obtained about 1.9 million Latvian inhabitants, some 300 thousand people 'missing' compared to the population register. Hazans (2011) has estimated that between 200 and 250 thousand people have emigrated between years 2000 and 2011. He reasons that 80 percent of the emigrants are aged 0-34, i.e., the age of students and potential students. The official results of 2011 population census will only be published in February 2012. This difference has to be taken into consideration when interpreting results especially of the enrolment projections section. If the basis population is smaller, the estimated projections would turn out to be too optimistic.

Data sources

During the period of writing dissertation the 2011 census data are not yet available. Given the focus of the current research, it relies on graduate survey data and on LU student register as primary sources; and statistical data from Latvian CSB and Eurostat that are collected based on register information and surveys as secondary sources.

Chapter 3 of the dissertation is based on database collected in terms of European Structural Fund national programme "Labour market research" project "Ministry of Welfare research" project "Higher and professional educational institutions graduate professional career after graduation" (n=2504) (further – Graduate Survey 2006)[5]. The databases and results of two other projects: "Professional and higher education programme conformity with labour market requirements (n=10025) (further – Labour market conformity project), and "Geographic mobility of labour force" (n=1080) (further – Migration project) are mentioned. The author has been part of the research teams of the above projects.

The other major source of data used in Chapter 4 is the University of Latvia Information System (LUIS) that contains individual level data on all University of Latvia students. The full education history of cohort of 2002 entrants (n=2879) in University of Latvia undergraduate studies is used to approbate the developed model and obtain results about gender differences in study paths.

To study the family impact on student education choices, and make EU-wide comparisons, the EUROSTUDENT 2006 project survey data for Latvia (n=1000) and University of Latvia 2009 research project "Modelling student number, content and

[5] Here and further in text: the 'Graduate Survey 2006' refers to the survey performed under Ministry of Welfare Labour Market programme project "Augstako un profesionalo macibu iestazu absolventu profesionala darbiba pec macibu beigsanas".

motivation in higher education" (n=2141) are used. Latvian Central Statistical Bureau, Latvian Ministry of Education and Science, EUROSTAT and OECD statistical data are used.

The literature used consists of earlier research in Latvia on demographic and education issues, foreign theoretical sources and journal articles; and foreign and local reports. The author also uses her practical experience and knowledge acquired during the study stay in Université Catholique de Louvain, Belgium, and from attending numerous conferences on demographic and on education topics.

Methods

The following methods are used in the dissertation work:

- Analysis of previous literature and reports on education, demography, projections, multistate modelling;
- Quantitative methods (multistate modelling, descriptive analysis, graphic representations, sampling and data grouping);
- Qualitative methods (expert interviews, case studies, author observations).

Scope and structure of the thesis

The thesis consists of introduction, 5 chapters, conclusions and recommendations, supported by 6 appendices. The total length of the thesis excluding appendices is 157 pages in type-writing. It contains 32 figures and 26 tables.

The first two chapters form the theoretical part of the thesis. Chapter 1 sets out the theoretical framework for analysing education in a demographic context and motivates the importance and need for education in demographics. The chapter reviews literature and shows theoretical interconnection between education and different aspects of demography, such as fertility, mortality, health, migration and other aspects. Chapter 2 is rather technical and addresses indicators and statistics for higher education research. Firstly, the author evaluates measures that are typically used to describe education and assesses data availability in Latvia. Further the author studies two country examples of data gathering systems and develops a proposal for higher education data gathering systems for Latvia.

The latter three chapters constitute the empirical part of the thesis. Three approaches are taken to answer the research questions and verify hypotheses. Chapter 3 takes a descriptive and cross-sectional approach to investigate the education-demographics topic: the author describes Latvian situation by the nominated measures, applies multinomial logit models and t-test to assess social background, incl. parental education, and gender impact on individuals' study choice Chapter 4 uses the well-known in demography life-course approach. The author

develops a theoretical multistate model (3 complementary specifications) for higher education in Latvia and applies them to the University of Latvia student database. Chapter 5 looks into the future development of higher education in Latvia. One of the sections is devoted to setting the international scene to inform the reader about the most important education development trends in the world. Further it develops enrolment projections for Latvia, using a trend extrapolation method and gives a set of three alternative scenarios for enrolment in Latvia till 2020. The last chapter concludes and gives recommendations.

Approbation

The results of the research has been presented and discussed in 18 conferences, 8 international and 10 local, 8 refereed publications and 5 reports have resulted from the research. The author has participated in 7 research projects directly related to the thesis topic.

Presentations in conferences and seminars:

- "Indivīdu studiju ceļu saistība sociāl-ekonomisko izcelšanos un vecāku izglītību", Latvijas Statistiķu Asociācijas (LSA) lasījumi, seminar (Riga, Latvia, 17 October 2011)
- "Gender Differences in Tertiary Education Student Profiles in Latvia", in international conference "Current issues of business and society development 2011" (Riga, Latvia, 6 May 2011)
- "Comparing male and female student study paths in Latvia", Comparative and International Education Society 55th annual conference (CIES2011) (Montreal, Canada, 3 May 2011)
- "Studējošo uzskaite augstākajā izglītībā: atbalsta sistēma lēmumu pieņemšanai izglītības politikas jomā" (*en: Student accounting in higher education: support system to decision-making in education policy*), Strategic Analysis Commission (SAK) conference „Nepieķemmētas idejas valsts attīstībai" (Riga, Latvia, 10 May 2011)
- "Studējošo sociālekonomisko un demogrāfisko profilu dzimumu atšķirības Latvijā" (*en: Gender differences in student socio-economic and demographic profiles in Latvia*), University of Latvia 69th Scientific conference (Riga, Latvia, February 4 2011)
- "Analysis of higher education population using multistate life tables", in 10th GDN Regional Research Competition Workshop, CERGE-EI (Prague, Czech Republic, 22-23 August 2010)

- "Tertiary education enrolment trends and projections in Latvia", in Joint Eurostat/UNECE Work Session on Demographic Projections (Lisbon, Portugal, 28-30 April 2010)
- "Impact of demographic decline on development of higher education in Latvia", in Comparative and International Education Society 54th annual conference, CIES2010 (Chicago, United States, February 27 – March 3 2010)
- "Daudzstatusu pārejas demogrāfiskais modelis studējošajiem Latvijā" (*en: Multistatus life table demographic model for students in Latvia*), University of Latvia 68th Scientific conference (Riga, Latvia, February 2 2010)
- Research results presentation in Jean Monnet doctoral colloquium (in terms of doctoral school "Baltijas jūras reģiona valstu integrācija ES nozīmīgākās sadarbības dimensijās") (Riga, Latvia, September 30 2009)
- "Sociālā un izglītības politika Latvijā pēc iestāšanās ES" (*en: Social and education policy in Latvia after EU accession*), in 3rd inter-university master and doctoral students conference "ES un Latvija: izejas no krīzes meklējumos", (Riga Stradins University, Riga, Latvia 10 May 2009)
- "Social policy implementation in Latvia after EU accession", public research presentation and discussion in European Union house (Eiropas Savienības māja) (Riga, Latvia, 21 April 2009)
- "Mobility of Student Population: the Regional Perspective in Latvia", in All China Economics (ACE) International Conference (Hong Kong, 12-14 December 2007)
- "Compliance of Professional Activity of Engineers, Health Care and Education Professionals to Acquired Qualification" (authors: I.Jaunzeme, Z.Cunska), in international conference "New Socio-Economic Challenges of Development in Europe" (Riga, Latvia 2-4 October 2008)
- "Studentu starpreģionu migrācija Latvijā" (*en: Student inter-regional migration in Latvia*), in University of Latvia 66th Scientific conference (Riga, Latvia, January 30 2008)
- "Demogrāfiskās izmaiņas: ietekme uz augstākās izglītības sistēmu Latvijā" (*en: Demographic changes: impact on higher education system in Latvia*), in University of Latvia 65th Scientific conference (Riga, Latvia, February 9 2007)
- "Compliance of selected professions employment to acquired qualifications" Jaunzeme I. un Leduskrasta Z. in University of Latvia 65th Scientific conference (Riga, Latvia, February 9 2007)

- Presentation on education in Latvia in Salzburg seminar session 436 "Beyond the University: Shifting Demographics in Higher Education", (Salzburg, Austria, November 9 2006)

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- Report „The Geographic Mobility of the Labour Force" (in Latvian "Darbaspēka ģeogrāfiskā mobilitāte"), Krišjāne Z., Eglīte P., Bauls A., Cunska Z., et al, LU, Rīga, 2007

Participation in research projects:

- Research project "Evaluation of Latvian competitiveness and development of sustainable competitiveness monitoring system" (a project commissioned to SSE Riga by LR State Chancellery): researcher. The author has been responsible for analysis and writing up of the topics related to demographic development (endowments) and education (knowledge infrastructure).
- Research project "Analysis of higher education population using multistate life tables", (8th Global Development Network Regional Research Competition (01/01/2010 – 31/12/2010, RRC-10), CERGE-EI), main researcher. The author has analysed and assessed possibilities to use MSLT for analysis of students with example and application to University of Latvia students.
- Research project "Midterm enrolment projections for student number and structure taking into account student motivations and expectations with respect to higher education" (in Latvian "Studentu skaita un sastāva vidējā termiņa prognozes, ņemot vērā studentu motivāciju un gaidas attiecībā uz augstāko izglītību" (01/07/2009 – 31/12/2009, University of Latvia research grant): senior researcher/project leader. The author has established, organized and analysed the

survey of LU bachelor programme graduates in spring 2009; as well as computed projections for student enrolment in Latvia.

- Research project "Social Policy in Latvia After EU Accession" (Year 2009, European Commission representation in Latvia), researcher. The author has participated and actively involved in preparing the report on Latvian social policy after 2004.
- Research project "Professional Activities of Graduates of Higher and Vocational Education Institutions after Graduation" (in Latvian „Augstāko un profesionālo mācību iestāžu absolventu profesionālā darbība pēc mācību beigšanas"), (01/08/2005 – 01/12/2006, project "Studies of the Ministry of Welfare" National program "Studies of the Labour Market" of European Union Structural Funds No VPD1/ESF/NVA/04/NP/3.1.5.1/0001/0003), researcher. The author participated in the project by analysing database on student study paths and career in connection with family and socio-economic background, and graduate socio-demographic profile.
- Research project "Compliance of Professional and Higher Education Programmes with the Requirements of Labour Market" (in Latvian „Profesionālās un augstākās izglītības atbilstība darba tirgus prasībām"), (01/08/2005 – 01/12/2006, project "Studies of the Ministry of Welfare" National program "Studies of the Labour Market" of European Union Structural Funds No.VPD1/ESF/NVA/04/NP/3.1.5.1./0001/0003, researcher. The author has been responsible for analysing commanded by individuals and demanded by labour market skills, responsible for analysis of connection between education (acquisition year, age, speciality) and unemployment, as well as involved in development of the survey questionnaire for economically active population.
- Research project "The Geographic Mobility of the Labour Force" (in Latvian „Darbaspēka ģeogrāfiskā mobilitāte", (01/08/2005 – 01/12/2006, project "Studies of the Ministry of Welfare" National program "Studies of the Labour Market" of European Union Structural Funds No. VPD1/ESF/NVA/04/NP/3.1.5.1/0003), researcher. The author was responsible for analysis of internal and external migration in connection with the level of education, drawing migrant socio-economic profiles and analysis of telework.
- International research project "Funding Systems and their Effects on Higher Education Systems" (01/09/2004 – 01/03/2006, University of Latvia in

cooperation with IMHE OECD), researcher. The author was involved in interviewing key stakeholders and writing the Latvian report.

1 LINKING EDUCATION AND DEMOGRAPHIC PROCESSES

Ever since history of human population has been written, people have learned. Education is a process of receiving or giving systematic instruction (New Oxford American Dictionary). At the same time education is also a body of knowledge acquired while being educated. Hence *education* is a concept closely linked to human nature. Education as a major factor affecting demographic variables, and the effect of demographic variables on educational attainment, have been widely recognized for decades and studied extensively in the demographic literature. "(..) it is generally accepted that education both influences and, over time, is influenced by demographic factors" (UN, 2003).

Interrelations between demography and education take many forms and are reflected in this chapter that is devoted to describing the role of education in population research. This chapter provides a summary of recent findings on various aspects of population, and concentrate especially on such factors as gender and socio-economic status. In general these associations may reflect the effects of education on demography, and the effects of demographic factors on education, as well as joint effects of other factors that may separately influence both education and demographic variables.

Section 1 of this chapter defines the education as a demographic variable. Further sections review literature and theories to find factors that determine education attainment (section 2) and to analyse impact of education level on population processes (section 3).

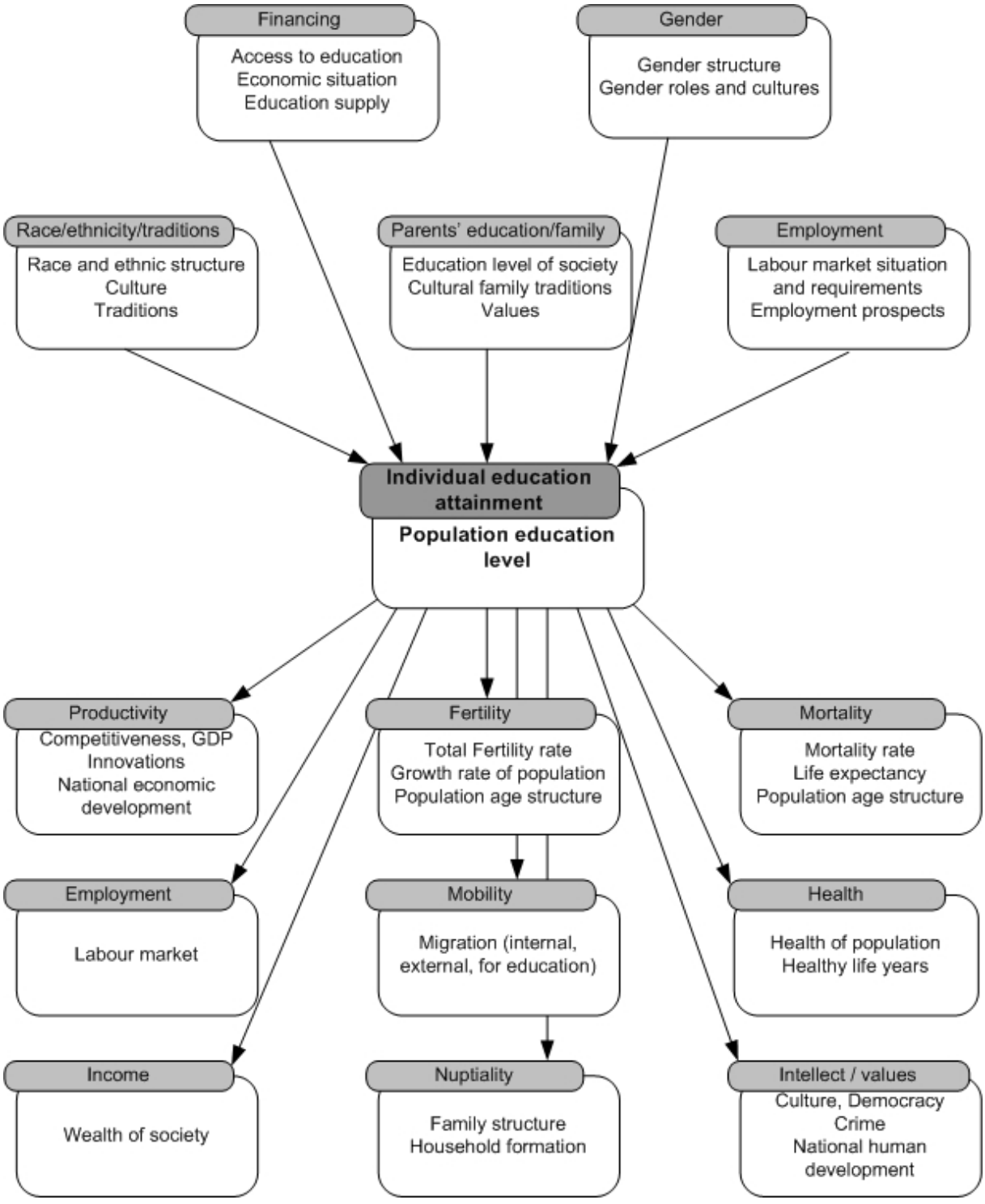
1.1 Education as a demographic variable

Education is a dimension that is both decisive at micro and macro level. Indeed, at individual level education is perceived as a crucial variable in explaining behaviour differences in fertility, health and lifestyles, migration, labour market performance and other fields. When aggregated, these individual decisions have dramatic consequences for population. At macroeconomic level education is an indicator of size, quality and potential of human capital – education provides the necessary skills for human capital and is an engine for economic growth.

From the other side, educational attainment is not a random variable – educational choice is influenced by the surrounding world and environment – family, culture, economy.

Therefore the system of linkages of education is very wide and its role cannot be underestimated (see Figure 1.1).

Figure 1.1. Linkages between education and other population determinants



Source: author's figure
Note: micro (individual) level factors on grey, macro level effects on white background.

Two levels of influences have to be distinguished – the micro and the macro level. Accordingly Figure 1.1 can be read in two layers with individual level effects on grey background, and macro level – represented on white background boxes. Each box therefore represents the individual as a part of a bigger population. The educational choice is made at individual level, and the influence is primary on a person's life – be it fertility, family

formation, mortality or employment. But the population is formed by individuals, and the effects multiply to macro level. The total fertility and growth rate of the population depends on individuals' choices, the family structure in the society depends on individual decisions to get married or divorce, life expectancy is retrieved from life tables that are calculated based on micro data, and the labour market consists of individual workers. Many more similar examples may be brought; the micro-macro link therefore may not be ignored.

There are two broad sets of factors. First, the factors that affect or explain educational choice and education level (financing, employment status, gender, parents' education, family values, as well as race and ethnicity), i.e., where the causality goes from the factor to education. Secondly, there are all the fields that are directly affected by the level of education of the individual and population. There education is explanatory variable of fertility, nuptiality, mortality, health, mobility, productivity, employment, income, and intellectual development. The following sections are structured according to the schematic drawing in Figure 1.1 – section 1.2 covers the linkages from population factors to education, and section 1.3 features how education affects population processes and individual performance.

1.2 Determinants of education attainment

The sources that influence educational choice are diverse and represent a wide spectrum of socio-economic conditions where individual originates.

1.2.1 Gender

Gender, along with race and ethnicity, are the individual characteristics that are normally unchangeable. Accordingly, it is often a major source of population education differences and often represents discrimination.

The concept of gender in relation to education refers to the idea that the educational system does not offer the same type of opportunities for upward mobility to both genders equally. Indeed, traditionally education is gender specific. In the societies with highly distinguished gender roles (for example, Central Asia, Arab countries, Western societies before middle of XX century), females would be perceived to live family-oriented life and employment career would be of second importance, resulting in comparatively little investment in schooling. In such societies average male education level exceeds that of females. In a more egalitarian society, females receive more education and nowadays in modern societies (developed countries) their participation and attained education level exceeds that of males. Even so, there is a large gender gap in what courses males and females take, which leads to different educational and occupational paths. For example, females tend

to take fewer advanced mathematical and scientific courses, thus leading them to be less equipped to pursue these careers in higher education, but males, for example, are underrepresented in humanitarians. It is a sizeable field of multidisciplinary educational research that places gender in relation to other key social characteristics and seeks to analyse if gender is a source of difference. An interested reader is directed to numerous gender studies in education, for example, Jacobs 1996 and series of journal "Gender and Education".

The education level of women in Latvia is considerably higher than that of men in all age groups (Goša, 2004: 46). Goša also finds that "between 1989 and 2000 the number of women with a higher and a specialized secondary education increased much more quickly than was the case among men". In terms of persons aged 20-24 years who have acquired a secondary and higher education, women in Latvia exceed the average level of the European Union member states, while men lag behind it. There is a similar situation in terms of lifelong learning indicators (Krumins et al, 2006: 18)

1.2.2 Race, ethnicity and traditions

The headline figures would typically indicate that education attainment correlate significantly with race and ethnicity, giving inequality in access. If such analysis is performed for a country with big minorities populations, the difference usually is important. The best example is probably United States. There recent history (from 1980 to 2000) shows that the educational attainment gaps between whites and Hispanics, African-Americans, and Native Americans are widening (Kelly 2005, but also numerous other studies). The causality though is not all that straight forward. Haveman and Wolfe (1995) after a literature analysis warns, that "most of the studies find that race is not associated significantly with educational attainment when family income and other background characteristics are included in the models; indeed, when these factors are controlled for, African American children, especially daughters, have more schooling than do non-African Americans." Even it is only an example of the USA, what this makes to conclude is that the race or ethnicity by itself is not a source of discrimination in the education sector, but is affected via income of parents, i.e., the different stand in labour market. It is well documented that non-whites in US earn less than do whites. Similar examples may be brought from other countries, for example, Germany, France, UK, Australia where correlation between ethnicity and education level is observed. In Latvia, the race issue is not relevant. In the Baltic countries with big Russian minority the ethnicity (minority) effect has been documented by Hazans, Trapeznikova and Rastrigina (2008) – they find that in Baltic countries the probability to complete tertiary education for minorities (predominantly Russian) was 7-8 percent points lower than for the titular

population. In Estonia and Lithuania the gap is diminishing, while in Latvia that gap historically was lower, but tends to increase. The ethnic education differences in Latvia are significant for some minorities – for example, the Jewish minority is very well educated, while Roma minority is characterized by very low education levels at all age groups (Latvian CSB, 2000 census).

Even though the causalities are somewhat disputable, and the impacts may be radically different or even opposite depending on the country or part of the world, in any separate country personal characteristics like gender, race or ethnicity is typically a statistically significant predictor of probability of attaining a certain level of education.

1.2.3 Family, parent education and values

It is well documented that parental education is a main explanatory factor for children education: the higher the education of the parent, the better – on average – the performance in school and the higher the education of the offspring (for a review of the literature on the determinants of educational attainment see Haveman and Wolfe (1995)). This association is confirmed by Pfeffer (2008) for 20 European countries, and this relationship was demonstrated to be persistent over time.

Wide range of literature in demography as well as in labour market studies examines intergenerational transmission of human capital suggesting both theoretical models and providing evidence (for example, Hazans, Trapeznikova and Rastrigina (2008), Cameron and Heckman (2001), Ermisch and Francesconi (2001), Dustmann (2004)). There are two main theoretical sources of the intergenerational link: genetic and behavioural. On one hand, more educated parents tend to be more intelligent, and children may have inherited their abilities genetically (Hazans et al, 2008). On the other hand more educated parents typically value education higher and by their example transmit these values to their offspring. They also create friendlier study environment, they bring children to better schools and are ready to invest their own time and financial means to support children education. By various means they encourage children education. Also empirical evidence suggests that parents with higher levels of education generally attach higher importance to the education of their children and therefore invest more time and money in their children's education. In addition, they tend to have higher income and fewer children, both factors leading to higher available resources per child. This implies an intergenerational chain transmitting the attitude towards the formation of human capital from one generation to the next. Hazans (2008) modelling 1999 NORBALT data has documented parent-children education effects in transition period in Baltic countries

– “parental education is found to have a strong positive effect on propensity to enrol in and complete secondary and tertiary education, both in Soviet times and during transition”.

The family experience and values, parents’ education history affects educational outcomes also by means of *expectations*. It is well accepted that parents' expectations have a powerful effect on children's academic performance: "It is clear that high achieving children tend to come from families which have high expectations for them, and who consequently are likely to 'set standards' and to make greater demands at an earlier age" (Henderson and Berla, 1994). They found that this held true across all social, economic, and ethnic backgrounds.

Individual research reports and comprehensive reviews of published studies demonstrate that an extremely wide variety of parental and *family characteristics* can have an impact on children in school. Beyond the now widely accepted belief that the family's socioeconomic status has an influence on achievement, it has also been shown that parental characteristics, the overall nature and atmosphere of the family, the general nature of parent-child relationships, and the interactions between parents and children concerning school activities all have an influential role in determining achievement (e.g., see Ryan & Adams, 1999).

The contribution to children’s education by two other parental characteristics have been regularly studied – the *family structure* (e.g. living in a one- vs. two-parent family) and the *extent of mother’s work*. Interestingly, in all studies known to the author that included information on family structure, growing up in a one-parent family is negatively related to the level of schooling attained, whereas the evidence on effects of mother’s employment on children education attainment is mixed. A negative correlation is found between number of siblings in the family and their education attainment, the so-called dilution effect (Ferrari and Zuanna 2010, and esp. Blake (1980)). Loury (2006) goes further to prove that *extended family members* (grandparents, uncles etc.) have an important role on children education.

I. Ciemina in her dissertation (Ciemina, 1988) studied student socio-demographic composition in Latvia in 1980ies. She found that students coming from higher educated families were more likely to persue higher education and their grades were higher. Offspring of clerks were more prone to achieve higher education level compared to other profession groups. She also found gender disbalances in study programmes by fields, as well as that female students in all higher education institutions in Latvia were on average higher than for male students. Already in 1980ies the number of female students exceeded the number of male students – a tendency that has continued to nowadays.

Correlation between parents and children professions, or the field of studies illustrate the inter-generational (across generations - changes in social status that occur from the

parents' to the children's generation (Lopreato, 1970)) social mobility in the country. It is very typical that children follow steps of (one of) the parents and choose the same or closely related speciality, hence inheriting their social level. This issue is getting a lot of attention in recent years; for example, it is studied in Eurostudent III projects (Orr, 2008).

1.2.4 Financing

Availability of financial resources and wealth of a person is yet another important factor determining the amount and field of education. Education costs money. Study fee is only part of the costs, the other being related to living and school expenses, and opportunity costs of the time spent in education. Hence, even if the school/university is free, it is not necessarily accessible to everyone. Findings from previous studies show that children originating from low-income families tend to have lower education and labour market attainments than children from more affluent families, suggesting that parental choices or attributes that result in reduced access by offspring to economic resources increase the risk of low attainment.

The various state higher education financing models have different effects on accessibility. It is arguable which is type of education financing model that is the most egalitarian, diminishing the effect of individual's financial stand on access to educational. Often fully state funded higher education is perceived as the model that gives most equal opportunities for all society members to attain the desired education. Though, if competition for study places exist, the individual's financial situation can be crucial (via previous education quality). Hence, paid education, but with an efficient (accessible) study loan system, is that which provides access to everyone interested (Kasa, 2007).

The financial resources that are at disposal to the individual for educational purposes consist of the family income and wealth, own income and savings, stipends and donor funding, as well as study loans. The family income variable is positively associated with the educational attainment of the child, and the variable is statistically significant in most cases where a positive relationship is estimated (Haveman and Wolfe, 1995).

There are several ways financing influences educational choices at an individual level. Firstly, very straight and direct, it is the ability to pay study fee and cover the other expenses connected to studying – it may include living expenses away from home, study materials, transport etc. Secondly, the opportunity costs determine the time of leaving school, as shortage of money may be a reason for a need to terminate education and enter the labour market. Thirdly, better financial stand allows better preparing for the university – acquiring more qualitative secondary education, attend preparation classes and have better private teachers if needed – and therefore perform better in the entrance examinations. In Latvia, that also means higher chances to receive and retain one of the state-financed budget places,

which are allocated according to the results of entrance examinations (central secondary school graduation examinations) and study results.

1.2.5 Employment

The labour market situation affects schooling enrolment decisions, i.e., the demand for education. There are two main lines of reasoning to be found in the literature. First, when conditions in the labour market are bad, leaving school and entering labour market is less attractive because new entrants have few job opportunities, and received lower wage, so people would rather stay at school. This is called the "discouraged worker" effect (Weber 2002). Therefore high unemployment and especially high youth unemployment reduces the opportunity cost of education and have a positive effect on enrolment. However, exactly the opposite effect, called "added worker effect", may be present under the same conditions. This reasoning argues that an increase in the unemployment and usually associated decreasing wages or loss of job of some of the household members reduce the household income and this can encourage early school leaving.

Substantial empirical evidence has been gathered using time series (Betts and McFarland 1995, Card and Lemieux 2000) and cross sectional region data (Rice 1987, also in Card and Lemieux 2000) that proves a positive relationship between total unemployment and enrolment. Studies that make use of relative differences in unemployment between levels of education find that high unemployment in the lower skill levels has a positive impact on enrolment, driven by re-qualification needs (Weber 2002). But there are also studies that cannot find positive, but show negative or insignificant relationship between unemployment and enrolment in higher education institution (e.g. Kane 1995). Even though there is no direct evidence about Latvia it is rather evident that labour market is among the most important factors that shape demand for education.

At the quality and content level of the education, it is also the labour market – the employers – that decides what skills are needed and demand them from the workers. If these requirements are deficient, sufficiently stable, and communicated, the universities adjust and establish study programmes to include the courses for acquisition of required skills, and population respond by taking up the demanded type of education. This way labour market is directly and closely linked to education.

1.3 Impact of education on population processes

The spectrum of fields that are directly influenced by education is also wide and lies anywhere between demography, economy and anthropology.

Time distinguishes education from other financial investments. Time in school helps to shape individual's personality and perspectives of life. Students interact with others, learn alternative views and discover new ideas, forming their view of life. They also acquire new skills that help to earn more money and be successful in the labour market. Increasing wealth clearly is the central motivator for why students pay the opportunity cost in form of foregone earnings and suffer through the effort of learning and exams. From the economic theory point of view education is a tool that forms and shapes the human capital embodied in people.

The experience and skills acquired generate also many other non-financial returns. Education may not only affect income, but also the degree one enjoys working, or the likelihood of not being able to find work. Schooling offers more opportunities for self-accomplishment, social interaction, and independence. Education can give people better understanding to making better rationalized decisions about health, marriage, family behaviour and planning. Researchers have suggested that schooling improves patience, tolerance, making individuals more goal-oriented and less likely to engage in risky behaviour. It generates occupational prestige, reduces the risk of unemployment by improving success in the labour market. Better decision-making skills learned at school lead to better health, happier marriages and usually more successful children. Schooling encourages patience and long-term strategic thinking; it promotes trust and civil participation. The demographic influences are the most visible.

The various impact factors of education on an individual (i.e., at microeconomic level) and population (at macro level) can be classified in nine socio-economic and demographic fields: the truly demographic factors – fertility, nuptiality, mortality; the factors on the margin of demography and other research fields – health and mobility; the labour market factors – productivity, employment, income; and socio-anthropological factors – like intellectual and cultural development.

1.3.1 Fertility

No other socio-economic variable shows such a high association with fertility than does education, but the direction of impact can vary. It is also one of the most studied fields in demography. Becker (1993) and the New Home Economics in general, use two behavioural mechanisms to link educational attainment and family formation. These mechanisms are contradictory and have been named the "income effect" and the "price effect." The income

effect implies a positive effect of educational attainment on the timing of family formation through higher earnings that will allow the highly educated to attain the costly good "family formation" earlier than the less educated, and will increase the respective attractiveness of the former. The price effect is the negative effect of educational attainment on the timing of family formation through the opportunity costs of family formation that are higher for the more educated because of the higher earnings. The income effect is expected to dominate the relationship between educational attainment and family formation among males, whereas the price effect would dominate the above-mentioned relationship among females (Goujon, 2007).

The price effect is clearly visible in developing countries where average difference between the fertility of women with higher education and that of women with no education can be as high as three children. "Education, depresses fertility for as long as this relation is observed (from early in the 20th century)" (Skirbekk 2008). For the developed countries the differentials are of lesser importance in absolute terms (lower average number of children per woman in the society), but it is quite important in relative terms. In most of European countries women with secondary education or more have fewer children than those with a primary education or less (Skirbekk 2008). A lower level of education was one of the main reasons why Latgale region in the 1930s had the highest fertility and infant mortality rate, and the life expectancy was lower than that of the country average by nearly three years (Krumins, Leduskrasta 2007). In the 1990s, the UN Family and Fertility Study in Latvia among other socio-economic factors evaluated the effect of higher education on fertility. Controlling for economic activity, unemployment level, wage, attendance of higher education institutions, the number of divorces and other determinants, it was established that the correlation between fertility and education is negative and statistically significant (Zvidrins, Ezera and Greitans, 1998).

It has also been suggested that higher education attainment entails stronger preference for the "quality" of children, i.e., prospects for their education and welfare. Under the limited resources available, it leads to lower number of offspring (Klesment and Puur (2010), Becker (1993), Gustaffson and Kalwij (2006)). It has been shown for Lithuania in year 1990 (Stankuniene and Kanopiene, 2003: 251), that attitudes towards children attending pre-school education institutions differs by female education level – higher educated women prefer parental care for young children below age 3, because of the perceived negative influence of pre-school establishments, but between age 3-6 higher educated female prefer their children to attend education institution, most likely because of the "income effect". The same study shows that "family values were most important to married women with lower level of

education, while work and professional carriers were most important to unmarried women with high education". The inverse relationship between education attainment and fertility is also linked to the theory of Second Demographic Transition – the move away from traditional family values and concentration on individualism and self-realisation (Klesment and Puur (2010)).

Recent research on developed countries, the negative relationship between women education and fertility has become increasingly controversial and it is often observed that more children are born to higher educated women. One of the reasons is that a dual-income family is less vulnerable to economic risks and the better-educated women are particularly attractive partners (Oppenheimer, 1997). Essentially, it is the same "income effect" referred to earlier. The Nordic countries exhibit positive education-fertility relationship (Krūmiņš and Leduskrasta, 2007), and elevated second and third birth intensities among highly educated women has become a standard finding there (Gerster et al 2007, Hoem and Hoem 1989, Kravdal 1992) and in Austria (Hoem et al 2001), France and Germany (Koppen 2006), Great Britain (Kreyenfeld and Zabel 2005), and Estonia (Klesment and Puur 2010). Andersson et al (2009), and Isen and Stevenson (2010) showed that levels of completed fertility between educational groups are similar. In contrast, the Central and Eastern European countries – Bulgaria, Hungary, Romania, Poland, Russia, Ukraine – usually exhibit negative relation (Klesment and Puur 2010).

Similarly to Belgium, Germany, Malta and Portugal, for Latvia a "v" shaped fertility rate is found with secondary education women having the lowest fertility (Skirbekk, 2008). Quite the opposite was found in the Fertility and Family survey of 1995 in Latvia (Zvidrins, Ezera & Greitans, 1998: 98) – the highest fertility (1.42) and also the highest desired number of children (2.16) was for females with secondary or professional education (ISCED 3-4) than for females with lower than secondary (ISCED 0-2: 1.22 and 2.10 respectively) or higher education (ISCED 5-6: 1.37 and 1.99). Based on 1990s data Eglite et al (Eglīte et al., 2002: 65) finds that the average number of children ultimately expected by males was greater the higher their education level. For women, this regularity was valid and even more pronounced than that of men only in respect of primary and secondary education. Women with a higher education wanted fewer children than women with lower levels of education.

Social and labour market policies have often proved to be efficient and can play major role in affecting women childbearing decisions (e.g. children benefits, availability of pre-school child care centres, flexible working conditions etc.). These conditions are especially important for educated women because they have invested resources and time in their education and are willing to capitalize on it in their career. They are particularly careful

interrupting the career and are often willing to return to work as soon as possible. Scandinavian countries are a good example of family support policies in this context. Sweden, Finland and Denmark have managed to reverse the generally negative population trends observed in much of Europe. In 1990 Sweden was the country with the oldest population in Europe, but as a result of family (and also of immigration), policies it is expected to have one of the youngest populations by 2060 (see Eurostat population projections and Latvian Competitiveness Report 2011). One of the main instruments and explanations there are exactly the conditions for childbearing. Evidence in Latvia also shows that public childcare unavailability deter families from having bigger families.

1.3.2 Nuptiality

The relation between education and family formation is primarily linked to the timing. Evidence from a number of studies has shown that the impact of educational attainment and labour force participation on family formation depends on the level of compatibility between these life domains (Blossfeld 1995, Blossfeld et al 2005, Corijn and Klijzing 2001), which in turn depends on complex set of relations to other factors. One of the important factors is perception of gender roles (Mason 1997). Katus et al state that in a society with high degree of gender differentiation, it is very difficult for a woman to reconcile the demands of family and career, therefore negative association between education and family formation can be expected. In a more egalitarian society, the gender roles are less distinguished, and there is less conflict between competing careers, and smaller the effect of education on family formation and fertility. "The higher the dominance of gender equality as a cultural value within society, the better the structural opportunities for female employment, the less polarized is the impact of educational attainment and labour force participation between men and women" (Katus, Puur, Poldma and Sakkeus 2007).

Reviewing the literature on the causal structure of education on family planning, the author finds that women acquiring higher education delay decision to form family and rise children to years after completion of education. In literature, it is often referred to as later transition to adulthood. This entails older age at marriage, but also reduction in the desired family size, increased opportunities for personal advancement, awareness of social mobility and freedom from close familial ties (the latter especially true for traditional male dominated societies in developing countries). Isen and Stevenson (2010) demonstrated that "patterns of, and reasons for, marriage have changed. College educated women marry later, have fewer children, are less likely to view marriage as "financial security", are happier in their marriages and with their family life, and are not only the least likely to divorce, but have had the biggest

decrease in divorce since the 1970s compared to women without a college degree. In contrast, there have been fewer changes in marital patterns by education for men". Marriages between higher educated people are therefore more stable. This may be explained by both, ability to better understand and evaluate the fit of potential partner and realized by more opportunities to meet people of similar interests, but also by the later marriage because at later ages people have undergone personal transformation and personalities are more mature. Different directions and speeds of development do not constitute such a big risk as at younger ages. It can be observed also in Latvia, that the marriages at very young ages (18-21) are highly unstable.

Even though the timing phenomena often argues that suppressing childbearing is only a temporary effect, postponement of the first birth also means that the total fertile period is shorter.

1.3.3 Health

Education attainment has a positive effect on health and is associated with almost every measure of population health. The well-educated experience better health than do the poorly educated, as indicated by high levels of perceived health and physical functioning and low levels of morbidity, mortality, and disability (Ross and Mirowsky 1999, Clark and Royer 2010, World Health Organization 2010, Public Health Agency of Canada 2010). Positive correlation between educational attainment and active life expectancy has been proved by Guralnik et at (1993) and other researchers.

The better health and associated longer life expectancy of higher educated people is a result of two effects. Firstly, there are behavioural differences such as better awareness of healthy lifestyle, harm of smoking, alcohol, and drugs. Higher-educated person does more informed decision-making. The sense of personal control may be an important link between education and health through health-enhancing behaviours. Because education increases effort and ability — the components of problem solving (Wheaton 1980) — people with more education will know more about health and are more likely to initiate preventive behaviours such as exercising. Secondly employment differences are existent. Population with a higher level of education are mostly employed in occupations of intellectual work that require less daily physical effort, in particular – heavy daily physical effort, thereby minimising the risk of injuries and accidents. Whereas people with little education are more often employed in simple professions connected to physical work.

1.3.4 Mortality

Levels of education are closely inversely related to mortality in developing countries as well as in developed countries. The impact of more education on mortality decline is always unambiguously positive. Many studies have documented high returns to longevity from education (Kitagawa and Hauser 1973, Feldman et al. 1989, Duleep 1989, Rogot et al. 1992; Pappas et al. 1993, Preston and Elo 1995). For example, Lleras-Muney (2005) estimates that in USA an extra year of schooling reduces 10-year mortality rates (i.e., the probability of dying between successive decennial censuses) by over 30 percent. Jamison et al (2006) go even further to explain education quality effect on mortality decline. The mortality differentials related to education are considerable and remain until the oldest age (90+) as shown by Huisman et al. (2002) in Europe. The reasons for the mortality differences are generally the same as for health differences – the behaviour and type of employment. For Latvia Krumins (1993:122) finds that the higher the level of education, the lower mortality in all age groups, especially in younger age; consequently, life expectancy for higher educated population exceeds that of population with lower levels of education.

At macro level, education via health and mortality patterns affect the population age structure. Lower mortality rate and higher life expectancy along with low birth rates determines ageing in developed countries, that have serious socio-demographic consequences, and has become in the focus of demographic interest in recent years. The health status of the population again is an important determinant of how many years people live in disability free status, how long their active life is, the need for healthcare and social care. In this way, education affects health economics and demography.

Given the importance of socio-economic status on mortality and health, Eurostat has decided to develop comparable statistics on mortality by education attainment to be updated on regular basis. While presently at experimental stage (Corsini, 2010), it already allows to see that educational attainment is a very important indicator of socio-economic inequalities related to health. It shows that at any age life expectancy is shorter among persons with lower educational attainment and that life expectancy increases with educational level. This difference is larger for males than for females.

1.3.5 Income and returns to education

In the economic literature the effect of education on the economic side of life – the employment and income – is typically referred to as returns to education or returns to schooling. Education is well known to be an important determinant of labour market success.

Countless researches and reports have shown unambiguous positive effect of schooling on employment opportunities and income.

Returns to education, or the income from more education, is typically positive. This is a result observable through ordinary labour force survey statistics and documented by scholars. Even if controlled for gender, ethnicity, experience, occupation and any other variables, the additional years of schooling yield additional income. The mechanisms are several. First of all, education via additional skills increases (or is a signal of) productivity, and the employer pays more for higher productive workers. Secondly, as education gives basis for further learning, more educated individuals can learn faster. In case of necessity they can re-qualify faster therefore their functional flexibility in the labour market is higher. Thirdly, they may see more opportunities and be able to exploit them by being more confident and entrepreneurial.

The private returns to education is comparatively easy to estimate and has been done for all countries, including Latvia. Hazans (2003) has documented that Baltic countries feature a combination of unusually low returns to secondary education, but high returns to tertiary education. Returns for females exceeds that of males, and is the largest in Latvia compared to the other Baltic countries. Leduskrasta (2003) also showed positive returns to education in Latvia. Ciemiņa (2008) showed concentration of people with tertiary education in higher income decile groups and people with primary education and vocational education in lower income decile groups. Interestingly, that persons with lower than primary education did not occupy the lowest, but rather 2nd to 5th deciles.

The standard estimates of returns to education that do not account for unemployment and substantially under-estimate true returns (Nickell 1979; also documented for 14 European countries by Weber (2002)). Weber summarizes the reason is that "education usually does not just increase someone's earnings potential, it also makes it more likely that this potential will be realized in the labour market."

At the macro level, the debate about how much investments in education contribute to economic growth has been longstanding in economic and labour market research, and no single unambiguous answer has been found. This is due to the complicated mutual interactions between variables and causalities. The biggest part of the problem is quantifying the impact of education on economic development or calculating returns to education to the society. It is a common perception that the returns to education are positive at all levels – private and public. As seen before, private returns are typically positive proved at different magnitude. The complication with the social returns to education is quantifying the benefit side from higher level of human capital since it requires long time series for computations and

regressions. However, there are many more studies that demonstrate a positive link between education and economic growth (see, for example, Barro (2002)) than those finding non-existent or negative relationship.

1.3.6 Employment

As described above, the labour market situation affects individual education choices and enrolment. The link though is two-directional since the education determines individuals' careers and work positions. The literature evaluating the incidence and duration of unemployment has always found education to be a key factor (Nickell 1979, Mincer 1991, Hoynes 1999), and higher level of education is always associated with less unemployment risk. One explanation for the lower unemployment incidence of skilled employees is that their risk of being laid off is reduced by their greater accumulation of firm specific human capital compared to unskilled employees. A second explanation is the "crowding out" or "over-education", i.e., the replacement of less skilled workers by those who are better educated and/or have more experience (Muysken and Ter Weel 1999). The technological change in the developed countries is skill-based, and the unskilled work is the first to be placed by technologies leading to reduced relative demand for lower educated workers. As higher educated people are more flexible in the labour market, they are faster in adapting new technologies and learning, and will be first to occupy work positions that need new skills. This also leads to higher unemployment risk for the less educated. Especially under economic crisis and high unemployment the lower educated are most vulnerable in the labour market – the employers realize that they can buy more skills for less and hence first fire the employees with less education.

For Latvia, Goša (2005) found negative correlation between level of education and risk of unemployment showing that in 2003 the lowest unemployment level was among the people with higher education. For people with tertiary education the risk of becoming unemployed is 50% lower than for persons with general secondary education, and 60-70% lower than for people with vocational secondary education (Krūmiņš, Leduskrasta 2007). Also Hazans (2007) found positive link between education level and participation in the labour market.

1.3.7 Productivity

The effect of education on productivity is less direct. No research known to the author has proved a negative association between years of schooling and productivity. However a statistically significant positive relationship cannot always be found.

Theoretical links between education, earnings and productivity in economics are supported by the neoclassical theory of factor pricing: provided both goods and labour markets are competitive, wage rates paid by employers will in equilibrium reflect the marginal productivity of the workers. This leads to the prediction that workers with the same productivity level will be paid the same, and that the workers that are more productive will be paid more than the less productive. As more educated workers are generally paid more than less educated, this leads to conclusion that they are more productive. This theory however is challenged. For instance, Maglen (2007) examines evidence on the links between education and productivity and concludes that the link is particularly weak.

One argument is the fact that labour market is not always competitive. In the modern economy work positions often require specific training, and substitute for a working person is not always easy to find. Or, labour market is not in equilibrium, which was a situation in Latvia between 2005 and 2008 when excess demand for labour was observed. Secondly, in the traditional investment model, schooling itself is often treated as a black box. Increased human capital comes in the form of increased productivity or a one-dimensional 'skill' variable. Alternative views consider more realistic settings in which school attendance generates many experiences and create different skills that affect individual's performance in the labour market and in other fields of life. Schooling may help to develop skills, but it may only serve as a signal that individuals possess certain skills. This effect is known as a 'sheepskin effect' (Altonji and Pierret, 1996, Spence 1974). This theory says that those with more education have more inherent abilities, and education only serves as signalling function. From that point of view education only serves as a filter and helps the employer to select the candidates with required properties. This is especially helpful when desired personal attributes, like discipline, time management, creativity, are not easily observable at first instance. Outside discussion about the actual contribution of education to individual productivity, and the causality direction, it is agreed that education is a good proxy for higher-level human capital.

1.3.8 Geographical mobility

Education – mobility link is present, although not unidirectional. Both – positive and negative correlation evidences are found between the level of education and migration. The majority of micro-economic models attempting to explain migration are based on the neo-classical approach that views migration as a form of investment that is performed if future returns are expected to be higher after migration. The human capital approach maintains that migration takes place if the migration costs will pay off in the future via higher income. It is

confirmed nearly everywhere that first and foremost of any factors these are exactly the economic reasons that make people to change the place of residence.

Emigrants are not random samples of their home countries' populations but are self selected groups. The theory for this selection grounds in the causes of migration: if migrants leave the country because of 'pull' factors in the destination country, they will be positively selected, i.e., their average education level exceed the average education in the home country. If they are responding to 'push' factors in the sending society, they will be negatively selected, i.e., their education will be lower than average of the sending country (Lee 1966).[6] Besides, this is true for both internal migrants (between regions of the same country or between cities), and for external migrants (across the borders).

Hence, the impact of education on migration probability is linked via the labour market. The observed correlation therefore depends on the strength of the factors than in turn depend on the economic situation in the countries or regions involved. As seen earlier, the less educated are more subject to unemployment risk and are known to be more sensitive to local economic conditions (Basker 2002), which is why they are more elastic to respond to push factors. A vast literature documents negative correlation between education and likelihood of migration – for example, see Schottmann and Herzog 1981, Curran and Riveiro-Fuentes 2003, etc.

The rationale behind the migration of higher educated groups is better opportunities and more possibilities to realize their potential. They more often move with employment contract in hand. Many researchers have also found positive relationship between propensity to migrate and education level (Taylor and Wyatt 1996, Greenwood 1993, Feliciano 2005 and others). International migration is strictly regulated field. Host countries tend to welcome the type of workforce they are scarce of, and more often these are better-educated individuals, that raise the productive power of the country. Accordingly, immigrants to the countries with stricter regulations present a positively selected group of the donor country population because the barriers to enter and associated effort is financially profitable only to better-educated people. They are also more ambitious and motivated persons than people staying behind (Portes and Rumbaut 1996). Besides, this refers to all migrants – legal and illegal.

Educational level differences between migrant and non-migrant populations is also one of the major links to regional development. In less developed regions 'brain drain' or emigration of highly educated population, deprives them of major resources, that may hinder future development, whereas economically higher developed countries or regions can afford

[6] For definition of 'push' and 'pull' factors, see the literature on migration theories. The theory here only describes economic migrants. Other migrants, for example, refugees are not covered here as they present different motivations for moving and has no direct linkages with education level.

to be selective and allow to immigrate only the young educated population. These effects magnify the development direction.

In the period 2003-2007 emigrants from Latvia are shown to be better educated than non-migrant population (Krisjane et al 2007, Hazans 2003). It is partly explained by the age distribution – the younger people (that represent also the better educated group of population) are more mobile. The other explanation is the realization of free movement of labour opportunities available with EU accession. With the 2008-2010 economic crisis and associated unemployment rise, push factors may have become stronger and casual evidence shows that increasing amount of unemployed lower educated people leave in search of job.

The ***migration of the study-age population*** itself is yet another field of interest in the education-mobility context. Even though labour migration is a widely researched problem, internal migration particularly of the younger generation – student population is a less analysed issue.

Increasing migration for education purposes is one of the most visible trends in higher education over the last two decades. Young people possess more information about study opportunities and especially in the case of Latvia and other Central and Eastern European countries, and the actual moving has become much easier and more affordable. This phenomenon has raised the interest of researchers who are working to analyse youth migration for studies and after graduation. The migration after graduation is closely linked to education migration as graduation represents a pivot point in ones' life course, and individuals have to make a fundamental decision where to work and where to settle for living.

German internal graduate migration has been analysed by Busch (2007), where he found that one third of observed out-migration after graduation takes place in the first year. Most of the remaining migration takes place in the first five years after graduation so that ten years after more than seventy percent of graduates still live in the place of graduation.

UK researchers (Prospects Net) found that the UK Eastern region, London and North Ireland face net inflow of graduates, London being the most popular final destination, and all UK regions retain at least 40% of those who graduate in their region. Another UK analysis (Faggian et al. 2006) specifically looked at graduate personal characteristics and found that UK female graduates are more migratory than male graduates. A research team led by Bond (2006) investigated migration among graduates from Scottish higher education institutions and found that Scotland is a successful importer of graduates first and foremost because of substantive returning population after studies, and graduate migration has regional characteristics.

The French results show (Detang-Dessendre et.al., 2004) that it is the education level along with labour market characteristics of their initial residential area that influence graduate destination choices. In Canada, migration of postsecondary students and graduates has been studied, using results from the National Graduates Survey. It was found that about 8% of university graduates have left their province of residence to study at a university in another jurisdiction.

For Latvia wide range of information about higher and professional education graduates was collected and analysed in terms of the EU-funded Ministry of Welfare labour market research programme. The University of Latvia researchers analyzed graduate life path after the graduation (Krumins et al. 2007). Another group of researchers (Krišjāne et al. 2007) studied labour migration of Latvia and found that education is an important factor determining migration choices in Latvia. Cunska (2007) found that shortly after graduation (1-3 years) 90% of graduates still live in the region of their graduation. The respective share is even higher for graduates of Riga region – 94%. This is very much in line with Germany (Bush, 2007) where 1 year later 90% of graduates still live in the state where they completed the studies, and 83% after three years. Cunska also finds that personal demographic characteristics such as gender, nationality, family status, and parents' education are not significant determinants of residence choice after graduation.

Results of Linneman and Graves (1983) and Détang-Dessendre (2004) research show that the educational level of young people and the labour market characteristics of their initial residential area particularly influence their destination choices. A study of US college graduates (Kodrzycki 2001) finds that which college graduates migrate is explained more by individual characteristics than by overall employment opportunities offered in the state where they graduated.

1.3.9 Intellectual development

Yet another field of educational impact is the intellectual development of the person pursuing education, cultural development of the society, development of value system and democracy. This field is marginally related to demography, but represents a wide area of sociological and anthropological factors such as democracy, civil participation, crime etc.

For the reasons of limited interest to demography, the author has chosen not to further discuss this field, but refers to the rich area of anthropology and sociology studies.

1.4 Summary of evidences

Summary of evidences of relation between education as a variable and other demographic and socio-economic variables is presented in Table 1.1.

Table 1.1 Summary of findings on influences between level of education and demographic variables

Effect on education **by**:	
Gender, race, ethnicity	Mixed evidence: • Strength and direction of gender, race and ethnicity effect depends on country/part of the world • Gender differences persist: in traditional societies females are less educated, while in modern societies female acquire more education than males • Gender gap in fields of education • Race and ethnicity correlates with education attainment via family socio-economic status, minorities generally receive less education
Family	Important factor: • Parents' education is the main explanatory factor of children's education – higher parent education is associated with higher offspring education and better school performance • Two links of inter-generational transmission: genetic and behavioural • Parental expectations affect children education • Family characteristics have impact on children's school performance • Children from one-parent families typically have lower attained education compared to two-parent family children • Evidence of mother's employment on offspring education attainment is mixed • More siblings in a family are associated with lower school attainment • Correlation between parents and children field of education
Finances	Always positive: • Family income is positively associated with the education attainment • Three sources how financing affects education attainment: direct school costs (fee, living, supplies), indirect costs (opportunity costs) and better performance at entrance examinations via better secondary schools attended
Employment	Mixed influences: • In bad labour market situation entering labour market after school is not attractive, young people tend to study (discouraged worker effect), little opportunity cost of studying • In the mean time, at bad labour market situation wages decrease and household income falls, other household members may need to start to work to compensate (added worker effect) or cannot afford to pay study fee • Labour market demand determines educational choice
Effect of more education **on**:	
Fertility	Mixed evidence: • Postponement of birth by females • More affordable through higher earnings • Preference for less children of higher "quality"
Nuptiality	Mixed evidence: • Postponement of family decisions • Reduction in desired family level • Increased opportunities of personal advancement competing with family • Greater awareness of social mobility • More free from close family ties • Financially more independent • Psychologically more independent • More stable and happy families
Health	Always positive effect on health: • Behavioural effects – more awareness of healthy lifestyle, less smoking, alcohol,

	drugs • Employment differences – better educated are employed in safer jobs, less physical effort, less risk of injuries and accidents at work
Mortality	Always negative, i.e., positive effect on life expectancy: • Longer healthy life expectancy, more qualitative life • More educated live longer • Less mortality at workplaces
Income	Always positive: • Returns to education typically positive • Education adds skills and signals for productivity • More educated learn faster, re-qualification easier, more flexible in labour market • See more opportunities and able to exploit them, more confident and entrepreneurial
Employment	Always positive: • Less risk to be laid off, greater accumulation of firm specific human capital • Replacement of unskilled workers with skilled (crowding out effect) • More flexible in labour market, easier to find new job if needed
Productivity	Positive, indirect, often insignificant: • In general school attendance increase skills, employers pay more for more skills • Schooling may only be a signal that individual possess certain skills • Because labour market not always competitive
Mobility	Mixed evidence: • Important the reason for migration – push or pull factors: if migration affected by pull factors, more education is associated with higher mobility, if with push factors – with lower mobility • Linked via labour market • Education is an important reason for migration (student mobility)
Intellect	Wide implications: • More education typically is associated with higher intellectual development • More democracy, civil participation, less crime

Source: author's table

Overall, the education level and demographic processes are closely linked – the level of education in one of the most important factors determining population demographic behaviour. The effects are observed at individual level, and robust at macroeconomic level.

Theory and empirical evidence suggests that the higher the level of education, the better is health, longer life expectancy, higher income, better employment outlook. Mixed evidence of education effect is observed with regard to fertility, family planning and migration patterns. Regarding geographical migration, education level is a more important determinant than any socio-demographic characteristic.

From the other side, an individual's educational attainment is positively correlated with level of parents' education and accessibility of financial resources to be spent for education. Gender is a very important determinant of the individual's educational attainment, but the effect depends on the society – in developing countries females typically have lower chances to acquire education than males, while in developed countries females are more active in acquiring education than males and statistically females are on average better educated. The educational attainment is also determined by race, thnic qualities, employment status – the direction of influence being mixed depending on circumstances.

2 STATISTICS AND INDICATORS FOR HIGHER EDUCATION ANALYSIS IN DEMOGRAPHIC PERSPECTIVE

This chapter describes education measures to be used for higher education research in Latvia from a demographic perspective, analyses data availability, addresses data insufficiency problems and provides two examples of good data systems from other countries. The final section suggests ways to develop the higher education statistics.

2.1 Education characteristics and data availability in Latvia

The developing paradigm in Latvian public opinion is putting the individual in the centre of attention as opposed to the former focus on a group of population (ex. nation, ethnicity or citizenship). This is also contained in the popular "every individual is important" statement[7], and policies and conceptions are drawn with an individual in the centre. Though, the author reasons that the idea has not penetrated to the actual implementation level and thinking. The statistics (author refers to education statistics, but this is generally true for other fields) typically count stocks – totals. The typical education statistics (see Ministry of Education and Science yearly reports on higher education) would contain yearly information about total new entrants, number of students, number of graduates (all by programmes, by genders, by financing, by institutions etc.). The policymakers make decisions based on information that is derived from these stocks. This aggregated period information does not provide sufficient details about what is happening at the personal level, for example, how many years it has taken for a person to acquire a diploma, if he/she has acquired the diploma from the programme he/she initially entered, if he/she graduated at all, and, if not, what happened to him/her, did he/she restarted studies in a different programme or later years. These are numerous other questions are important both for the policy decision makers and for the higher education institution leaders, because this allows to understand what is happening inside the system and how to affect processes there. For instance, there is an observation from the statistics, that 20 thousand students discontinue studies in HE institutions every. Decision maker needs to understand who, when, from where has dropped out to make any attempt to change it. This is where longitudinal data and associated analysis techniques are irreplaceable.

[7] For example, very precisely this is stated in the recent draft of introduction to National identity and integration guidelines prepared by Ministry of Culture: "Every Latvian and citizen of Latvia (including those living abroad), every Latvian inhabitant is necessary for Latvia" (in original language: "Ikviens latvietis un Latvijas pilsonis (arī tie, kas dzīvo svešumā), ikviens Latvijas iedzīvotājs ir vajadzīgs Latvijai"). (Nacionālās identitātes un integrācijas vadlīniju ievada projekts, available at http://www.km.gov.lv/lv/doc/nozaru/integracija/Integ_ievads110315.doc, accessed 22.03.2011)

The four principal descriptive categories of education indicators are school enrolment, educational progression, literacy and educational attainment (O'Hare et al, 2004). To maintain the focus of this study on higher education, literacy as a characteristic is not featured here because with the development of human capital in Latvia this indicator is losing its relative importance. Instead, from the demographic point of view, education policy makers should be able to follow the higher education system at least according to the three principal educational characteristics – *enrolment, progression and attainment* – as well as labour market outcomes. All the indicators can be presented and viewed at different levels of detalisation of student socio-demographic characteristics.

Enrolment – share of population, especially at younger age, in schools – is a key indicator of a society's level of socioeconomic advancement. In developed countries most young people are enrolled in schools and a high share of 18-24-age group are enrolled in universities/colleges. Often distinction is made between enrolment in public or private higher education institutions, full-time and part-time enrolment, different levels of degrees (bachelor, master, doctoral), as well as by fields of studies, source of financing and often by gender and ethnicity.

There are various measures of school enrolment that are used depending on the particular question of interest. The most general measure is *crude enrolment ratio*, calculated as the total enrolment over total population and expressed in percent. Because this measure is very general and sometimes irrelevant, it is more common in the denominator to use population in ages at which persons are customary enrolled in studies, i.e. to partly eliminate the population age structure effects, that is age 5-34 for all schools, or 18-34 for higher education. In this case the measure is called *general enrolment ratio*. To make more precise account of the population age distribution, *age-specific enrolment ratio* is computed as enrolment at age *a* over total population at age *a*, or *level-specific enrolment ratio* (enrolment at school level *l* over population at age group *a* that corresponds to the respective schooling level). Sometimes there measures are combined in *age-level-specific enrolment ratio*. For comparative purposes (especially between countries or over long periods of time) demographers often standardize the above indicators, obtaining *age-standardized enrolment ratios*. The enrolment measure and age-specific enrolment ratios are used in this research work for enrolment projections in Latvia.

Measures of educational **progression** reflect how students move though the educational system (O'Hare, 2004). The progression can be measured between transitions points like levels of education, or year by year through entire schooling. The progression indicators are a useful source of information about education system and about population subgroups if

indicators are computed separately for groups. The progression is measured by retention or by dropping-out – leaving school without graduation or without completing the programme of the respective school year.

The three obvious measures of education progression are *crude dropout rate*, *age-specific dropout rate* and *cohort dropout rate*. While the first measure describes the proportion of all students who drop out with respect to the total enrolment, the second indicator measures the proportion of dropouts within a specific age range. Because the age-specific dropout ratios can reveal the extent of the dropout problem in the population, they can also be used to estimate the need for further education and training. The Ministry of Education and Science recognizes that "decreasing dropouts is a very important issue from the resource saving point of view" (IZM 2009 report). The cohort dropout rate represents the relative number of dropouts occurring to a cohort of students who started studies on the same year. This rate can only be estimated from repeated measures of the respective group of students and reveals how many students who started that level drop out over time and do not finish. This information is obtained from student registries in the institutions of longitudinal surveys. The analysis of Chapter 4 of this dissertation uses progression approach following the path of one cohort through education cycle.

Educational **attainment** is a critical measure of education, showing the output of education system. The human capital of the country is also typically measured by population formal education qualifications. As such, it provides a proxy for the knowledge and skills available to national economy and society. Usually, educational attainment is not measured by number of years a person has spent at school but rather by the highest grade or degree he/she has been able to complete. In censuses and surveys attained or completed level of education is the most common measure of education.

The most common indicator of educational attainment is *cumulative grade attainment ratio*, expressed as persons (at age *a*) who completed at least the level of education of interest over population (at age *a*). One particular derivative of this indicator is the *high school completion ratio* which is applied to population aged 18 to 24. Median years of schooling and mean years of schooling are often used by UNESCO and OECD in country comparisons and can be calculated where attainment is expressed in years at school rather than degrees. These are population structure indicators and they show how the knowledge is distributed in the human capital. This work uses cumulative grade attainment measure to illustrate Latvian population education level development over a period of forty years and in the analysis of socio-economic factors that determine individual's education path.

Finally, **labour market outcomes** or the career of graduates after finishing education is the quality indicator of education. The author does not attempt to analyse work career paths in this thesis, but refers to the recent dissertation of Jaunzeme (2011) that studies higher education graduates' early career performance in Latvia, as well as the project report with author's contribution (Krumins et al, 2007) that studies higher and vocational education institutions graduates' professional performance three and five years after graduation. These works clearly are complements to this study.

Socio-demographic characteristics like gender, age, ethnicity, social background, parents' occupation and education, origin, income group are very important variables for education, and in the analysis these indicators provide additional dimensions or level of detalisation to the analysis of student population in total. They go beyond the headline figures and describe how education is distributed in the population, give indication about how equal and fair access to education is. Correlation between individual's and parents education or occupation represent level of social mobility. Student population socio-economic characteristics describe their demographic behaviour and determine their life-course. These issues are all relevant in demographic context. The author employs analysis of socio-economic characteristics in Chapter 3 of this thesis.

The main data sources for demographic research are censuses, various population registers and surveys (Zvidriņš, 2003:28). Table 2.1. represents data availability in Latvia for the above indicators.

Table 2.1 Summary of data availability on higher education in Latvia (available on regular basis)

	Sources	**Level of detalisation of available measures (socio-demographic characteristics)**	**Lacking information**
Enrolment	Student register data from HE institutions transformed into period reports to CSB and Ministry of Education and Science	Various stock data on enrolment by institutions, form of study, financing, age, gender, field of studies; various enrolment ratios can be computed easily Institution databases contain some information on social support/stipend recipients (very segregated information)	Information typically sufficient for analysis at all levels of detalization
Progression	Student register data from HE institutions transformed into period reports to CSB and Ministry of Education and Science	Total dropout by institutions, education programmes and form of studies	Age specific and cohort dropout rates, retention/dropout indicators by social groups
Attainment	Population censuses (±10 year interval); surveys, such as LFS or other representative survey; diploma register (not linked with other information)	Education attainment typically by broad education levels (i.e. levels within tertiary education not distinguished), age, gender. Surveys may occasionally	Attainment by levels of tertiary education, representative information between census years

		contain more detailed information	
Education outcomes (labour market performance)	No representative sources about all HEI. Some institutions perform occasional graduate surveys (usually linked to data needs for accreditation purposes). Employment state agency for unemployed. LFS – employment by broad levels of education and by professions, not by universities or programmes	Employment by broad levels of education, age, gender, ethnicity	Any indicators of graduate career by institutions, programmes, length of search for work, further education after graduation (longitudinal approach)

Note: The information described here is the routine statistics available on regular basis and exclude special once-off projects like Ministry of Welfare labour market studies (2005-06) and similar or non-repeated research projects.
Source: author's table

Clearly, all forms of information for measuring enrolment on regular basis is available from the Ministry of Education and Science and Central Statistical Bureau. The progression indicators are more problematic. While education institutions maintain student databases, they are only obliged to report period statistics. But progression can only be analysed with appropriate individual level data, which allows longitudinal analysis methods. In principle the necessary information in Latvia is existent, but is 'lost' between the original sources and the final users of statistics and policy makers. Proper dropout analysis currently can only be done on institutional databases. For a substantial period of time there was an effort to link all the higher education institutions in a unified database, called Latvijas Augstskolu Informatīvā Sistēma (LAIS, in English: Informative system of Latvian higher education institutions). It was developed in context of the more general LIIS (Latvian education informatization system) programme with the aim to computerize all Latvian education system. LUIS and LAIS is essentially the same software and was provided by the University of Latvia programmers. One of the values of the unified platform is the ease of obtaining and analysing information, and the possibility to follow the paths of students through higher education system and between institutions. Provided the database of all students of Latvian higher education, multistate education tables (Chapter 4) could be calculated for all Latvia and results could be interpreted without caution. In 2007 the financing to LAIS system ceased and the database is not maintained. The author believes that interruption of financing and discontinuation of the programme is a mistake. Research on student demography is fragmented and results are with limited value. No survey can fully replace register information.

The most representative information about population education attainment is available from population censuses. The problem with censuses though is that they are nowadays only

organized with frequency once in every ten years. Education is a rapidly changing characteristic and ten-year period is too long. Education attainment can be assessed from regular surveys, such as Labour force survey, but samples are rather small and sometimes education by one-year age groups are not available and not representative. These data also does not cover all population. Another problem with both censuses and surveys is that education is not reported in sufficient detail – no information is available by levels of higher education, tertiary education stands as one group. When a country approaches a state of universal higher education and relatively big proportion of adult population holds tertiary education, more detailed information is needed.

Neither is any information is available on regular basis on student and graduate socio-economic situation. While some universities may hold account of students, who receive social support, for instance, scholarships, of students who have children and of dropouts due to inability to pay study fees, the information is not unified and overall monitoring is not possible. Very similar situation is with monitoring labour market outcomes for the students. The State Employment agency records information about unemployed and can distinguish the levels of education and even the year of graduating from higher education institution. This is though only minor share of the graduates. No regular information is available about employment characteristics of working graduates. Occasionally institutions interview their graduates for their employment status and career for programme accreditation purposes. This is a good exercise but unfortunately information is very fragmented, rather irregular and does not allow for cross-institution comparisons. The Ministry of Welfare labour market research project "Professional Activities of Graduates of Higher and Vocational Education Institutions after Graduation" (Krumins et al, 2006) attempted to fill the gap of missing socio-economic and career information by surveying two cohorts of graduates in 2006. Even there, information about all higher education institution graduates could not be collected, since some institutions refused to disclose graduates' contact details. Probably the reason is a fear of comparison and potential to reveal underperformance by the institution compared to others. Unfortunately this was a one-off exercise and currently is not repeated on regular basis. There is Ministry of Education and Science initiative however that all graduates that have received state-funded higher education would have to be surveyed after graduation about their employment career.

Overall, the author concludes that the statistics information available in Latvia is insufficient for research, analysis and monitoring of higher education in demographic context. Many of the indicators cannot be analysed because they cannot be estimated from existing statistics, which is very fragmented. The author thinks that a large share of the necessary

information (as described above) could be gathered without large extra effort and costs, and describes the proposed solution in section 2.3 below. This is not a unique problem in Latvia; many other EU countries have similar data issues. However there are two good practice examples from Ireland and Sweden that author analyses and develops recommendations for Latvia.

2.2 Case studies

Two countries that have set up good education statistic record systems are Ireland and Sweden, which can be thought of as 'best practice' examples. Below the two systems are described. The author thinks that the two peers can serve as guidelines for Latvian education statistics system development.

2.2.1 Case study: Ireland

Ireland is an example of one of the best education process surveillance practices. The body responsible for higher education and research planning and policy development in Ireland is the Higher Education Authority (HEA)[8]. The HEA is the funding authority for the universities, institutes of technology and a number of designated higher education institutions and has advisory powers throughout the third-level education sector. It is the main stakeholder and driver behind development of education and research sector.

The HEA Statistics Section is responsible for collecting data and compiling reports. It uses the information it collects on students to advise and inform national policy, meet reporting duties to international institutions (Eurostat, UNESCO, OECD) and produce statistical publications for general use and public interest.

The HEA Statistics Section processes its information from three main sources of data: (1) *Student Record System* (SRS), (2) *Equal Access Data Survey* and (3) *First Destination Report* (FDR).

The Student Record System (SRS) is the HEA's in-house database of students. The database contains a record of every registered student in a HEA funded institution in any given academic year. Every higher education institution uploads the respective institution's file containing individual level information about each student registered in the institution. The SRS therefore forms the main database. The system was established in 2004, and since 2007 all HEA funded institutions participate in the system.

[8] Information in this section is based on HEA public sources and retrieved from descriptions in publications, as well as from HEA website http://www.hea.ie/en/node/1388.

Since 2007, all publicly funded higher education institutions in Ireland have gathered additional Equal Access information, as part of student registration, on the socio-economic, ethnic/cultural and disability background of new entrants to the sector.

The First Destination Report (FDR) is based on an annual survey of graduates six to nine months after graduation. This survey presents a snap shot of the labour market or further study situation of students who graduated in the previous academic year, having completed a full-time course of study. Higher education institutions forward the questionnaires to all their graduates and the students return the completed questionnaires back to their institutes. In 2008 the response rate was 58%[9]. The completed information is then sent by each institution to the HEA in an anonymized electronic version and the HEA Statistics section runs a report from the information collected. This report examines the employment, further study, and training patterns of graduates on the 30th of April each year. Information is broken down by institution, level of award received, area of study, information relating to the pattern of first destinations, composition of the graduate labour market, employment sector and occupational classification, region in which employment was found in Ireland and overseas and salary is also presented.

The database contains individual level record on each student, referenced by student ID number: demographic and socio-economic information (incl. gender, age, ethnicity, origin, background, parents' education and employment, disability indicators, income, social class), study information for each year (incl. previous education, enrolment status, study programme, year, form of study, study abroad information, graduation, qualification grades), and early career information (incl. employment 6-9 months after graduation, position, employer, salary, sector and location of company, further participation in education). The database allows longitudinal approach in analysis. Close attention is paid to data protection and safety. Individual contact details and addresses are not held, the database is maintained purely for research purposes.

This data is the source material from which the HEA Statistics Section delivers its various publications and reports, that form informative basis for HEA actions and decisions, supports the work of a number of government departments and agencies connected with furthering the development and enhancement of education in Ireland. The information is used to provide an overview and monitoring of the activities, inflows and outflows to the Irish Higher Education System. The data provided enables the HEA to monitor: inflows and outflows to the higher education system; student demographics, efficacy of access measures;

[9] What do graduates do? The class of 2008, Higher Education Authority, Ireland, p 64. http://www.hea.ie/files/files/file/statistics/48078%20HEA%20graduates%20report%2008.pdf

institution performance (retention, completion, quality); international participation; subject choice and provision; and flows between institutions and NFQ levels, as well as inform public funding allocations. The information is constantly used for decision making. For example, The Irish Ministry for Education and Skills has used the information in development of the new strategy for higher education (in 2011).

2.2.2 Case study: Sweden

The system in Sweden is different from that of Ireland and represents a different approach.[10] The approach there is to link various registers to form data system that contains information about every resident of Sweden – be it residence, employment, income and tax, family, health, or education. The information is kept in separate databases, but is cross-linked regularly, using the Personal Identification Number as the key.

The Swedish Register of Education is kept, organized and updated by Statistics Sweden – Swedish central statistical bureau. The first version of the Register of Education was established in 1985, since then it is updated once a year. The updated database is usually available from April, around four months after the time of reference.

The register comprises the population 16-74 years old registered as resident in Sweden on 1 January each year. The register contains demographic and education data – base age, gender, place of residence, country of birth, national background, level of educational attainment of the parent(s), highest education level attained, completion year and field of studies, use of student grants, arrival country and type of migration for immigrants, destination country for emigrants and a few other pieces of information.

For demographic variables, data from up-to-date Total Population Register are used. Data on education are collected from a number of statistical registers kept at Statistics Sweden as well as external sources. The most important sources are the register of graduates from higher education and the registers of school leavers from primary and secondary school. These registers are continuously updated with graduation and examination information reported by all education institutions.

To construct and update the register, all known data on completed education are assembled together into a comprehensive file. The sources usually give more than one completed education for each person. The first comprehensive file in 1985 was established based on 1970 census data plus information on education completed in Sweden between 1970 and 1985 from other source registers. Since then, the file is updated with educational

[10] The information in this section about the data collection system in Sweden is based on public sources of Statistics Sweden, http://www.scb.se/ and consultations with academics from Sweden.

activities in Sweden during the last school year and also updated with data from other sources, for example, the survey on ”Education completed abroad” and data from The National Board of Health. The data on highest education from the comprehensive file is matched to the actual population 16-74 years of age, living in Sweden at 1 January from Total Population Register (TPR). TPR gives the correct population, together with the demographic data that are to be included in the register of highest education. In 1995 and 1999 special surveys ”Education completed abroad” were carried out, including persons aged 20-59 born in other countries than Sweden, where data on attained education was missing. Since 2000, an annual questionnaire is carried out on newly immigrated foreign-born persons to obtain information on their education.

Summary data are published in Statistical Databases of Sweden (SSD) in http://www.scb.se/databaser, free of charge, open for the public and available also in English. Reports of education information to international organisations (Eurostat, UNESCO, OECD) are compiled based on Register of Education. This register data in turn is used as an input to the linked statistics databases, for example Employment Register; also the Labour Force Survey uses data on education from the register. Full individual anonymized datasets are available free for research purposes, allowing longitudinal studies of high quality and usable for policy decisions.

To author’s knowledge the Register of Education does not include current study status (enrolment and type of studies), life long learning activities, further education and training. Graduate career development, skills and education assessment are not surveyed, while employment information is available from Employment Register.

The strength of the Register, compared to the Irish system is its universality, i.e. it contains information about every single person in the economy (illegal immigration excluded), hence there is an overall picture about amount, kind and quality of human capital available to the economy. The long accumulated time series comparable over time is yet another strength of the register, that makes development and trend analysis, and projections based on them possible. The links between databases ensure that there are no double request and collection of the same kind of information for different institutions or different databases, hence the administrative burden is efficient and costs are optimized.

2.3 Proposed education statistics model for Latvia

The author thinks that Latvia has to move to a new level of education and demographic research and therefore require an improved approach to statistics. Nowadays when higher

education becomes universal, the statistical division of education by “no education”, “primary education”, “secondary education” and “higher education” categories is insufficient. The distinction has to be made between the levels of higher education – as minimum by “college”, “bachelor”, “master” and “doctoral”, optimally, distinguishing also by academic and professional degrees. Jaunzeme (2011) confirms the idea stating that bachelor level higher education is not any more perceived by the labour market as completed higher education.

The proposal of this section rely on three fundamental factors: (1) the higher education has changed in Latvia, and the statistical system has to adjust accordingly; (2) demographic prospects of declining population makes to understand that every single person is important in Latvian economy; and (3) economic crisis puts financial pressure on state, municipal and individual budgets, therefore “saving” and “optimization” become key words for any actions. Hence for informed decision-making related to these factors there is a need for informative data sample at national level that allows research and analysis to inform about situation in Latvia.

The author suggests re-establishing a Latvian student database analogous to the LAIS database and based on the principles of the Irish model. The holder of the database should be the Ministry of Education and Science (or alternatively the responsibilities could be delegated to a different institute, but it has to be one body). The collection of data, use and responsibilities should be governed by separate legislation documents. The access to actual complete database should be strictly governed, limited to supervising persons, while non-personalized individual data should be available for use by government officers and analysts, universities, statisticians and researchers. Secondary summary statistics should be prepared by responsible authorities on regular basis and publicly available, or prepared as per request.

The database should contain the following information on individual basis:

1. Individual information – name, identification number (possibly personal ID number), contact details;
2. Study information – institution, study programme, level, status (year in studies, academic leave, studying abroad), grades, previous education and institution;
3. Demographic information – gender, year of birth, family status, number of children, ethnicity, parent education level, place of origin;
4. Financing – source of study financing (state, private), study loans, student loans;
5. Socio-economic information – parents’ occupation, family income level, vulnerable social group (disabled, orphan etc. if any);
6. Employment (for sample of graduates, one survey after graduation) – employment status, position, economics sector, salary, country, length of

looking first for job, skills assessment, further studies (there other information necessary for education decision-makers can be included, but should be comparable between years).

The above information points 1 through 4 should be submitted to the common database by each higher education institution every year on particular date. The author suggests the October 1 as the date for reporting as it corresponds to the current routine of statistical reporting. Point 5, socio-economic information should only be gathered once, upon first time entry to higher education institution and submitted to common database on the same date. The employment information should be gathered by the responsible institution (IZM or other) by centralized surveying of a representative sample of graduates 6 – 9 months after graduation. Design of the survey might be analogous to that of the Ministry of Welfare labour market studies graduate research project. Alternatively, individual institutions can survey their own graduates according to unified questionnaire and submit information to the system. Over time, the database will build up to be longitudinal allowing for more complex and in-depth research than currently available from cross-sectional statistics.

With this database all the current higher education student statistics and tables would continue to be available. In fact, computation of them should become easier and could be done centrally, therefore more cost efficiently. Clearly, other data that HE institutions report to Ministry and/or statistics office (ex. academic staff information, research data, premises etc.) would continue to be reported. The author estimates that information processing under that scheme should be faster than currently, hence also more efficient.

The database would allow routinely monitoring the higher education (in addition to the current framework) especially regarding:

- Progression (dropouts);
- Transitions of students between higher education institutions currently is unknown;
- Length of studies by levels of education;
- Socio-economic factors determining study outcomes. A database that includes social indicators will help to tailor and target social policies to those in need;
- Allow benchmarking institutions against each other and be an input to the quality assessment system;
- Graduate labour market analysis is another input to the higher education quality assessment.

As further steps, the author invites thinking about linking and incorporating the higher education student database to State Education Information System (Valsts Izglītības

Informācijas Sistēma) that contains pupils' register of primary, secondary and professional schools; and to population register, as learned from the Swedish model.

Researchers, including the author would certainly also benefit from the described data system and in this research work could potentially rely on such a database as the only and representative source of information about students in Latvia. In the absence of that, the author uses the Graduate Survey 2006 and University of Latvia Information system that contain information in the necessary form, but suffer from representativity, therefore can be generalized under certain assumptions. Therefore further in the thesis the author looks separately at the student socio-demographic characteristics, based on Graduate Survey 2006, but also other available data sources; and then uses LUIS data as a *case study* to illustrate at least one way longitudinal student database can be employed to obtain information about processes happening to higher education population. Here it should be reminded that even LUIS does not yet contain all the potentially relevant socio-demographic or socio-economic parameters.

3 STUDENT SOCIO-DEMOGRAPHIC CHARACTERISTICS AND GENDER EFFECTS ON STUDY CAREER

This chapter takes the analytically descriptive approach to analysing student population. In section one the author briefly illustrates and analyses education development in Latvia by the first three measures described in Chapter 2. Section two is concerned with explaining the role of socio-demographic parameters on individual's choice of education. Section three aims to understand gender role in differences in education paths.

3.1 Educational characteristics

To maintain the focus of this study on higher education, this section analyzes characteristics relevant for higher education analysis – enrollment, progression, and attainment.

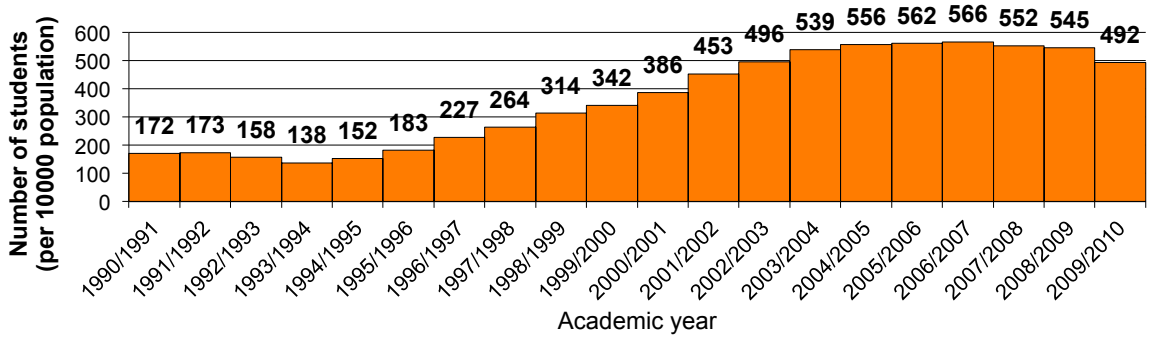
3.1.1 Tertiary enrollment

The number of students enrolled in higher education (ISCED 4-6) in Latvia has gradually increased by 40% from 1999/2000 to 2005/2006 (see Table A2.2, Appendix A2), peaking at 129316 and decreasing since that. In the 2009/2010 academic year the Latvian higher education system for the first time experienced a significant fall in number of students. Total enrolment decreased by 10%, with the number of first year bachelor students down by 26% compared to the year before.

At the same time, the number of students enrolled in doctoral level education programmes has gradually increased and doubled over the last decade, reaching 2152 students in 2009/2010 compared to 1003 in 1999/2000. This effect is largely attributable to the government programme and generous support to doctoral students financed by European Structural funds and Latvian government (Cunska, 2011), but also to the bigger "recruitment base" – the higher master programme graduates' number.

According to statistics on number of students per 10 thousand inhabitants (492 in 2009/2010, see Figure 3.1), Latvia is still among world top performers together with Finland, UK, and Canada. There were as many as 566 students per 10 thousand inhabitants in 2006/2007, and this indicator had been increasing since 1993 when the expansion of higher education started. In the period between 2003 and 2008 the indicator was rather stable and fluctuated at around 550. Some decrease was seen in the 2008/2009 school year, but a significant decline is clearly visible in 2009/2010.

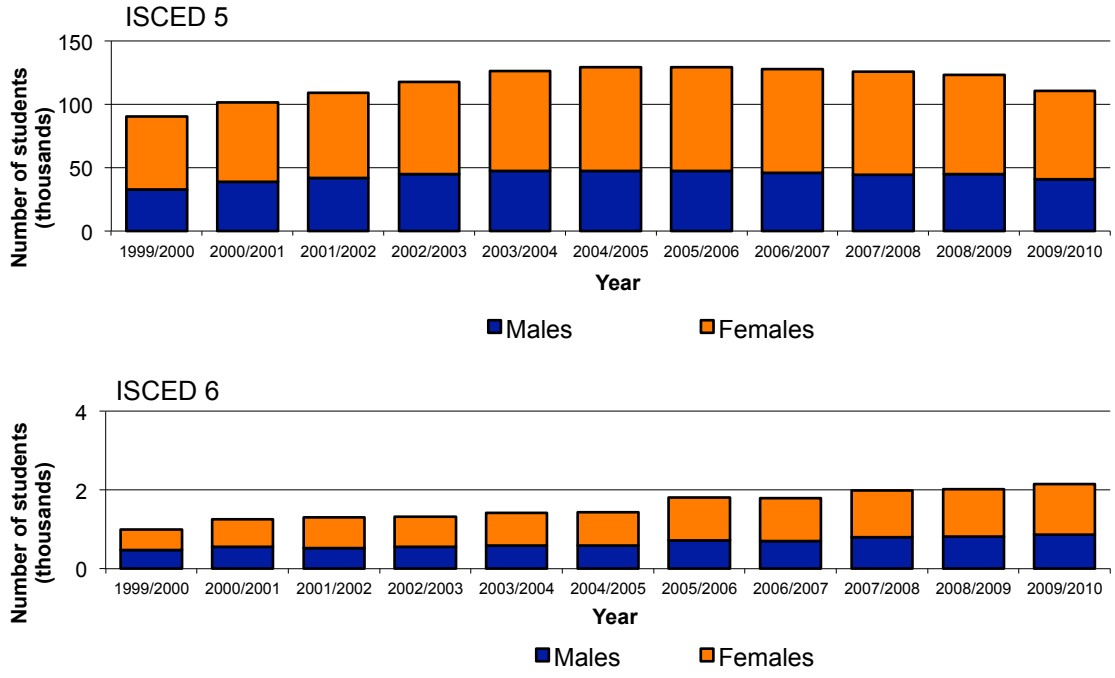
Figure 3.1 Tertiary (ISCED 5-6) enrolment per 10 thousand population, Latvia, 1990-2010



Source: LR Ministry of Education

The gender distribution in Latvian higher education system over the previous ten years has been surprisingly stable (see Figure 3.2). The percentage of women enrolled in tertiary education remained rather constant over the period 1999-2010 in the area of 62-64 percent. Hence expansion of higher education has happened similarly for both genders. In general, the majority of students in Europe are female, and similar proportions of near two thirds of female in the entire student body are also in Sweden and Slovenia (Eurostudent III, 2008 data). The rest of European countries recently have joined this trend except for Slovakia, Germany and Switzerland. Doctoral studies are somewhat different. The percentage of women enrolled in post-graduate studies has increased from 52% in 1999/2000 to about 60% in 2001/2002 and stayed at this level till now.

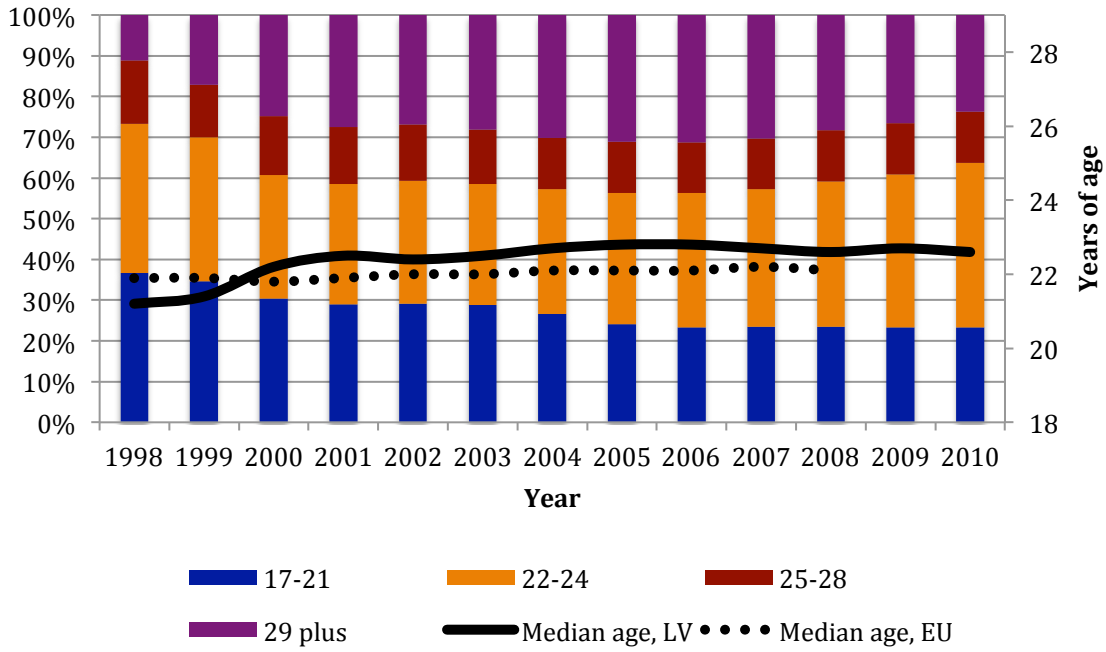
Figure 3.2 Number of tertiary students by gender in ISCED 5 and ISCED 6, Latvia, 1999-2010



Source: CSB Latvia

In line with the observed trend of ageing student population in Western countries, the students in Latvian higher education become older too (see Figure 3.3). The median age of tertiary students was 22.6 years in 2010. The median age jumped for about a year between 1998 and 1999, and has been rather stable since that with a small upward trend. The reason for this jump was expansion of education possibilities and increasing demand for education by adult population. Latvian tertiary students are about half a year older than on average in European Union, where the student population has been growing older.

Figure 3.3 Age distribution and median age of tertiary education students, Latvia, 1998-2010



Source: Eurostat databases (education and training)

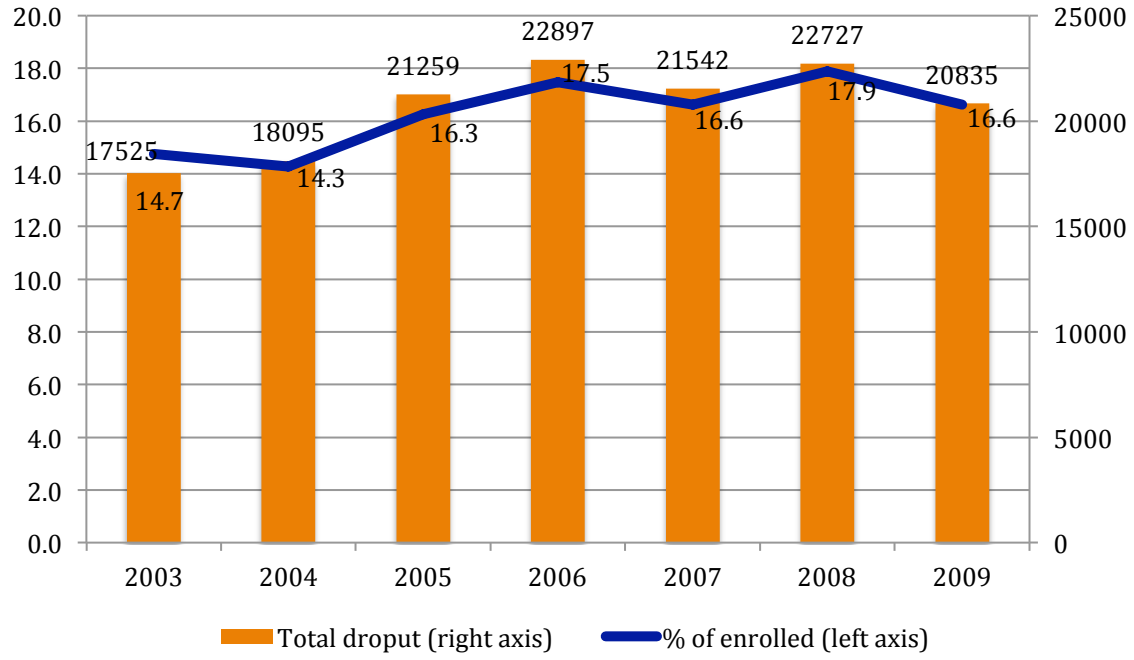
The tertiary student population age structure also informs that the biggest changes in the education system have happened before 2000. After this year the age structure has not changed significantly. The proportion of students aged less than 21 years old has decreased from 30 to around 23 percent in recent years. The proportion of 22-24 year-olds grew from 30 to 40 percent, and the 25-28-year-old make up constantly around 13 percent of all students. The number of older age students (29 plus) was increasing from 11 percent in 1998 to 30 percent in 2004, but shrink slightly in recent years reaching 23 percent in 2009. This age structure is explained, firstly, by demographic processes – the recent years have been the period when 1980ies baby-boom cohort entered tertiary education. Secondly, part of the change can be attributed to increase in supply of programmes aimed at more experienced students (for example, Executive MBA programme in SSE Riga), and also to structural

changes happening in the economy and following need to upgrade education. Following this, coming years in higher education would be characterized by ageing and contraction of higher education of the sector as will be shown in Chapter 5.

3.1.2 Progression in higher education

Chapter 2 found that in Latvia, higher education institutions are holders of student registries and therefore are the only who can follow student progression through programmes. Cohort rates represent a longitudinal approach and provide more contextual and background data than are available though more common data collection systems that give static cross section information (like Ministry of Education and Science and CSB are using now). The cohort dropout rate therefore is also an indicator of efficiency of the education programme and can help to spot any specific problems in the education system. The cohort approach is used in Chapter 4 of this research where author follows a cohort of University of Latvia year 2002 enrolment students through an 8-year period as a case study for one institution. It is impossible to compute any specific education progression measures such as age-specific and cohort dropout rates in Latvia on regular basis because appropriate data do not exist. The only indicator available for Latvia is the crude dropout rate (see Figure 3.4).

Figure 3.4 Crude dropout rates in Latvia 2002 - 2009



Source: Ministry of Education and Science, author's calculations

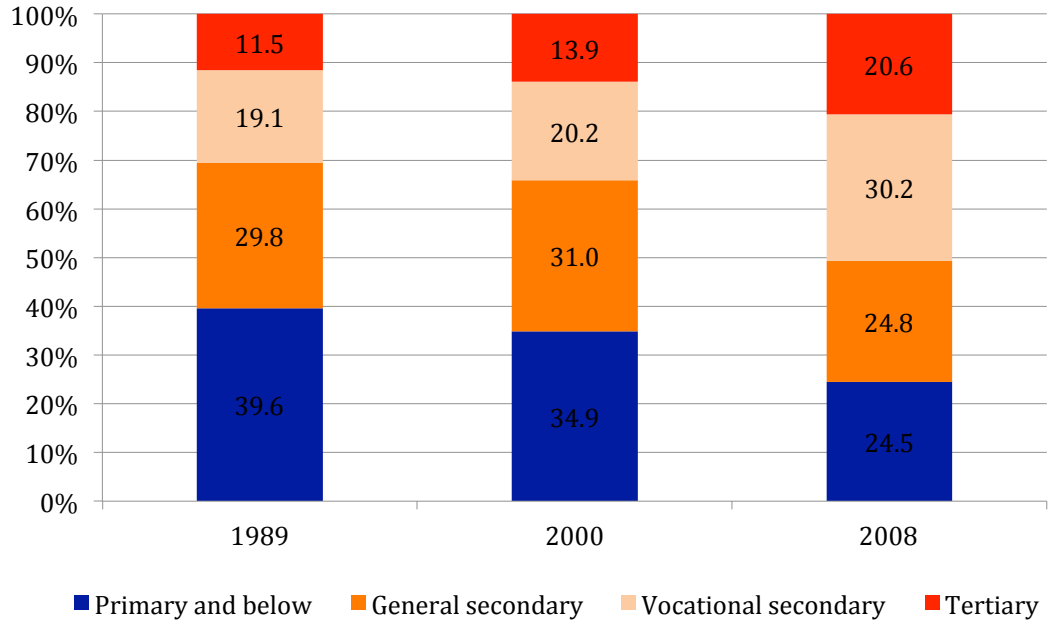
The number of students that drop studies is rather stable at around 20 thousand a year in latest years. This is between 16 and 18 percent of students that discontinue studies out of total

enrolment. However, this is a very general indicator and does not explain at what stage the studies are dropped, which programmes are discontinued and where the people end up, i.e. if they continue studies somewhere else, re-enter the same programme after a brake, or leave the education system for good.

3.1.3 Overall education attainment

There is a significant development in population education level since a decade and two decades ago. Trends in attainment levels over time provide a complementary picture of the progress of human capital available to the economy and society. As the 1989 census showed, as much as 40 percent of population in Latvia aged 15 and older had lower than secondary education, in 2000 the respective proportion was 35 percent, but in 2008 it was only 25 percent (Figure 3.5). The share of population with secondary level education has remained relatively stable over years at around 50 percent, but the proportional distribution between general and vocational secondary diplomas has changed between years 2000 and 2008 – the share of vocational secondary diploma holders has increased by a third from 20.2 to 30.3 percent, while the share of general secondary degree holders has shrunk accordingly. In 2008, fewer than one-fourth of working age population (24.5%) held only primary education or below as the highest education attained, 55% of the population had attained general or vocational secondary education (25% and 30% respectively) – and than one-fifth (21%) had attained a tertiary level diploma or qualification. Judging by the trends, the share of lowest level education in population is expected to fall further (see Figure 3.7). The growth of number of tertiary education graduates once again illustrates the expansion of tertiary education sector with proportion of tertiary education graduates rising almost twice over the twenty-year period 1989-2008. Even though part of the development is related to the changes in population age structure, in itself it means that the Latvian labour force has become more educated, i.e., the human capital embodies more skills that are available for the employers.

Figure 3.5 Distribution of population education attainment by levels (aged 15 and older) in Latvia, years 1989, 2000 and 2008

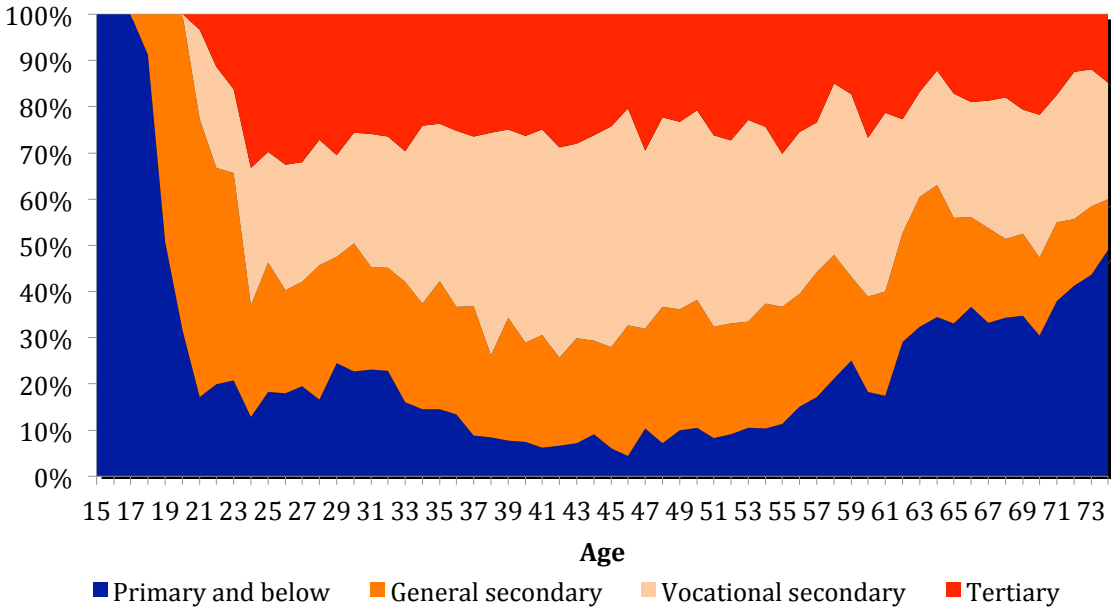


Source: Computed from Latvian CSB data
Note: 1989 and 2000: census data for population 15 and older, 2008: estimates based on LFS for population 15-74

As consequence of the rapid and significant changes in education globally and in Latvia (see Chapter 5 for details), significant attainment differences between ages exist. Figure 3.6 reveals labour force education attainment by age. People in younger age groups appear, on average, to be better qualified than those who are older. Similar to European countries the proportion of population without at least a primary education qualification raises with age. The very young adults (ages 15-24) are typically in the education system and their attained qualification at the moment of survey cannot be considered as final since most of them have not yet finished the education cycle. The education of population aged 35-50 is more dominated by vocational secondary qualification that corresponds to the education policy at the time of their secondary education period when vocational schools were popular. Increase in the share of general secondary and tertiary education in partly due to less vocational secondary education – a trend that most probably would continue, given the secondary vocational education status presently. The author thinks that this is not a fully desirable trend as skills acquired in tertiary education are not a good substitute for vocational skills in the labour market. Employers complain (see Latvian Competitiveness Report 2011 for

Employers' Confederation opinion) about lack of qualified specialists in industry – the workers with secondary vocational education.

Figure 3.6 Labour force education attainment by age, Latvia, 2008



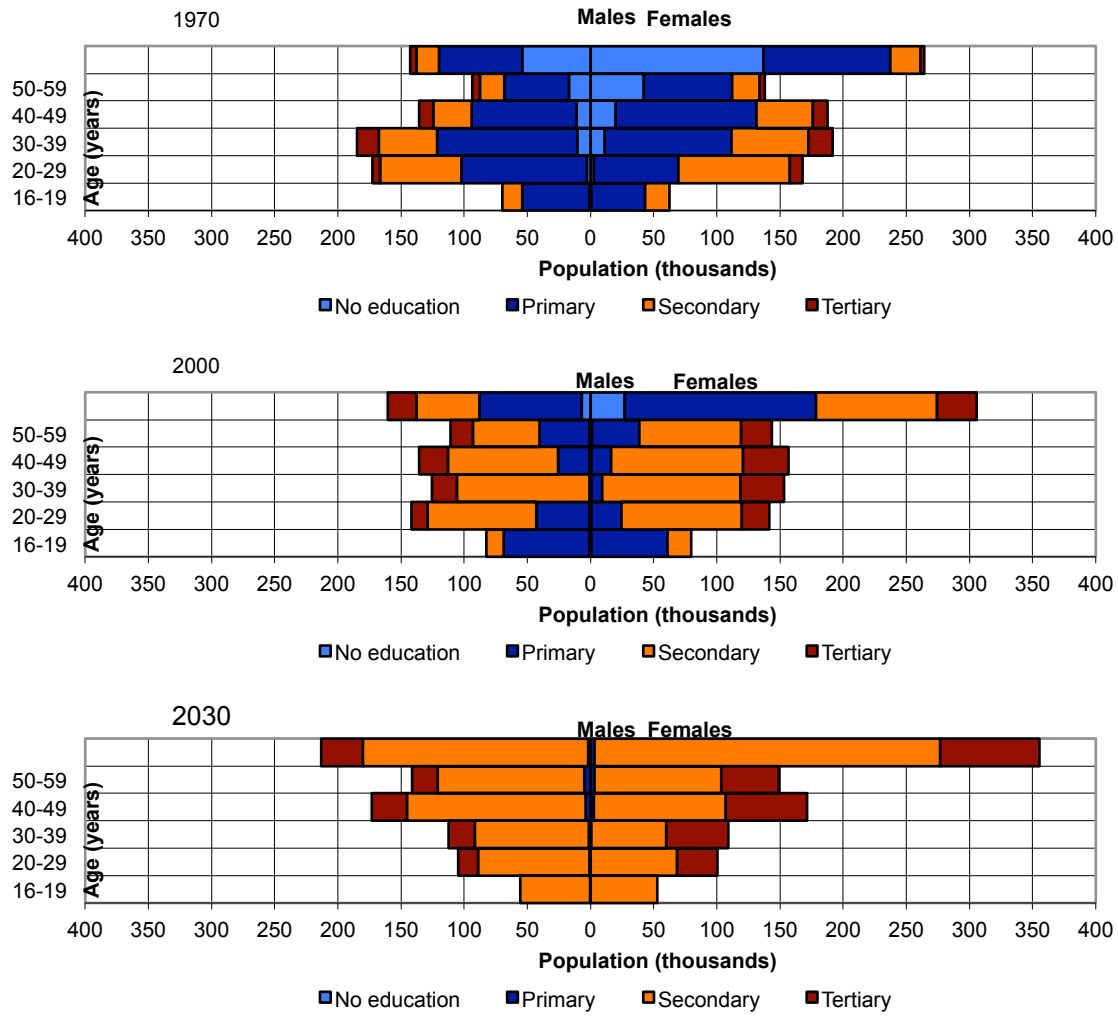
Source: Latvian CSB, author estimates based on LFS 2008

Note: The data for population education attainment are estimated from 2008 labour force survey. While methodologically representative, it is survey data and should be taken with caution for each separate age, but rather used for overall picture. Hence, the volatility between nearby ages should be ignored.

Structural changes in education are more apparent if changes are observed over a period of 30 years, which roughly corresponds to a length of generation. Education changes along cohort lines, and there has been a remarkable increase in the proportion of qualified people from one generation to the next (first two graphs of Figure 3.7). The cohort diagrams show that an important share of population in 1970, especially, the old people, did not have even primary education, and a primary qualification was a standard and dominated all age groups above 29 years. In 2000 the situation was radically different – only in 60+ age group there were some ten percent of people without primary education, primary education was dominating only the older age groups (and youngest group where education cycle was not yet completed), but secondary education has become a norm among all but the oldest cohort in Latvia as in almost all OECD countries (OECD 2009). Similarly, the tertiary education attainment has gained more important place in all age groups, including the older people. Additionally, these figures must have changed quite dramatically over the past ten years as a consequence of massive move of people to tertiary educational levels. Comparable census

data of 2011 would become available in 2012 as earliest, but as seen above and from flows of graduates, the levels would be even higher.

Figure 3.7 Education attainment by age and gender, Latvia; 1970, 2000 and 2030 (projected)



Source: author computations from Latvian CSB (1974), Latvian CSB (2002) and Samir et al (Lutz) (2008) (respectively for figures)

Note: For 2030: projection of population distribution by gender, age and education level, IIASA, GET scenario, assumes that a country's educational expansion will converge on an expansion trajectory based on the historical global trend (for details see Samir et al, 2008).

The results of IIASA projections of population distribution by age and education levels (for 120 countries, including Latvia (Samir et al 2008)), suggest that in the future in Latvia nearly all adult population would hold at least a secondary qualification, and the tertiary education would expand even more (third graph of Figure 3.7).

The pyramids of population distribution reveal changing *gender* distribution in education and goes in line with findings about global trends of rising female/male balance. In Latvia in 1970 the average education level in all but oldest age groups and proportional distribution of education levels within age groups was similar for both genders, only in age

groups above 50 males were on average higher educated revealing the historical fact that in early days up to beginning of twentieth century they were typically males who perceived formal education. In 2000 the proportional distribution of education levels were also rather similar for both genders at all ages. The 2030 projections take account of the higher female education participation and graduation rates and project that females will, on average, have higher education attainment in all age groups.

3.2 Family background and parents' education

Social make-up of the student population has been among main topics of higher education policy debates in Europe over the last few years. Improvement of social equity is seen as a pre-requisite for competitiveness of a country. The topicality also determines the availability of comparable data in Europe. Student mother's and father's highest attained education level and occupational status is a proxy for student social background that allows to investigate how well the student population represents general population and to what extent higher education is socially selective, i.e., how certain groups are over- or under-represented in higher education.

Both parents' education is considered to determine student's educational background. The reflection of theory and empirical studies of chapter 1.1 suggests that the parents' education and socioeconomic status determines the children's choice of study area. Therefore in broad categories the share of students whose parents are holding higher education diploma (ISCED 5, 6) represents the extent of social reproduction in a higher education system, whereas the share of students whose parents have only completed secondary or lower education represents social mobility. At the same time it also illustrates social disadvantage. Students with parents holding tertiary education are thought to come from high social background, and those, whose parents have primary education or less are thought to come from low social background. Hence the aim of this section is to understand what education heritage patterns holds in Latvia and what socio-economic factors affect student education choice.

3.2.1 Socio-demographic characteristics of students

This section concentrates on analysis of socio-demographic background and situation of students in Latvia to understand how equitable is access to higher education and how are student family situation.

Parents

In international comparisons, the educational attainment of students' parents is often viewed as an indicator for the impact of socio-cultural and economic factors on access to higher education. Most definitions of an equitable access to (higher) education, share the idea of representativeness or proportionality: the share a social group holds in higher education should reflect the share this group holds in the general population. Often only one parent's (typically father's) education is used, but here the situation is presented with both parents. The author uses Eurostudent III survey results for this analysis, that gathers information on academically oriented tertiary education (ISCED 5A) in publicly funded HE institutions and considers only national or permanent resident students in a particular country. If assessed by father's education, 39 percent of higher education students in Latvia come from high social background and 4 percent from low social background (see table 3.1.). If measured by mother's education, the situation is somewhat different and 54 percent would be high, and 3 percent low social background students.

Table 3.1. Student family background (percent of students)

	Share of students fathers	Share of males aged 40-60 in all population	Share of students mothers	Share of females aged 40-60 in all population
Educational background				
Primary or below (ISCED 0, 1, 2)	4	12	3	6
Secondary (ISCED 3)	46	61	36	54
Post-secondary, non-tertiary (ISCED 4)	11	8	8	12
Tertiary (ISCED 5, 6)	39	18	54	28
Occupational background				
High skilled white-collar	45	..	51	..
Low skilled white-collar	18	..	29	..
High skilled blue-collar	13	..	4	..
Low skilled blue collar	9	..	8	..

Source: EUROSTUDENT III, National Profile of Latvia

The comparison of the parent education distribution with the general population of the age 40-60 (i.e., the population that can possibly be parents of students) reveals the social mobility in the country. From the comparative data we see, that both – fathers and mothers – of tertiary students are better educated than the general population at the respective age. This makes to conclude that higher education students in Latvia come from higher educated parent families. If compared with other European countries, Latvian data show important underrepresentation of low-background students in higher education systems along with Slovak and Czech Republics, Romania and Bulgaria, whereas the Netherlands, Spain and Finland are seen to be relatively open systems with near to perfect representation of the low education background group in the student body (Orr, 2008 (Eurostudent III report)). Proportionally, high background students are overrepresented. The higher education system in

Latvia therefore is rather selective and the level of social mobility if measured by achieved education level – low.

If social background is measured by parents' occupational group, it can be seen that 45 percent of student fathers and 51 percent of mothers are employed in high skilled white-collar jobs and can be seen as coming from high background, but 21 percent of fathers and 12.4 percent of mothers are employed in blue-collar occupations (both high and low skilled, occupational group which performs manual or technical work). No data on distribution of population aged 40-60 is available, but due to this groups relatively low chance of entering higher education (Orr, 2008), it also represents social disadvantage of the offspring. Measuring social background either by parent's educational attainment or occupational level therefore produces similar results. The European-wide study of equitable access to higher education (Bohonnek, et al, 2010), largely based on the same EUROSTUDENT survey, but also on Eurostat data, show that in Latvia together with Bulgaria, Czech Republic and Germany persist high barriers to higher education due to both dimensions of the socioeconomic background (parents' education and occupation).

The higher education Graduate Survey 2006 in Latvia showed that children are acquiring higher education level than the parents[11], even it is possible that the students at the time of interview had not finished their education career. This survey shows lower parent education compared to EUROSTUDENT information – only 39 percent mothers and 34 percent fathers of the graduates in 2003 and 2005 had attained any level higher education, but the pattern is similar that *mothers are higher educated than fathers*.

The imbalance between population education at age 40-60 and student/graduate education is lower as represented by the Graduate Survey 2006, still indicating underrepresentation of low background students in higher education, but at a lower scale. This difference arises from the target population – the EUROSTUDENT focuses on state funded institutions whereas Graduate Survey 2006 – on all higher education institutions. Hence, the difference reveals that *unequal access is more persistent in state-funded higher education institutions*.

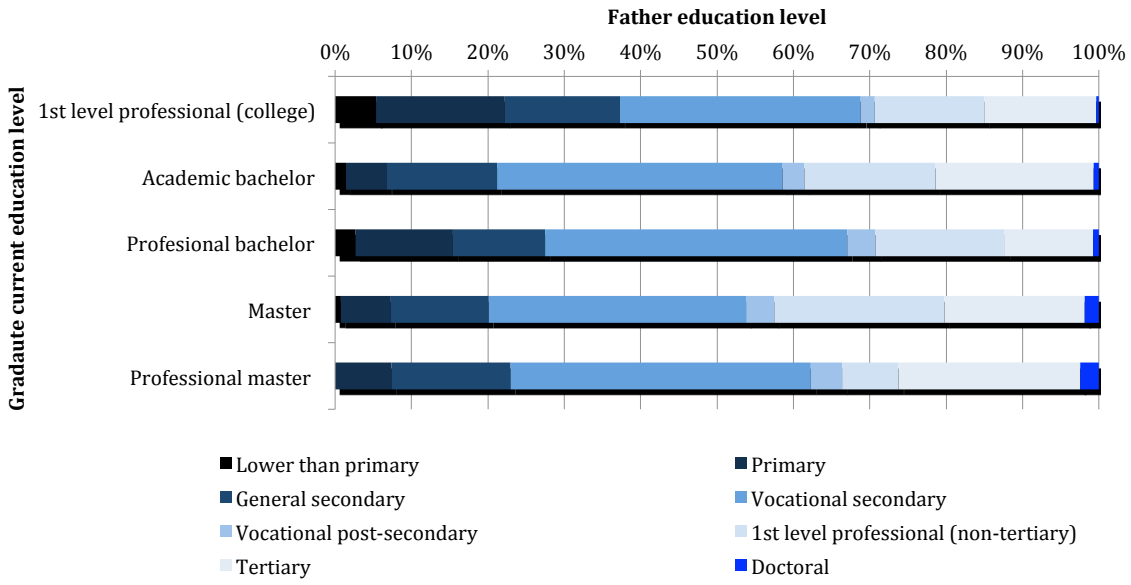
A deeper analysis from the same data regarding connection between family member education yield rather ambiguous results. It is not possible to truly assert that higher level of parent education is related with higher education of the offspring. For graduates from all higher education levels about 30 percent of parents (both fathers and mothers) hold vocational secondary education (Figure 3.8). The proportions are also similar for such other parents'

[11] The average age of graduates surveyed is 31 years. Accordingly, their parents cound be estimated to be aged 50-70, precise information not asked in the survey.

education levels as post-secondary vocational and 1st level (non-tertiary) professional levels. A tendency though appears visually from the figures regarding the very lowest (i.e. below primary) and the very highest (doctoral) levels of parental education. There is a property that for graduates with higher (i.e. master) degrees proportionally more parents hold doctoral degree, while for graduates from college programmes proportionally more parents are with primary and below primary education. By visual inspection it appears somewhat specific that graduates' with professional degree parents (and this regards both mother and father) have lower education levels, potentially indicating that people from lower social background tend to choose professionally oriented education, possibly allowing faster access to labour market. Statistical affirmation for this conclusion cannot be obtained here,[12] but it is nevertheless important feature.

Figure 3.8 Graduate family backgrounds - proportional distribution of parental education level by graduate education.

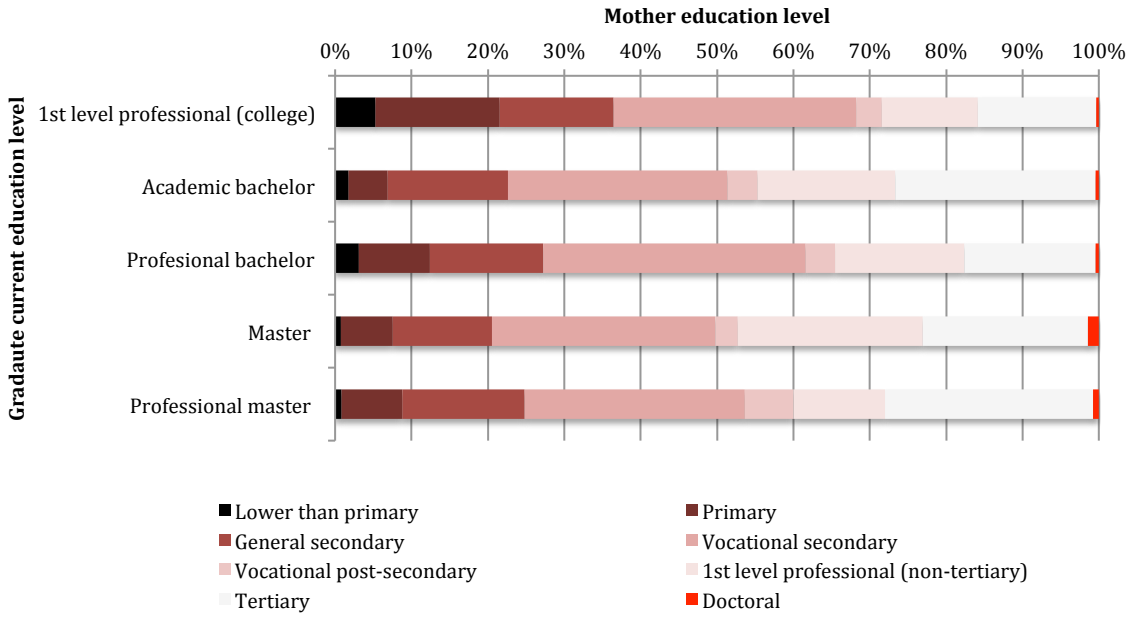
(a) Father



Source: Author computations from Graduate Survey 2006

[12] The reason is because it is unknown at what stage of the education career the graduates were interviewed, i.e. if they intend to study more or have finished the education. Therefore the analysis would be significantly biased.

(b) Mother



Source: Author computations from Graduate Survey 2006

Overall, there is evidence that there exists a persistent link between children and parent education levels, pointing at non-equal access to higher education. What is especially critical that the access to state- (or partially state-) funded higher education institutions appear to be more un-equal. Some of the problem why it is not possible to precisely assess the link between levels of education is that the education system between parent and children schooling periods has changed and are not easily compatible. More evidence on differentiated access by social groups to education in Latvia would be seen in the fourth round of EUROSTUDENT survey that has been completed, but the results are not available as on the moment of writing.

Student family status

When student marital status is assessed, large share of students consider them to be single, i.e., nor in a long-term relationship, nor married – 77 percent (81 percent males and 75 females) (EUROSTUDENT III). There are large differences in Europe – in the Czech Republic, Germany, Romania and Slovenia and Slovakia less than half of all students consider themselves to be single, while on the other end of the scale as many as over 90 percent of the students in Spain, Portugal and Italy consider themselves single. According to the EUROSTUDENT survey results, only 2 percent of all Latvian students are married, and 20 percent are in long-term relationship (17 percent males and 22 percent females).

98 percent of students have no children (equally for both genders), but the other 1.9 percent have one child. This is the lowest result in EU. Students with more than one child at

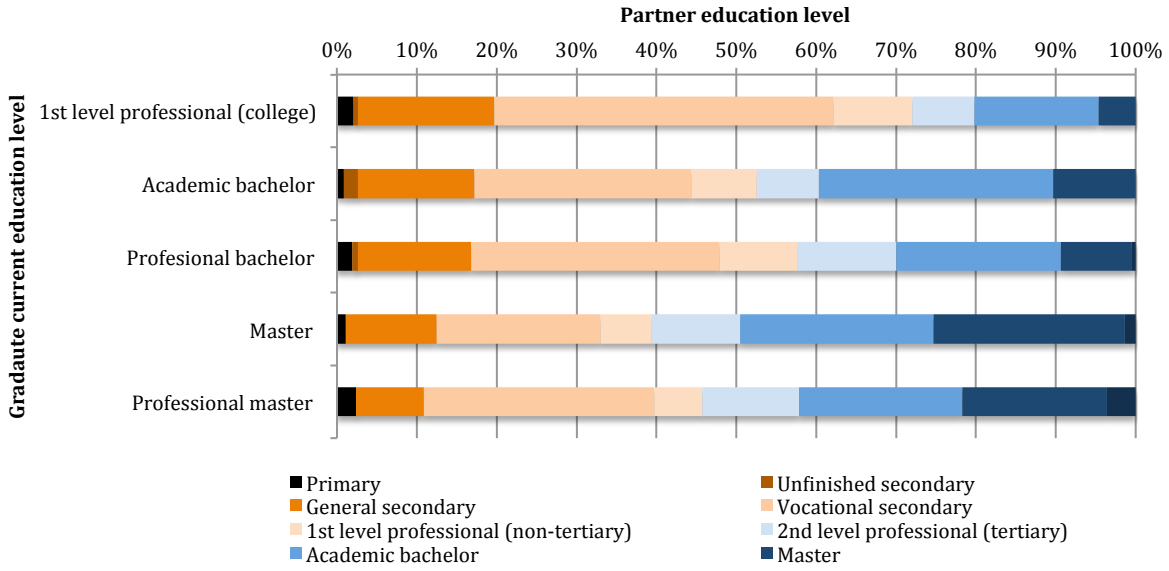
the time of studies are highly uncommon common. Norway is the other extreme, where 21.7 percent have at least one child. Very large differences prevail also with the neighbouring countries where Lithuanian students are similar to Latvia and only 3.6 percent have children, in contrast to 11.2 percent in Estonia (the surveyed students are older). In most national systems less than one in ten students has a child. This seems to indicate that Latvians typically do not perceive parallel careers of education and family but rather postpone family and childbearing decisions to after graduation. It goes in line with the raising age of women at first childbirth.

Same conclusion is confirmed by the graduate survey results. By graduation the student family status significantly differs from the student statuses. 3-5 years after graduation 62 percent of graduates (56 percent males and 64 percent females) are married or stable cohabitation; 45 percent of graduates have children (31 percent males and 50 percent females), and of those they have, on average, 1.54 children.

Regarding partner education, the data confirm presumption that people tend to engage with partner with about the same level of education. Although exactly the same level of education is not most important, as the data in Figure 3.9 illustrates.

Referring back to the population education attainment in Latvia (Figure 3.6), and for now assuming here that partners of graduates are around the same age, the partner education level exceeds that of the general population where between 20 and 30 percent in the respective age possess tertiary education. Not more than only 20 percent of tertiary graduates' partners education is below general secondary, but for graduates with higher levels of tertiary education about 10 percent. Here again the trend can be observed that professional higher education graduates' partners possess lower education. The most selective appear to be graduates with master degree (doctoral degree graduates are not examined due to low numbers in the survey) – partners are with comparatively highest education level: 65 (for academic master) or 60 (professional master) percent with tertiary education, more than 20 percent with master or higher degree.

Figure 3.9 Graduates' partner education – proportional distribution of partner education level by graduate education.



Source: Ministry of Welfare graduate survey

The above results again confirm that significant link between individual and partner education exists. Individuals tend to choose their partners with similar level of education. Partly, this is a result of the social network obtained in the time of studies – people not only study together, they also meet and establish relationship. Secondly, similar education level people have similar interests.

3.2.2 Factors explaining choice of study field

So far, the author has described graduates' family background and the impact of family background on offspring education. In order to understand the factors behind choosing field of study, the author has carried out a multivariate analysis using Graduate Survey 2006 data. A multinomial logit model, also known as multinomial logistic regression, is a regression model, which generalizes logistic regression by allowing more than two discrete outcomes. That is, it is a model that is used to predict the probabilities of the different possible outcomes of a categorically distributed dependent variable, given a set of independent variables (which may be real-valued, binary-valued, categorical-valued, etc.).

The aim is to associate the education field choice with parent and partner education, occupation, gender and other control variables that could potentially have impact on the choice of field of education to answer the following questions:

(1) Does parents' and partner's education level affect choice of study field?

(2) What role do parents' occupation have on children's field of study?

(3) Does gender have significant impact on the field of study chosen, i.e. are study fields gender specific?

The model is as follows: dependent variable – field of studies (7: education, humanities, sciences, engineering, agriculture, health and social care, services; reference category – social sciences); regressors: gender, age, ethnicity, marrital status, partner and parents' education level, origin, sector of parent employment:

$$\begin{aligned} \textit{Field of studies} = \; & \alpha + \beta_1 * \textit{gender} + \beta_2 * \textit{age} + \beta_3 * \textit{ethnicity} + \beta_4 * \textit{family status} \\ & + \beta_5 * \textit{partner education} + \beta_6 * \textit{mother education} + \beta_7 * \textit{father education} \\ & + \beta_8 * \textit{origin} \\ & + \beta_8 * \textit{mother sector of employment} + \beta_9 * \textit{father sector of employment} \end{aligned}$$

While the aim was actually to test existence of heritage of profession from parents or how the profession of parents affect the educational choice of children, the database puts some limits of the choice of variables. For parents two different kinds of information are known – their profession and their sector of work. For graduates, we know the field of study, and the sector of work. Profession of parents was included in the first variation model to explain field of education of children, but majority of variables turned out to be negative. The reason is that parents profession is accounted according to Profession Classificator of Republic of Latvia (MK noteikumi Nr. 461, 1.pielikums, 18/05/2010), while the field of studies is coded according to a different classification – the classification of education programmes. The profession classification by broader groups (1-9) does not reflect the actual content of work while more detailed disaggregation is problematic from the point of view of sample size. The sector of work of parents was therefore taken as a good indicator of parents occupation.

The overall explanatory power of the model is satisfactory (chi-square significance 0.00), the strength of the relationship measured by classification accuracy is appropriate (see Appendix A3 for details). The author concludes therefore that the model has sufficient overall explanatory power and the results are valid and can be interpreted.

Table A3.4 (Appendix A3) presents results. First, the modelling results demonstrate, that study fields are indeed gender specific. By itself the result is not surprising, it confirms the obvious statistics that one or the other gender is more common in certain disciplines. Though, this model controls also for the other factors known to affect the educational choice. So, girls are more likely to choose education sciences and humanities, while boys would more probably choose the fields of sciences, mathematics, IT, engineering, construction, agriculture

and services sectors, as compared to social sciences. Males have very strong preference for sciences, mathematics and IT field, and especially strong result (in terms of significance and the size of coefficient) for engineering. Being a female strongly increases the odds of choosing education sciences over other fields.

Some effect is observed from age on the probability of choosing the study direction. It appears that the younger the student the more probable he is to end up in science, mathematics and IT fields, and engineering and construction, compared to the reference field (social sciences), while the older the student the more probable he is to graduate from fields of education and health. This result though has to be taken with caution as the age of respondent is registered at the graduation rather than start up of studies.

Being a Latvian rather than other ethnicity decreases the odds of studying natural sciences and engineering. The ethnicity does not have significant effect on choice of other fields. The possible explanation is that studying sciences and mathematics potentially require less state language skills and are therefore easier for other ethnicities, predominantly Russians.

The 'partner' and 'partner education' variables were controlled for but turned out not to be significant. The main reason for this is most probably the fact that similar to age variable it is registered at the moment of survey and establishing partnership with very high probability has happened after starting the studies.

Mother and/or father holding higher education was included as explanatory factor in the model, but did not turn out to be very significant. This result does not mean that parents' education level is not an important factor for children education as such and does not contradict with theoretical expectations and earlier research. Instead, it confirms that parents' education level as such does not affect the study direction. Statistics confirm that people coming from rural regions increases the odds of him/her studying agriculture.

The analysis reveals that there is no close statistical relationship between parents' employment sector and children's field of studies. There are only discrete significant relationships. Father working in health sector increases the probability that the son or daughter will study medicine, while mother employment in health sector does not increase the respective probability. The parent education background for those studying agriculture and services are so diverse that not a single relationship holds there. Other coefficients that appear to be significant are truly difficult to explain, such as mother working in education or state administration decreases odds to choose sciences; or father being employed in construction sector increases the probability of person to study pedagogy. The author concludes that the

parental background in all education sectors is so diverse that it cannot explain the choice of field.

In fact, correlation between parents' employment sector and first employment sector of respondents was not high either. The correlation coefficients are statistically significant, but very low (Table A3.5), giving yet another affirmation that *individuals in Latvia tend to make independent careers from their paren*ts.

3.3 Gender as determinant of study choice

As reflected in theoretical part, gender is one of the major covariates in educational demographics. Previous analysis revealed, among other things, the significant differences between male and female education patterns. This was seen both – from the review of studies and theoretical motivations (Chapter 1), and from the statistical data on Latvian higher education (section 3.1). The author attempts to document the differences here.

3.3.1 A brief overview of gender differences at the outset of higher education

In several aspects the education path of males and females in Latvia at the outset of higher education do not differ substantially. For example, the school life expectancy in primary and secondary education (ISCED 1-3) is identical for males and females – 11.6 years (UNESCO, 2010:192). However, in a few aspects, females seem to be more advantaged. More females than males attended general (i.e. academic) secondary education (89% as compared to 85%; Ministry of Education and Science, Secondary education statistics, 2010), whereas more males attended vocational secondary schools (11% vs. 15%). Also the gender balance in secondary level schools is shifted slightly towards females (49.61% girls and 50.39% boys in 2010/2011 academic year) when the distribution in the general population at the respective age 6-18 is respectively 48.98% and 51.02% (source: Latvian CSB databases). The difference is not big but persistent through years. So, males appear to be in somewhat disadvantaged position for study career before start of higher education.

Girls' performance at school is significantly better in reading and somewhat better in science subjects (PISA[13], 2009; Kiselova, 2011), while boys performed slightly better in mathematics (though, both genders knowledge level was below the OECD average). It can be concluded hence that females from early career steps are somewhat more oriented towards humanities while boys show relative preference for science subjects. This most probably affects the future choice of field of studies in higher education.

[13] PISA: OECD Programme for International Student Assessment

The above are aspects that predetermine different careers for genders from the outset – the orientation of males towards professional career and mathematical subjects, leading more often to technical fields – engineering and science; and for females towards academic education career and hence towards less technical fields such as humanities and social sciences. Similar trends academic-vocational division in secondary schools are observed in Sweden (Statistics Sweden, 2010) and rest of the Europe (Einarsdottir, 2007).

While the school attendance rates for general secondary and vocational secondary schools are 87% and 13% respectively, stable at the same levels since 1993 (CSB Latvia databases, IZ06), the view from graduate perspective at the student background looks different. According to the Latvian Graduate Survey 2006 for the graduates whose previous education was secondary level, 71.7 percent was general secondary education while 28.3 percent – vocational secondary (74.4% and 25.6% for males respectively; 70.4% and 29.6% for females). Quite opposite to the expected, the relative representation of vocational school graduates in the higher education entrants exceeds that of general (or academic) secondary education. This effect is true for both genders, and especially for females.

3.3.2 Gender profile of tertiary graduates

The aim of this section is to understand if significant differences exist between male and female personal and family background profiles. Of course, the first indicator is the overall rates of genders in higher education, where females are 70% vs. 30% males (or 1756 and 735 in the 2491 Graduate Survey 2006 sample). Is this the only difference? The approach chosen is to characterize each gender group. There are indeed some differences in tertiary graduate student profiles between males and females. The Graduate survey 2006 reveals the difference (Table 3.2).

The demographic profile of graduates significantly differs between genders. First, female graduates (and hence female students) are on average about four years older than male students (32 vs. 28.4 years), and the difference is statistically significant. This is linked to the fact that females study longer and in part time studies.

Upon graduation females are more probable to be engaged in a stable partnership (the author does not discriminate between marriage and partnership without official registration). They are also much more likely to have children in the household (50% vs. 31%)[14], while if person has children, the number of offspring is not statistically different between genders.

[14] The survey asks whether there are children in the person's household. The statistics therefore does not account children that live with the other parent if parents are separated.

Rather interestingly a significant difference exists between partner education levels. The graduate males' partners are higher educated than females' partners.

Table 3.2 Differences between male and female socio-economic profiles (comparison of means)

	Mean Total	Mean Males	SE	Mean Females	SE	t-test for Equality of Means Sig. (2-tailed)	
Age	30.98	28.41	0.271	32.05	0.229	0.000	*
Latvian	0.77	0.77	0.016	0.77	0.010	0.803	
Partnership (lives with partner)	0.62	0.56	0.497	0.64	0.480	0.000	*
Children (lives with children)	0.45	0.31	0.028	0.50	0.021	0.000	*
Number of children (if any)	1.53	1.51	0.053	1.54	0.024	0.598	
Partner has higher education	0.34	0.42	0.018	0.31	0.011	0.000	*
Mother has higher education	0.39	0.51	0.019	0.35	0.011	0.000	*
Father has higher education	0.35	0.46	0.019	0.30	0.011	0.000	*
Finished previous education in Riga or Rigas rajons	0.57	0.59	0.018	0.56	0.012	0.233	
Finished previous education outside Latvia	0.02	0.01	0.004	0.02	0.003	0.046	*
Study field: education	0.17	0.04	0.008	0.23	0.010	0.000	*
Study field: humanities and arts	0.07	0.04	0.007	0.08	0.006	0.001	*
Study field: social sciences, management and law	0.54	0.49	0.019	0.56	0.01	0.002	*
Study field: sciences (natural sciences, mathematics, IT)	0.05	0.11	0.01	0.03	0.004	0.000	*
Study field: engineering, manufacturing and construction	0.08	0.21	0.02	0.03	0.004	0.000	*
Study field: agriculture	0.01	0.018	0.005	0.008	0.002	0.056	
Study field: health and social care	0.05	0.03	0.006	0.05	0.005	0.004	*
Study field: services	0.03	0.07	0.009	0.02	0.003	0.000	*
Full time studies	0.68	0.80	0.015	0.63	0.012	0.000	*
Budget financing throughout the programme	0.35	0.43	0.018	0.31	0.011	0.000	*
Study or student loan	0.23	0.25	0.021	0.22	0.012	0.297	
Worked during studies, was entrepreneur or self-employed	0.79	0.79	0.015	0.79	0.010	0.784	
Continued studies after graduation	0.41	0.48	0.019	0.38	0.012	0.000	*

Note: Statistical method: Independent samples t-test
All variables are binary (1 or 0) except age (scale). The binary variables are also convenient to be interpreted as shares of the respective respondent group possessing the indicated property.

The two groups seem to come from somewhat different social background. Males more often than females come from highly educated families where mothers and/or fathers hold higher education. In the absence of information about the income level of the family, parents' education is an important indicator of student family's social status. Hence, the author concludes that male students in higher education come from higher social background, and they are also surrounded by higher educated family since also the partner is typically higher educated. The author tends to conclude that males more often choose higher education because it is motivated by the parents having high education levels and they do not want to

fall lower. This is also true for females, but for them there is stronger motivation to achieve higher education level than parents as a means to secure place in the labour market.

This analysis confirms the gender specificity of study fields. Humanities, arts and education study fields are clearly female dominated, and perceived so generally. The health and social work field is also more female specific basically due to high number of medical sisters that is almost exclusively a female profession in Latvia. It turns out that also proportionally more females than males study social sciences, as the difference is not big but very significant. The male students would more typically choose to study in one of hard sciences fields – natural sciences, mathematics, information technologies and engineering. Representation in agriculture field is similar for both genders. Males are more often students in the field of services than are females. These results are true for other European countries (Einarsdottir, 2007). Bohonnek et al (2010) concludes, "As female disadvantage in the vertical level of education has largely disappeared, the issue of gender inequalities in education seems to have shifted to the issue of horizontal gender disparities in the choice of field of study."

Among males there are more students that studied full time and studies were financed by state budget. These two indicators are linked as budget financed study places are available only for full time studies. Though between genders there were no statistical differences with respect to other financial and employment parameters – about the same share of males and females used study and student loans (23%), and the same proportion were engaged in labour market activities either as employees or employers (79%).

3.4 Discussion

The positive intergenerational transmission of human capital is a standard finding in theoretical and empirical literature. This analysis confirmed the relation between parental education background and children education attainment. This study also assessed connection between field of education and parent employment, and concentrated on gender aspect as determinant of study choice.

Access to higher education continues to be more open to children of highly educated parents. It appears though, that it is the level rather than particular kind of education that matters – statistically significant connection between the field of parental employment and children education or their first employment sector was not observed.

While we may think that intergeneration education connection is logical and feel comfortable about it, there is also the other side of the coin. This close inheritance may point

to low intergenerational social mobility and unequal access to education. Youngsters from lower social background, measured by parent education level, which is known to correlate with income, may be in disadvantaged situation for starting studies and may have to choose shorter education programmes with faster access to labour market. This calls for necessity of regular monitoring of student social economic situation.

The EU gender pattern in education was also confirmed, indicating that sciences, mathematics, IT and engineering are male dominated, females choose humanities and education, and both genders with equal intensity choose social sciences. Gender is the strongest and the most robust determinant of study field decision. The different education patterns start in secondary education level with selection of general or professional secondary education and different study results in different subjects. It should be studied in-depth if something "happen" to males in primary/secondary education that determines their lower performance and makes them less "fit" for higher education.

The author reasons that the key difference underlying the gender education paths in higher education is motivation – in the labour market females compete with higher education level compared to males to offset gender gap in remuneration. They connect their promotion and career development with increasing their human capital. The difference may also lie in culture – in Latvia (and so if true for many other post-communist countries) females are used to perform multiple roles at the same time – employment, studies, family care – more so than males.

What does policy maker have to learn from these conclusions? Is it a problem that education is female dominated? Not necessarily. Though policy instruments for education development, if needed, may have to be designed separately for both genders. We may also bear in mind that in the future higher-level human capital would be comprised in female part of population, making birth, childbearing and childcare leaves relatively even more costly to the economy. In this context the education payoff schedule (both individual and social) for females is different from that of males.

For better understanding of where in the education process the differences between genders arise, quantitative modelling approach to education cycle is a good complement to descriptive measures. It allows studying the typical study paths through higher education and allows to answer "which" students went "where" to study "what".

4 STUDY CAREER: LIFE TABLE APPROACH IN MODELLING HIGHER EDUCATION

There are two objectives of this chapter. The first is to develop a multistate model for modelling study career and analysing student progression through higher education system. To do that, the author reviews multistate life table (MSLT) method and emphasizes the methodological innovation and potential utility of this method to population education studies. This explains the relatively large and detailed attention devoted to describing methodology, theoretical issues and mathematical construction of multistate life tables. The second objective is to apply the developed approach on University of Latvia (LU) student data hence testing the fit and obtaining results for LU. Under certain assumptions the results can be generalized to student population in Latvia. This chapter defines three model specifications for higher education.

Multi state life table is an extended model of the classical life table technique, which in contrast to the simple model distinguishes more than two possible states of existence (the most straight forward example: a person can be a student, alive, but not student, or dead), and multidirectional transitions between (at least some) of the states are possible (between being a student and not student). The author's methodological innovation is in development of the technique for higher education system studies, whereas the practical novelty is application of the technique to actual database and obtaining results for LU. Was there a national database available of the similar kind (as discussed in Chapter 2), the author could answer the same questions for Latvia – for instance: what are the dropout probabilities in first, second or third year of studies?

This chapter consists of the following sections. Section one sets study path in the framework of life cycle approach. Section two describes methodology and defines models. Section three describes database and addresses data issues. Section four presents results for the case study. Section five discusses and concludes.

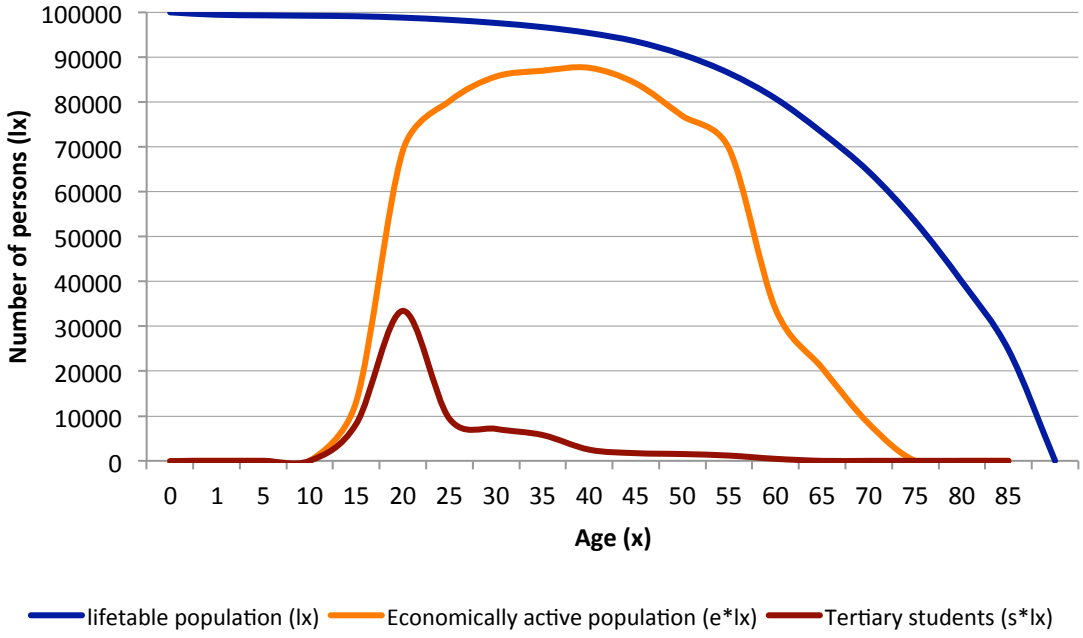
4.1 Higher education in life history models

Survival analysis is a traditional way of analysing cohort development and dynamics using age specific probabilities computed within life tables.

Figure 4.1 indicatively illustrates the set of events occurring to a hypothetical cohort of Latvian population – the survival of the cohort, the cohort's work and studies profiles. It shows age specific rates of different statuses the population occupies. It illustrates a cohort's survival, intensity of study and work lives. This graph is typical for most developed countries

– people acquire education early in their careers (primary and secondary education not shown here), when the share of cohort studying is the highest at age 20-24. Later they enter the work life being active (or inactive) in the labour market. The greatest number of years a cohort lives is actually spent in active population status. In older ages the population activity diminishes.

Figure 4.1 Life table indicators, active population and tertiary students in Latvia, 2008



Note: Life table population (l_x) for Latvia calculated based on year 2008 mortality data (blue line) for hypothetical cohort (5-year abridged life table). Age specific indicators of economically active and tertiary students are calcualted as shares (s_x and s_x) in real population (for the respective 5-year age group) and attributed to the cohort.
Source: Author's calculations

This thesis is concerned with the tertiary education period of people's lives and analyses processes there (schematically any transitions that affect the shape of or area below the dark red line in Figure 4.1).

While the total time a cohort spends in acquiring higher education from the lifetime perspective is relatively small, the dynamics of transitions between higher education and labour market, and within different levels of education determine the size and quality of human capital. These transitions also determine demand for education and show effectiveness of education system. Therefore the author uses multistate life table approach for in-depth analysis of the cohort dynamics within tertiary education.

4.2 Methodology for modelling higher education progression in multistate life table environment

4.2.1 Origin and applications of multistate life table models

The basic life table has been known in mathematical demography since the first tables were introduced more than 300 years ago when John Graunt comprised first life table for a hypothetical London birth cohort of 100 people (Graunt, 1662). Since that, life tables have developed and are used as a separate technique in demography. It has been developed to include different statuses, which change over time, as well as increments and decrements from the statuses.

The multistate life table is also referred to as an increment-decrement life table. Multistate demography studies the dynamics of multistate populations, i.e. populations stratified by a set of attributes. Multistate populations have also been referred to as multigroup populations (Schoen, 1988) or multidimensional demography (Land and Rogers, 1982). The founding father of multistate demography, Andrei Rogers, considered a population stratified by region of residence and hence defined the field as multiregional demography (Rogers, 1975, 1995). The term 'multidimensional demography' is also used (e.g. Land and Rogers, 1982).

Schoen (1988) found that the earliest work on multistate life table models have been done by DuPasquier (1912), who studied disability insurance using a model with two active states, healthy and disabled. There were a few subsequent studies (Depoid (1938); Fix and Neyman (1951); Chiang (1964)), but multistate approach did not attract much attention until 1970s, when computers became available to carry out calculations.

The contemporary multistate method originated in the early 1970s with Rogers who generalized classical demographic models – the life table, population projection models, and the stable population model – from two states (alive and dead) to multiple states of existence. As a specialist in urban and regional planning, Rogers's interest was mainly in regional population dynamics and migration, and the generalization was to a system of regions: a multiregional system. His first results appeared in the journal Demography in 1966 and in book form only in 1975 (Rogers, 1975). Schoen (1975) and Schoen and Land (1979) applied it to the analysis of population marital habits. The National Science Foundation recognized the development of the field and in 1981 sponsored a conference "Multidimensional Mathematical Demography" in Maryland, USA (organized by Land and Rogers). Proceedings published (Land and Rogers, 1982) constituted the reference basis for any subsequent research in multistate demography.

Since that time, the field has expanded and developed, as multistate methods have been found to be both powerful and flexible enough to capture the movement of the complex behaviour of a cohort (Mills 2000). Willekens (1987) argues: "the life table has made a transition from a method for estimating the length of life to a technique for describing the structure of life." The key to development of this method was the use of the Rogers' mathematical demography, especially the application of matrix algebra in the life table.

The methods of multistate population dynamics were developed in and associated with International Institute for Applied Systems Analysis (IIASA) in Austria during the 1970s and 1980s (Keyfitz, Rogers 1982) and have since become a standard component of the demographic tool box. Nowadays, development of multistate methods is largely, but non-exclusively concentrated around IIASA and the Netherlands Interdisciplinary Demographic Institute (NiDi).

Development of multistate methods and applications have been empowered by development of computer technologies and software for statistical data analysis that have made it possible to compute complicated mathematical models at high speed. Calculation of multistate life tables involves matrix calculus, which are not overly difficult but are time consuming if attempted to do it by hand, especially if more than three states are involved. Nowadays various computer programmes exist to perform the calculations. Specially developed programmes, for example, GSMLT v.90, ImaCh, LIPRO, SPACE, are available for use. General software packages such as STATA, MATLAB and MATHEMATICA contain pre-programmed routines such as matrix inversion and can be supplemented by user-defined commands. Calculations with MS Excel are slightly lengthier, as its current version includes the predefined operations with matrices, but setup has to be done manually.

The application of the multistate method includes diverse subject matters related to the family (Bongaarts 1982, Wolf 1987, Belanger 1989, Rogers 1975; 1995), labour force participation (Willkens 1980, Phang 1995, Lee & Rendall 2001), migration (Rogers & Willkens 1986), spatial population distribution (Willekens and Rogers 1978), marital status (Willekens 1987, Espenshade 1982), fertility (Bongaarts 1982, Scherbov & Vianen, 1999; Willekens and Scherbov 1994), active life expectancy (Rogers et al. 1989, 1990, Willekens 1980), transition to adulthood (Billari et al. 1999), mortality and morbidity projections (Rusnak et al. 1992), health status and life expectancy (Crimmins et al. 1994, Mamun 2003, Manton and Stallard 1988, Peeters et al 2002, Niessen 2002) and education (Lutz 2004, 2006, 2009, Goujon 2008, Macura 1989). Life tables are nowadays used by two main groups of users: the demographers to analyse population processes and to make projections; and insurance companies, for which life tables constitute a tool for premium setting policies.

There is a high potential for applying multistate models to the education progression analysis even though it has not been done extensively so far. As will be shown, it can be with good success used to obtain crucial indicators for policy decisions in higher education. In author's opinion, the reason for the sparse use so far is the combination of two factors. First, education progression analysis is on the margin between population studies, sociology and higher education management in contrast to other social factors like health, nuptiality, fertility and migration. The actual number of demographers working on education research is not large. Secondly, multistate analysis is an advanced mathematical demography technique, hardly ever used outside demographers league. Often education is used as a stratification variable in multistate models to define subgroups of population (for instance, Guralnik 1993, Skoog and Ciecka 2001). Land and Hough (1986) have attempted to use multistate methods to compute tables of school life.

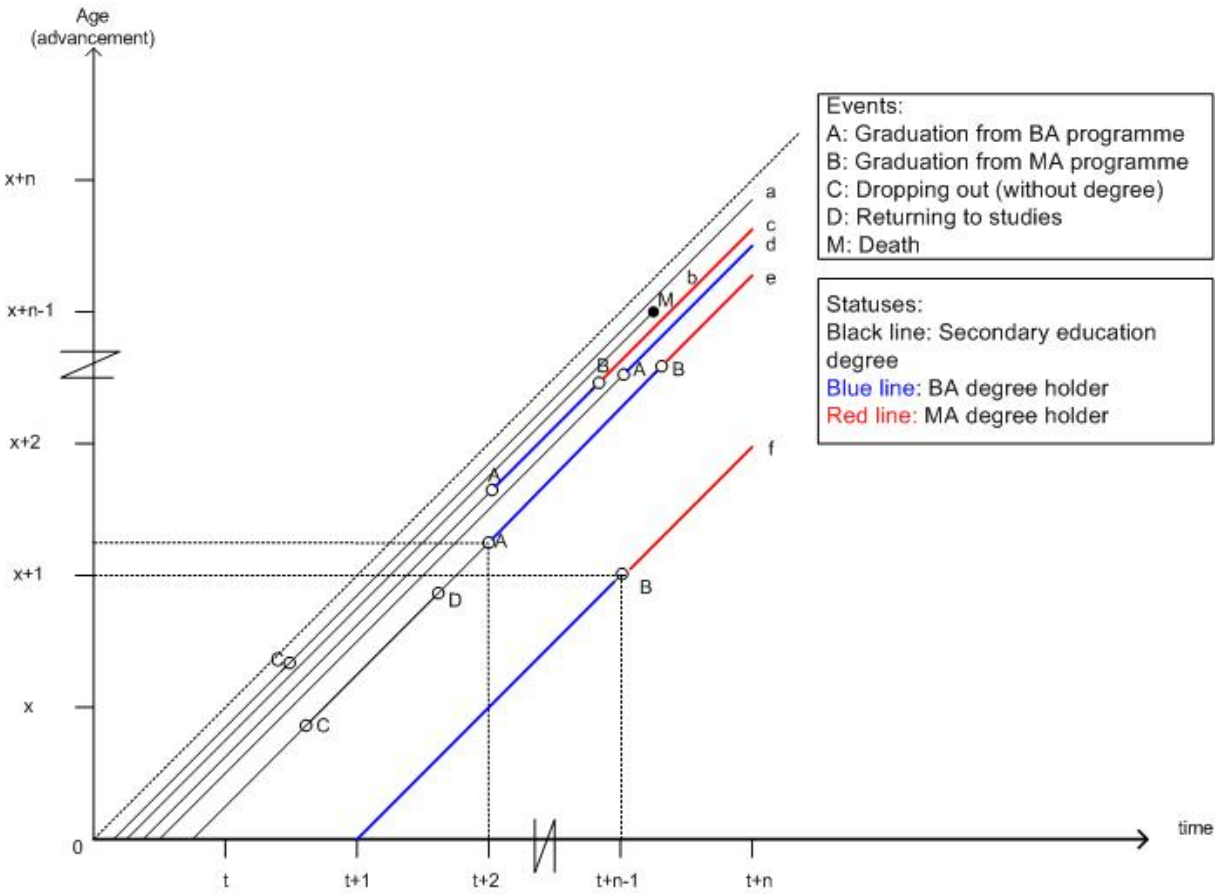
While conventional life tables are used for total population size projection by gender, multistate life tables can be used for subpopulation projections – be it geographical locations, marital status, health status, education or any other defined subpopulation that is analysed within this framework. Only recently multistate-based projection methods are accomplished. A huge step in terms of methods and applications in using multistate method in education analysis was done by International Institute for Applied Systems Analysis I (IIASA) (Samir et al 2008, Lutz 2001 etc.) that started and are effectively using multistate life tables for population projections by age, gender and level of education. Their approach consists of modelling four education categories (no education, primary, secondary and tertiary), and based on the obtained transition probabilities and assumptions about global education developments, estimate scenarios for population developments for 120 countries, including Latvia.

Any demographic investigation of renewable events, like education, may benefit from application of the increment-decrement life table model and hence multidimensional demography methods. "Education analysis is one possible field of application of multidimensional demography" (Willekens, 1982). The author attempts to tailor this technique for application to education analysis in Latvia.

4.2.2 Mathematics of multistatus model

Multistate life tables construct the individual biography based on partial observation, and the information is gathered during the observation period, and this information can be displayed graphically in a Lexis diagram.

Figure 4.2 Lexis diagram for multiple statuses in higher education



Note: This diagram represents an example of status definitions. Under alternative definitions of states and events the points and lines in the diagram would have different meaning.
Source: Author's figure.

The construction of Lexis diagram is analogous to that of conventional life table – historical time represented on the horizontal axis, and person's age on the vertical (Figure 4.2). Each diagonal line represents one person's lifeline (a, b, c, d, e and f). Points on the line (A, B, C, D and M) are events or transitions. The line between two events represents the status of the person (line between A and B says that the person is a bachelor degree holder). For convenience, different statuses can be represented by different colours (here: black for secondary degree, blue for BA degree and red for master degree holder). For example, consider the representation of a student cohort in the above chart. Individuals *a, b, c, d* and *e* all belong to the same cohort, enrolled in undergraduate studies in year t (between 0 and t), individual *f* belongs to a different cohort (some cohort starting graduate studies on year t+1). Individual *c* was enrolled in a bachelor programme at *t*, acquired Bachelor degree at *t+2* (event A), continued studies and acquired Master degree at time *t+n-1* (B). For the rest of the observation period his status was "holding a master degree" (red line). An individual *e* was enrolled at the same time, interrupted studies at *t+1* (between *t* and *t+1*, on the x^{th} year of

studies) (event C), re-enrolled at *t+2* (D), and graduated at *t+2* (A), at $(x+2)^{th}$ year of studies. He continued studies and acquired MA degree at *t+n*. The individual *b* studied all through time 0 to *t+n*, when died at *t+n* (event M, filled dot represents absorbing state). Four out of the five cohort members survived to the end of the observation period, the survivors are distributed among three different statuses (holding: secondary (1), bachelor (1) and master (2) degrees).

The Lexis diagram is convenient for visualization of the research problem. It helps the researcher to establish the basic relationships and define statuses. In author's model year *t* is year 2002, and the entrant cohort is observed through period of 8 years (*t+8*) because LU data are used.

Life tables are closely related to Markov processes[15] and the description of the model typically starts with introduction of the Markov concept, and it will be followed here. The model in this study is based on Markov process with discrete state spaces, and it can be described as time-inhomogenous, finite-space, continuous time Markov models, in line with Schoen (1988). In nontechnical language, the time-inhomogeneity means that the forces of decrement can vary within the age intervals. The finite state space of the model contains *J (j=1, 2, .., J)* states where *J* is greater than 1 and a positive integer. The *Jth* state is absorbing state from which there are no decrements, e.g. death.

We define the stochastic process *{S(x):x≥0}*, where the continuous time parameter *x* denotes the exact age attained (Schoen, 1988). The *S(x)* is the individual's position in the state space at age x. The transition probability between states *i* and *j* is:

$$\pi_{ij}(x,n) = prob\{S(x+n) = j \mid S(x) = i\} \qquad (4.1)$$

where $\pi_{ij}(x,n)$ denotes probability that a person in state *i* at age x will be in state *j* at age *x+n*. The transition intensity $\mu_{ij}(x)$ from state *i* to state *j* is defined as:

$$\mu_{ij} = \lim_{n \to 0} \pi_{ij}(x,n)/n \ , \text{ where } i \neq j. \qquad (4.2)$$

Equations (4.1) and (4.2) specify the Markov process as the probability of transition from one state to another only depends on the state the person occupies at the particular age, but not on any previous moves between the states. This assumption is a simplification (Schoen (1988) calls it "oversimplification"). The Markovian assumption ignores any history of how the person has reached the particular state and does note take into account the duration in the state that has proven effects on likelihoods of happenings, i.e., there is no path

[15] Markov process is sequence of possibly dependent random variables ($x_1, x_2, x_3, ...$) – identified by increasing values of a parameter, commonly time – with the property that any prediction of the next value of the sequence (x_n), knowing the preceding states ($x_1, x_2, ..., x_{n-1}$), may be based on the last state (x_{n-1}) alone. That is, the future value of such a variable is independent of its past history (Britannica Online Encyclopædia, http://www.britannica.com).

dependence. In real life, social behaviour is known to depend on length of state occupation (for example, divorce is a function of length of marriage, graduation probability depends on length of studies), history of earlier moves (return migration) and other social-economic, psychological and other effects (covariates). Some authors have developed methodology to relax the restrictive assumption by introducing duration-dependence in the models, hence duration-dependent multistate life tables (DDMSLT) (Wolf (1987); Belanger (1989), Lawless (1999)). Still, models with Markovian assumption continue to prevail in the literature.

In this study, MSLT are constructed, using individual level information. First, the age specific transition probabilities are estimated from the observed occurrence rates. When this is done, the other life table statistics are easy to calculate. The calculation process is therefore described in two steps: first, calculation of transition probabilities, and second, estimation of other parameters and construction of MSLT.

Since the MSLT can be described as Markov process, it can also be described with the equations that are used in Markov model. Therefore, a set of all transition probabilities between the *J* states can be represented in a matrix *Π(x,n)* (each row sums to 1):

$$\Pi(x,n) = \begin{pmatrix} \pi_{11}(x,n) & \pi_{12}(x,n) & .. & \pi_{1j}(x,n) \\ \pi_{21}(x,n) & \pi_{22}(x,n) & .. & \pi_{2j}(x,n) \\ .. & .. & .. & .. \\ \pi_{j1}(x,n) & \pi_{j2}(x,n) & .. & \pi_{jj}(x,n) \end{pmatrix}. \qquad (4.3)$$

Rogers and Ledent (1976) and Willekens (1982) have shown that *Π(x,n)* can be calculated as follows:

$$\Pi(x,n) = \left[I + \frac{1}{2} M(x,n) \right]^{-1} \left[I - \frac{1}{2} M(x,n) \right] , \qquad (4.4)$$

where *Π(x,n)* is the transition probability matrix defined by equation (4.3), *M(x, n)* is the matrix of observed (empirical) rates of transition from *i* to *j* at age x to *x+n*, *I* is the identity matrix, and the superscript "-1" denotes inverse of the matrix.

$$M(x,n) = \begin{pmatrix} \sum M_{1j}(x,n) & -M_{12}(x,n) & .. & -M_{1j}(x,n) \\ -M_{21}(x,n) & \sum M_{2j}(x,n) & .. & -M_{2j}(x,n) \\ .. & .. & .. & .. \\ -M_{j1}(x,n) & -M_{j2}(x,n) & .. & \sum M_{jj}(x,n) \end{pmatrix}, \qquad (4.5)$$

where $M_{ij}(x,n)$ is the observed occurrence/exposure rate of transfer from state i to state j between ages x and x+n, and the summations over j run from 1 to J, excluding the case where $j=i$. Each column in the matrix $M(x,n)$ sums to 0. Each element of the matrix is:

$$M_{ij}(x,n)=D_{ij}(x,n)/P_i(x,n), \qquad (4.6)$$

where $D_{ij}(x,n)$ represents the observed number of transitions from i to j in the age interval x to $x+n$, and $P_i(x,n)$ represents the observed (mid-period) population in state i between ages x and $x+n$.

This interpretation involves a number of assumptions. First, the earlier introduced Markovian assumption states that the transition probability during certain interval depends only on the state in which the person is at the beginning of the interval and is independent of history. The second is the linearity assumption, that transitions and deaths are distributed uniformly over the interval x to $x+n$. The mean duration of transfers is therefore ½ of n, or in the middle of interval x and $x+n$. This allows for estimate of $\Pi(x,n)$ as set out earlier. Linearity assumption can provide grounds for critique if there are reasons to think that transitions tend to happen in a different time than middle of the interval. Palloni (2001) argues that under general conditions, the linear method is to be preferred on the grounds of simplicity and ease of calculations. For derivations and discussion on the calculation models based on observed rates the author refers to Schoen (1988: 70-76) The third important assumption is that annual age-specific life table rates are equal to annual age-specific rates of observed population, i.e., $m(x,n) = M(x,n)$. This assumption implies that the observed rates provide adequate estimates of the life-table rates to be used for longitudinal analysis (Schoen, 1988). Again, this assumption can be criticized if transition rates in the year of observation can be proved to be unsustainable or believed to change over years.

In the second step, when the age specific transition probabilities between the defined states are obtained, the other life table statistics are obtained: number of years in education, number of transitions between states (i.e. graduations, dropouts, entering another level programme), total number of years studied by the cohort, expected years in education. Formulas for computing the parameters are described in Appendix A3.

4.2.3 Multistate models for higher education in Latvia

The previous sections provided a general framework and theoretical background for multistate modelling. This section defines and describes the multistate models for higher

education. In the core of interest are higher education students. This section presents the model specifications for use in education analysis. Multistate increment-decrement method is applied to analyse progression in higher education in Latvia. The multistate life tables follow women and men through their educational progression (career).

4.2.3.1 Multistate models for Latvian education system

The number of model specifications that could be constructed for education is nearly infinite. The setup depends on the desired result or research question, and availability of input data. Appendix A5 presents a set of 6 models for modelling Latvian education system in multistate life table framework[16]. Different state spaces and transitions are specified starting from most simple and less detailed, ending with more comprehensive and advanced. The list is not exhaustive, but for each of the specifications there is a reason to be included.

The variations (A) to (E) (Figure A5.1) are constructed by author and gradually moves from a simple 2-state variation with high abstraction to a rather complicated 8-state model. In variants (D) and (E) transitions are defined by acquisition of degree and state defined by highest qualification attained. These, especially (D), are very useful variations for practical purposes because most often in surveys level of education is measured exactly by the highest degree attained. The results of the multistate modelling are therefore readily interpretable and comparable. A very similar setup to variation (D) model was used by Lutz et al (2007; 2008) for reconstruction and projections of population by age, gender, and level of education for 120 countries.

The variations (A), (B) and (C) differ in the way that state is defined by enrolment status (yes/no) in an education institution, and transition is a change in the enrolment status (i.e., registry entry), possible with or without acquisition of degree. To some extent these are more flexible and allows analysing dropout and re-entry flows. Again, the level of detalization depends – a 4-state or 3-state models, and a simple basic 2-state model for higher education system. All the variations contain different information and used to obtain different results, so no strict preference for any can be attached. Preferably, if data allows, alternative modifications are developed and results compared. Author follows this advice in the current study by applying three model specifications.

The last variation (F) (Figure A5.2, Appendix A5) is not created by the author – the flow chart is taken from the official documents describing overall Latvian education system in timeframe (AIC, Latvia). It can however be directly interpreted in the multistate life table framework where individual occupies one of the states and undergoes one of the education

[16] In all figures boxes represent a state, and arrows represent transitions. Non-filled arrows are movements that are in principle theoretically possible, but actual probabilities are very low.

paths. For example, a person going to school is in state "basic education". Typically at age 16 he graduates and hence transits to another state – "general secondary education", or "vocational secondary education" (or, taken together, "secondary education"). Another three years later he graduates and again changes the state to, for example, "college education", or to state "professional higher education". It is evident, that this model in principle has the same construction as above described approximated models. This is a very complicated model for practical computation purposes with some 18 states, but represents the closest-to-reality model. The author thinks that it is a very important link that illustrates the closeness of multistate modelling and all the undertaken exercise with real life education structure in Latvia.

The models in this study ignore any parallel statuses such as marital status or employment. It is possible to model, for example, labour market status as additional state and interactions with the education transition and career, or family status changes. The author concentrates on education statuses only, with option that the method can be extended to wider applications in the future.

4.2.3.2 Applied model specifications

The author has selected three specifications for application and construction of life tables, starting from a simple state space and ending with a more complex one. The choice is determined by database limitations. All constructed models are increment-decrement life tables. This model variation allows individual members of the life table population to move into states (increment) and out of the states (decrement). All three are cohort life tables - describes development of one particular cohort (2002 university entrants) over time (longitudinal approach). They are uni-radix – the initial cohort is concentrated in one stage, and complete as contain full information for each single year in the observation period. Real cohort – 2002 university entrant cohort – is modelled. The list of life table statistics to be computed and analysed is provided in Appendix A3. The author looks at three model specifications – two focusing on enrolment and one on educational attainment. These models are complements for determining dropout rates.

Specification (a): 2-state process (enrolment) model

The simplest variation of the model applied to data is a two-state model. Despite it's simplicity, the results are of general interest. The state space is {inside tertiary education (student); outside tertiary education (not studying)} (if he/she is in the process of acquiring education or not, hence *process* model). (Figure 4.3.(a)). Analogous to general models (A)-

(D) (Figure A5.1) belonging to a state is defined by administratively registered status in institutional registers, and transition does not require graduation, i.e., could also be dropouts. Both states are transient, non-absorbing, and recurrent i.e., individuals can pass in all directions between states. Transitions (events, changes of state) are defined by change in the student status as registered in University of Latvia Information System (im-matriculation or ex-matriculation).

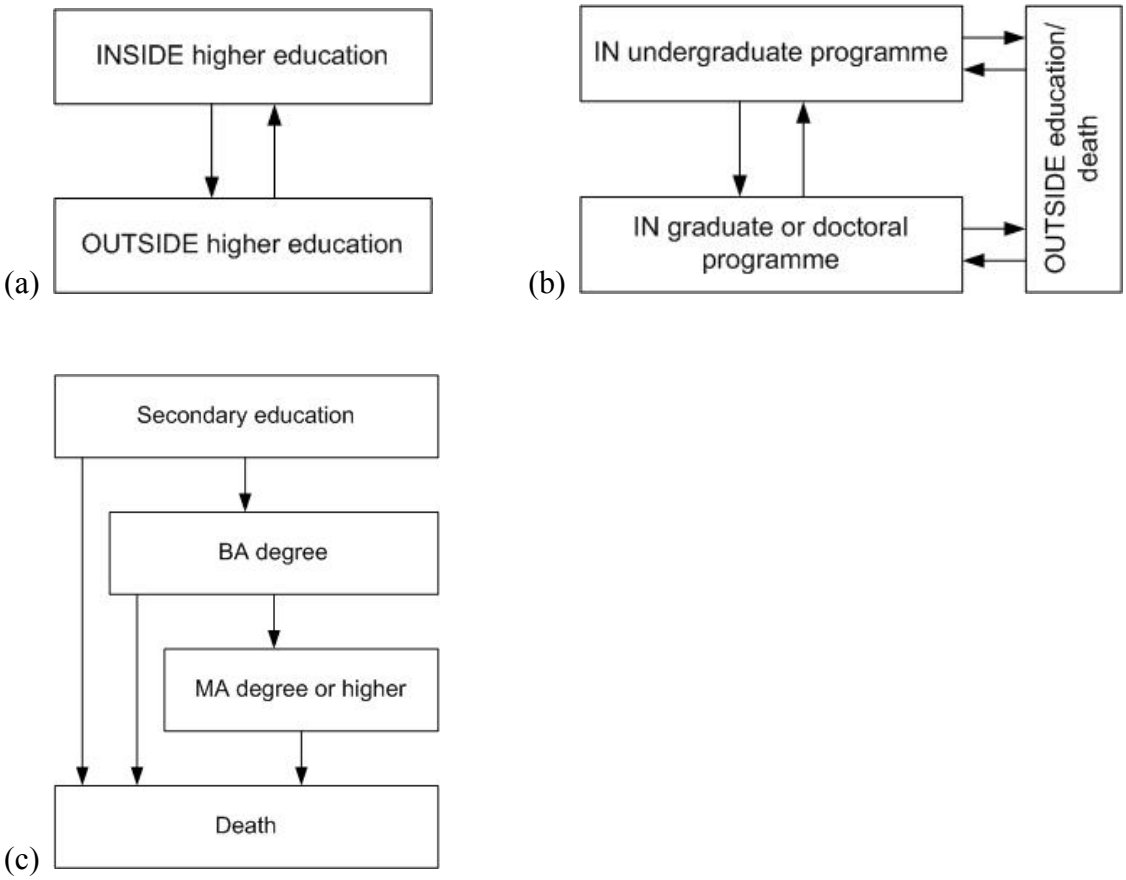
Specification (b): 3-state process (enrolment) model

The three-state model splits the status of being a student into two – in undergraduate or graduate level. The results from this specification are more precise and provide information on each level separately. State space consists of three states (Figure 4.3.(b)). In the three-state model, the state of being inside higher education is divided into two states – in undergraduate or in graduate and postgraduate programmes. The state space therefore is {in bachelor level programme; in master level or doctoral programme; outside education/dead}. All three states are transient and recurrent, i.e., individuals can pass in all directions between states. There are no absorbing states. Similarly to Specification (a), transition between states is defined by registered change in the student status – im-matriculated as an undergraduate (bachelor) student, im-matriculated as a graduate (master or higher level) student, or ex-matriculated from any.

Specification (3): 4-state attainment model

This specification significantly differs from the first two because the status is defined by the *highest level of education attained* (hence 'attainment model'). There are no reverse flows, the states are consecutive and no return to lower level is possible. The Specification 3 is a hierarchical model, state space consists of four states (Figure 4.3.(c)). Belonging to a state is defined similarly as in general models (E) and (F) and it is a fragment of model (F) with the state space consisting of {secondary education; bachelor degree; master of doctoral degree; death}. States are non-recurrent, only one-directional transitions possible, death is absorbing state.

Figure 4.3 Applied models for higher education



Source: Author's figures.

Multistate life tables are constructed for all the three models (Figure 4.3). These simplified variations can be easily developed into more complex models with more than four states (modelling separately different levels of education, or introducing employment or marital status as other possible states). This research exercise however concentrates on establishing the methodology for use in education analysis, and applying it to the available data for testing its applicability and accuracy.

4.2.4 Critical assessment of models

Despite the overall utility of the method and its widening use, there are limitations to the use and applicability that is often a source of critique. Some limitations are arising from the model itself while others are connected to application of methods for calculation and assumptions. The most important criticisms are as follows:

(1) Markovian assumption. Markov model ignores past experiences and examines the effect of most recent experiences. Most real-world problems are not fully Markov in nature – they are often non-stationary and history-dependent. In education, duration of studies is important and determines probability of graduation.

(2) Linearity assumption that transitions are uniformly distributed over the time interval, and the transition happens in the middle of interval used. For education analysis, strictly speaking, this is not true as transitions between states, esp. graduations, typically happen in the end of the academic year, i.e., in the end of the period.

(3) Representativeness of observation scheme, i.e., assumption is that annual age-specific life table rates are equal to annual age-specific rates of observed population may not hold, implying that the observed rates do not provide adequate estimates of the life-table rates to be used for longitudinal analysis. It may be possible that for the sample used transition rates in the year of observation are unsustainable or believed to change over years.

(4) Single move per unit time interval assumption (Rogers 1975, p 59) is an implicit assumption in multistate models. If this assumption does not hold true, the survivorship in states and transition between states measures gets imprecise. In education analysis this may be the case that changes between statuses happen more than once in a period, for example, a student takes academic leave for a year, but returns to studies right before the end of semester, passes final examinations and graduates. In this case, the changes from his/her status in the beginning and end are captured.

(5) Homogenous population within each group is yet another implicit assumption. Essentially it means that there are no distinct subpopulations within the stratified groups of age and gender category. For example, a particular student group (ex. minorities, foreign students) may exhibit some special study path pattern.

(6) High data demands is a technical criticism for the method. Multistate methods are demanding regarding data requirements. It requires age-specific gross flow data among the various states considered in the analysis. This kind of data is typically only available from registries or surveys. Registries are the best-fitted source of information for multistate analysis, but the problem is that they usually represent selected population groups and not total population. Surveys are appropriate if they include precise retrospective information.

(7) Mathematically complicated method entails that not only it takes resources to compute the multistate life tables, but also they are difficult to follow and verify by peers and referees.

The author judges that the Markovian assumption (ignorance of the path dependence) is probably the most problematic of the described. It was noted earlier that duration dependent multistate life tables are possible to be applied. This would be a release of assumption at the expense of increased data demands and computation difficulty. Overall though, the criticisms are confuted and multistate life table analysis is perceived as a powerful and appropriate tool for education analysis.

4.3 Overview of database

Multidimensional methods are demanding regarding data and put a heavy burden on data availability. Study of individual life histories requires individual data and repeated measurements (longitudinal data). "Data requirement is a major drawback of multidimensional analysis" (Willekens, 1982). With advancement of the multidimensional techniques and more frequent applications, the issue of data availability is raised and discussed at statistical offices. Steps are taken towards solution, but it is far from completeness. Unavailability of data in appropriate form has been and still is one of the factors hindering more frequent application of multistate models. Hence, here author shows what could be done for a country's education system, had we had the relevant data.

Multidimensional demographic analysis requires age-specific longitudinal data among the various states considered in the analysis. Conventional demographic analysis of populations subdivided into subpopulations focuses on size of each subpopulation and on changes in size. This stock perspective makes use of prevalence rates, which indicate the extent to which a particular characteristic is prevalent in the population (e.g. labour force participation rate, proportion of married population, proportion of students or proportion of population with higher education). In multidimensional analysis, population size is of secondary importance. The emphasis is on flows, i.e., passages among various states. The size of each subpopulation is merely an outcome of an initial condition and the stochastic process. The rationale for adopting the flow perspective is that the dynamics underlying population change can more readily be represented. Entrances to and exists from each subpopulation are considered explicitly. The adoption of the flow perspective requires existence of flow data (i.e. longitudinal data at individual level).

The main sources of information for accounts are registries and censuses or retrospective surveys. Registry systems represent the best-fitted source of data for multidimensional modelling because each change of status is accounted for and is therefore easy to transform in the required form. The problem with registries is that they do not always exist for all problems researcher is interested in. Also, they seldom represent total population as in the case of student registries (they contain only information on those involved in education). Generalization to all population is usually difficult. Where registries do not exist, surveys are used with retrospective information. Overall student registers are maintained in many countries as in detail described in Chapter 2, but not available in Latvia.

This research therefore makes use on the University of Latvia student register LUIS. The register contains information on all students that have ever entered the University and any subsequent changes in the person's study status in the LU. It also contains detailed education

data and information on most important demographic characteristics (age and gender). Most importantly, it is presently the widest database in Latvia containing life history information about the question of interest – the progression in higher education. The register exists since 1992. In its initial form the database was rather simple and contained mistakes and errors. Since then, LUIS has been developed and largely reprogrammed. As a result, currently it correctly represents all information and is developed to include more and more information, as well as made user-friendlier. Given its development, the author estimated that only since around 2001 or 2002 LUIS could be used for multistate applications. The judgement is supported by persons operating the database (A.Niedrītis, I.Leduskrasta).

The observation period is 8 academic years (16 semesters) from 2002 to 2010. The student data are registered on semester basis to best represent the academic environment, but for research purposes the data is transformed to yearly periods. The cohort is defined by autumn 2002 first year undergraduate enrolment, i.e., it is all the 2879 students (2073 females and 806 males), who entered University of Latvia undergraduate studies (academic bachelor and professional bachelor, but not college programmes) in autumn semester 2002 right after the secondary school[17]. Full time and part time students are combined. In contrast to more often used birth cohort, in this model the cohort is all individuals starting studies in higher education undergraduate programmes on Autumn semester 2002 and with similar educational background (only secondary school). What is typically in the life table modelling context referred to as "age", in the current context is study years. In order not to confuse the reader, the term "*progression*" is used to measure maturity in studies. The time (x in earlier formulas) is measured in academic years, i.e., starting in autumn and ending in summer. Combined and separate education life tables are computed for males and females.

The University of Latvia is the largest university in Latvia and by the number of students it is also the second largest university in the Baltic countries after Vilnius University. In 2009/2010 academic year there were 20500[18] students in University of Latvia, or 21% of all students in Latvia. In the beginning of observation period, 2002/2003 academic year, there were 30044[19] students in LU, or 25% of the total number of students in Latvia. The respective year University enrolled 4749 students in first year of undergraduate studies out of total 31499 in Latvia, i.e., 15% of all who started studies. The size of the University and the fact that it is a classical university offering programmes in almost all fields of studies, as well as

[17] The total enrolment in first year of undergraduate programmes in autumn 2002 was 3791 persons, 2879 of them were age 18-19 and are assumed to be the cohort graduating from secondary school the same year, whereas 912 were aged 20 or older and have finished school earlier.
[18] Source: LR Ministry of Education and Science, Pārskats par augstāko Izglītību Latvijā 2009. gadā.
[19] Source: LR Ministry of Education and Science, Pārskats par augstāko Izglītību Latvijā 2002. gadā.

associated size of the student register allows (with some caution) generalizing results to Latvian student population.

The limitations in data are connected to the fact that it is a one-institution database. First, only changes in student register in connection to LU are encoded. Any education activities outside the University are unknown. Transitions of a student changing the education institution between education levels, or even in middle of a programme are also unknown. Secondly, it is arguable if University of Latvia is truly representative of all Latvian higher education system. Even though it covers nearly all fields of studies, institutional differences do exist. Nevertheless LUIS database is the best proxy available and provides a readymade and rich source of information for the study process and permits drawing inferences concerning the graduate population as a whole. But these limitations determine the pilot character of the exercise. The limitation for generalizing the results to 2010 situation may also come from changed labour market situation – the observation period covers the time of (nearly) full employment in Latvia having effects on education decisions (as described in Chapter 1), whereas in the middle of 2010 with the economic downturn and high unemployment the higher education participation may have changed.

Multiple transitions are not 'allowed' (not possible in model) within one year in life table framework, but in reality it sometimes happen. For example, a student can be ex-matriculated for not paying the study fee, a few days later he/she pays the study fee and is again im-matriculated and registered as a student. Another situation – a student is registered in an academic leave, towards an end of academic year, he/she returns to studies (registers as a student), passes final examinations and acquires a bachelor degree. In these and similar situations, it is assumed that his/her status all through the period is as registered to the point of observation – 31st October of the respective year.

The application of the multistate life table technique involves advanced matrix mathematics calculations, that are performed with MS Excel and SPSS 16.0 programmes.

4.4 Results: higher education multistate analysis for Latvia

The education histories through an 8-year period are presented in three sections. In Section 4.4.1, the observed event occurrences are given. In Section 4.4.2, the education history of the observed cohort is analysed according to three models' specifications presented above in section 4.2.3.2. In Section 4.4.3, differences in male-female education paths are explored. The latter two sections contain the results from education progression multistate life tables that are presented in full in Appendix A6 tables.

4.4.1 Observed event occurrences

The initial cohort of autumn 2002 semester entrants consisted of 3791 students. These were all age groups students that entered a first level higher education programme in the University of Latvia. From those, for modelling purposes the individuals born in 1983 and later were selected (76% of the total sample), i.e., aged 19 and younger who went to university right after the secondary school. The total sample for the study therefore consists of 2879 individuals aged 18 and 19, 806 (28%) males and 2073 (72%) females (Table 4.1)[20]. All individuals entered the university with a secondary education diploma, they have not had any higher level education. The cohort was followed from autumn 2002 semester through an 8-year or 16-semester period till spring 2010, the latest available completed period in academic year 2009/2010.

Over the eight years of observation 43% of those who entered university (32% of the males and 48% of the females, see table 4.1) acquired and retained first level higher education (bachelor degree or equivalent), and 23% (21% of the males and 24% of the females) attained second level higher education (master degree or equivalent professional degree[21]). 33% of the individuals, who took up first level higher education, did not attain it within 8 years. If the observation period is considered end of the study process, these 1/3 can be thought of as dropouts, and the male dropout proportion (47%) significantly exceeds that of females (28%). It is surprising to find that almost half of the males that start studies in University do not finish it within such sufficiently long time.

Table 4.1 Outcome statistics from 8-year education history - attained education at the end of observation period

	Secondary	Bachelor level	Master level or higher	All education levels (total sample)
Males	377 (47%)	257 (32%)	172 (21%)	806 (100%)
Females	587 (28%)	994 (48%)	492 (24%)	2073 (100%)
All students	*964 (33%)*	*1251 (43%)*	*664 (23%)*	*2879 (100%)*

Source: author's table

From Table 4.2 follows that in the end of period, 9% of the initial entrants (12% of the males and 8% of the females) were still registered as students in some programme. 7 percent of individuals were students in undergraduate programmes, and 2 percent of the initial cohort in graduate programmes. For them the education lifecycle cannot be considered completed. There were 4 death cases (0.1% of 3791) of students registered in the observation period.

[20] The male/female ratio 2/3 is consistent with the ratio in Latvian higher education system (see Chapter 3).
[21] Even though theoretically it is possible to acquire also a third level (doctoral) degree during the particular time frame, there were no such cases registered in database.

Disregarding the importance of the mortality rate as such in the demographic processes, the observed rate in the current sample is virtually zero and can be ignored (these cases are modelled as being outside education system).

Table 4.2 Outcome statistics from 8-year education history - status at the end of the observation period

	Outside education	Undergraduate student	Graduate student or higher	All statuses (total sample)
Males	706 (88%)	84 (10%)	16 (2%)	806 (100%)
Females	1914 (92%)	121 (6%)	38 (2%)	2073 (100%)
All students	*2620 (91%)*	*205 (7%)*	*54 (2%)*	*2879 (100%)*

Source: author's table

Obviously, the overall length of studies is affected by length of study programmes. Latvia has participated in Bologna process since its very beginning in 1999. Among other reforms foreseen by Bologna declaration, one of the practical consequences in Latvia has been shortening of most academic Bachelor programmes from 4 years to 3 years of studies. The transition happened at different years in different programmes, but by 2002, the beginning of the observation period for this study, the change had happened in most programmes in University of Latvia, hence the data should not be affected by the changes.

4.4.2 Results for males and females combined

Education life tables for the three model specifications ((a), (b) and (c)) – genders combined and separately are presented in Appendix A6. Specification (a) – the simplest 2-state process model – in Tables A6.1 to A6.3, specification (b) – the 3-state process model – in Tables A6.4-A6.6, and specification (c) – the 3-state attainment model – in Tables A6.7-A6.9. The following sections contain results on education life table indicators.

Transition probabilities

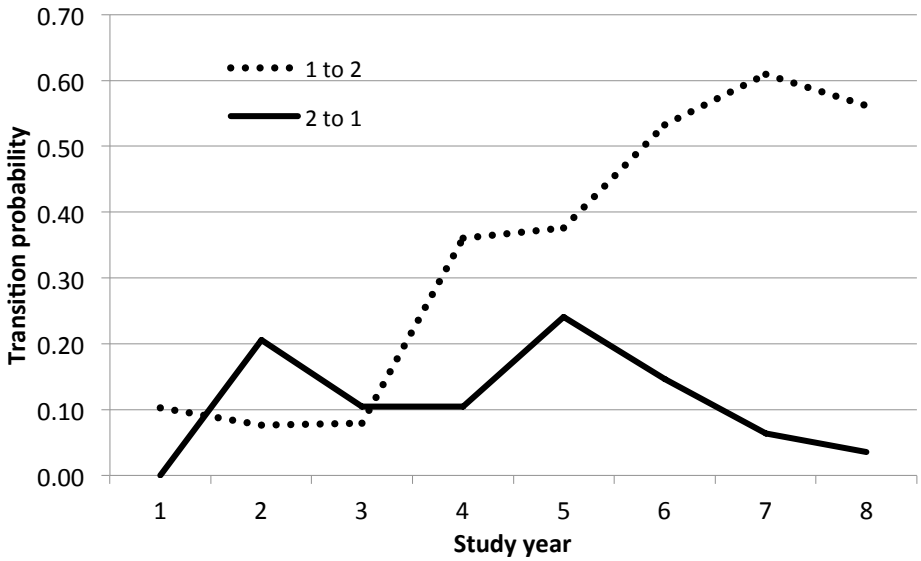
The transition probabilities are the first measure obtained from data on observed rates via matrix calculations (the calculation procedure described in section 4.2.2, and given by equations (4.3) – (4.5)). The transition probabilities at different study years reveal the intensity of changes between states associated with length of the studies. The transition probabilities in study years are shown in Figure 4.4. The transition probabilities show that move to outside education are not very frequent in first years of studies, but rises in later periods (Figure 4.4.(a)). The transition probabilities from outside to inside education have two peaks – the second year, apparently due to some part of students dropping studies in first year realizing that they are not interested in the programme they have started up, or finding the

studies too difficult, and entering studies again, and in 5th year when most accessions to graduate programmes happen. Figure 4.4 (b) confirms, that the flows from graduate to undergraduate programmes (states 2→1, i.e., to lower degree programme) are negligible, and so are all flows into education programmes after 6th year (states 1→2, 3→1 and 3→2).

Very clearly the academic cycle can be seen from model (c). The transition probability of acquiring bachelor level education is the highest and almost equal in 4th and 5th year after entrance in university. There is some (2%) probability to receive bachelor degree in 3rd year of studies, but here it is seen that finishing first cycle higher education within 3 years is unusual. The restructuring from 4-year to 3-year bachelor programmes in accordance with Bologna reforms were only under way, which may explain the rather long time for undergraduate education. Regarding acquisition of master level or equivalent degree (transition from state 2 to state 3), the probability is the highest on 6th year after entering university, and also 7th year, but non-zero starting from 5th year. This leads to conclusion, that although the shortest time to receive graduate education is 5 years, most typical period is 6 years.

Figure 4.4 Transition probabilities between states

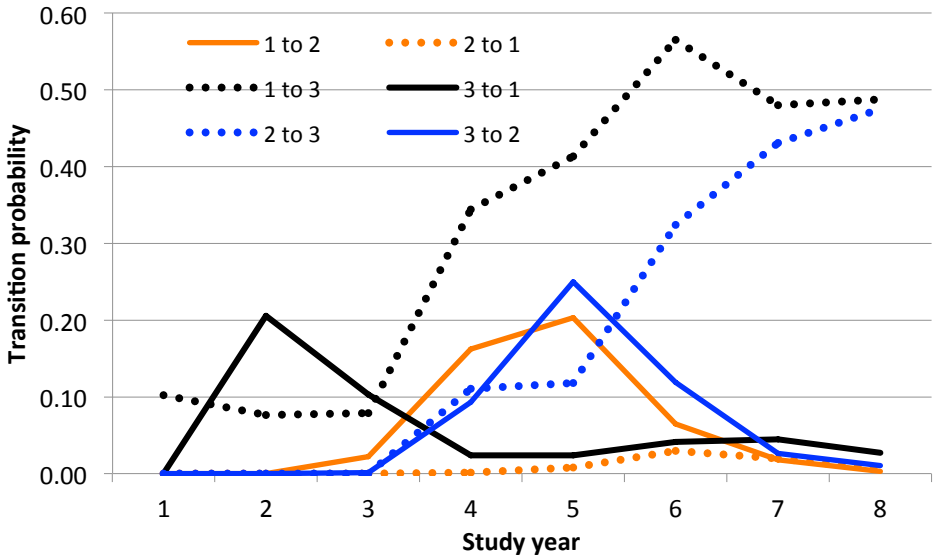
(a) Transition probabilities between being *in* education and being *outside* education



Note: State 1: in education, State 2: outside education

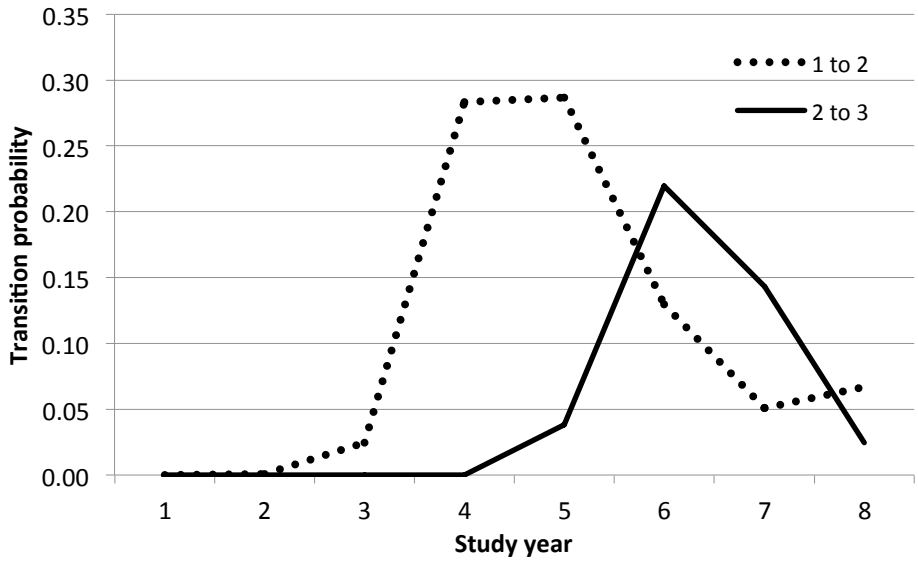
(Figure 4.4 continued on next page)

(b) Transition probabilities between undergraduate studies, graduate studies and outside education



Note: State 1: in undergraduate education, State 2: in graduate education, State 3: outside education

(c) Transition probabilities between degree attainment levels – secondary, undergraduate and graduate



Note: State 1: secondary degree attained, State 2: undergraduate degree attained, State 3: graduate degree attained

Survivorship in states

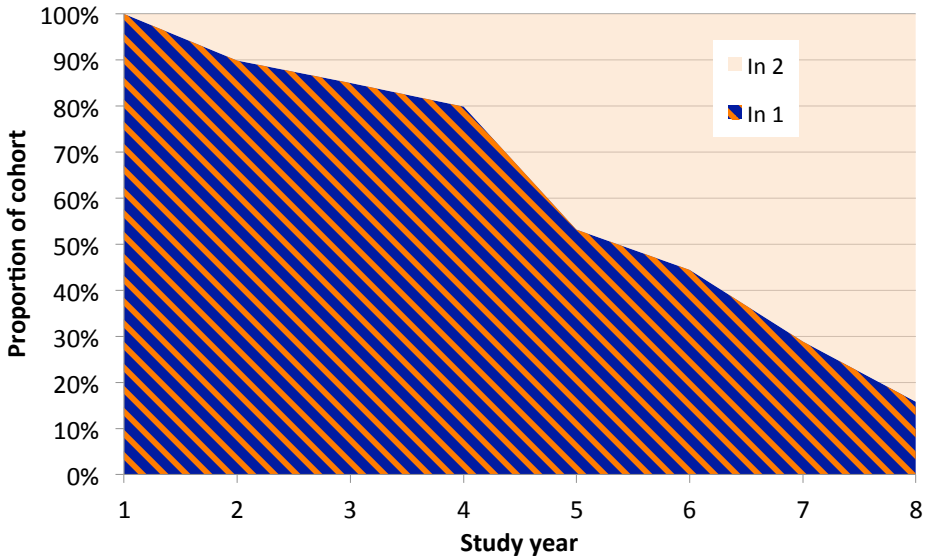
Survival probability of a cohort of 2002 autumn university entrants through 8-year education life period is demonstrated in Figure 4.5 – (a), (b) and (c) for respective specifications. This figure shows distribution of population by states. The survivorship probability is calculated by equation (4.12) (see Appendix A4) The light area in (a) and (b) represents the state of being outside education system, while the dark areas are survivorship in student status. As expected, the survival in student status diminishes with time – it is the

highest in the first four years after university entrance that coincides with average length of bachelor study programmes. With further progression of the cohort through the traditional student age, the participation in education diminishes. When student status is split in two levels, it reveals no surprises. The participation in undergraduate programmes sharply falls after 4th year, and after 5th year remains below 10 percent. The highest participation in graduate education is between 5th and 6th year of studies, and falls after. It has to be noticed that, even the period starts with everyone entering the studies; the actual survivorship in the education never exceeds 70%.

The interpretation of the Figure 4.5 (c) is somewhat different from the first two, because the state definition differs (see section 4.2.3.2). There through the first four years the cohort only occupies the state 1 – holds secondary education. About 40 percent of the cohort survive in state 1 through the entire education cycle of 8 years (never receive undergraduate degree), survivorship in undergraduate degree or equivalent as highest attained education increases starting from 4th year and also reaches about 40 percent in the end of education cycle. Significant increase in survivorship with graduate diploma attained starts with 5th year, and in the end of the period around 20 percent hold graduate level education.

Figure 4.5 Survival by states of 2002 entrant cohort through observation period 2002-2010 (l_x)

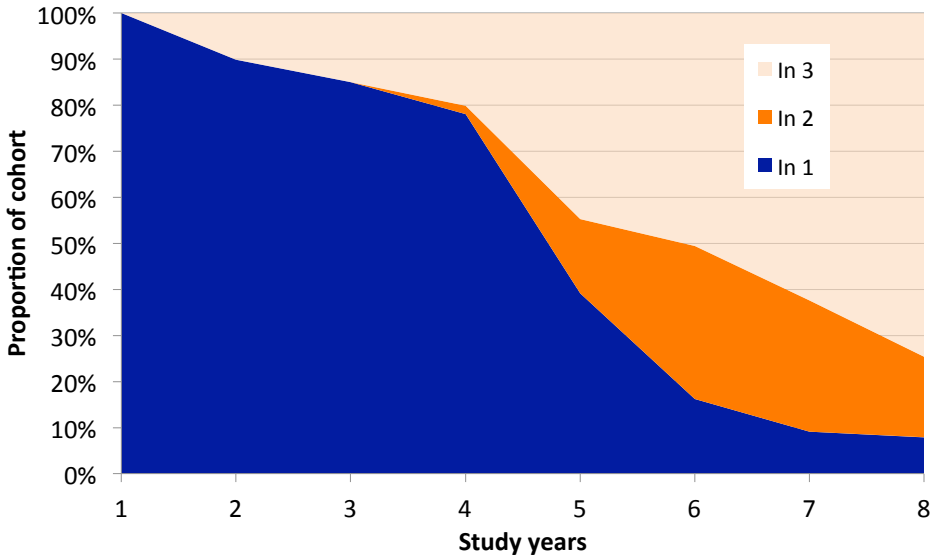
(a) Survivorship by study years X (*l(x)*) being *in* education and being *outside* education



Note: State 1: in education, State 2: outside education

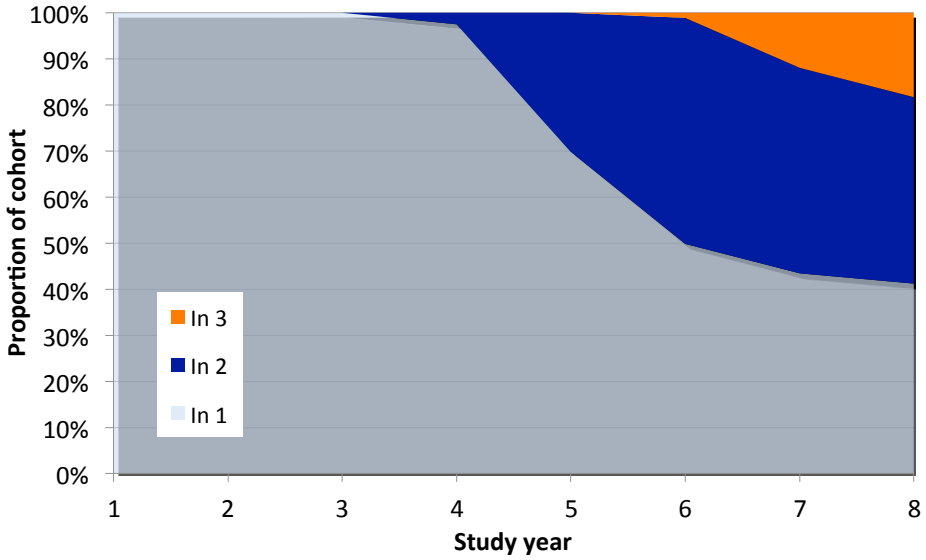
(Figure 4.5 continued on next page)

(b) Survivorship by study years X (*l(x)*) in *undergraduate* studies, *graduate* studies and *outside* education



Note: State 1: in undergraduate education, State 2: in graduate education, State 3: outside education

(c) Survivorship by study years X (*l(x)*) with attained education - *secondary, undergraduate* and *graduate*



Note: State 1: secondary degree attained, State 2: undergraduate degree attained, State 3: graduate degree attained

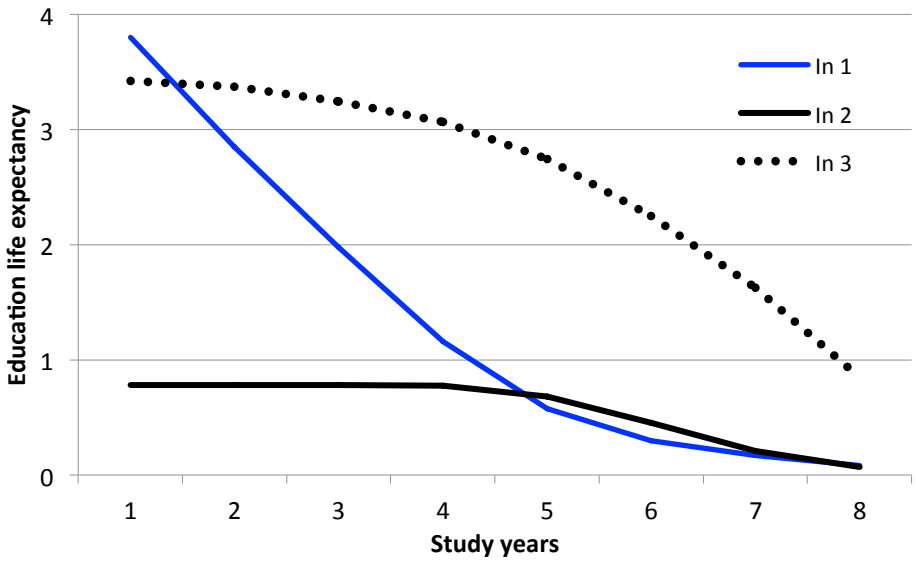
Schooling time expectancy in tertiary education

It is known that one of the major advantages of life table analysis is its ability to synthesize the consequences of age-specific incidence rates and to calculate expected time to be spent in defined states. In the context of education analysis, this is one of the most interesting and necessary result to find what is the education time expectancy (schooling life expectancy) in each education level, i.e. how long the student is expected to study. The respective indicator of the life table is obtained by equation (4.16) (see Appendix A4).

At the outset of tertiary education, an average person is expected to study 4.58 years (Table A6.4 and Figure 4.6). Of this time 3.80 years would be spent in an undergraduate study programme, and 0.78 years in a graduate programme. The reader will notice that one year later, at the end of year 1, the remaining expected schooling time in tertiary education is lower – 3.63 years, but not exactly one year lower. It takes into account the dropout in first year, and so are the following years.

Under current exercise the interpretation is different, given that 'end of life' in this model interpretation is not death as in conventional life tables, but end of notational education cycle of eight years, which corresponds approximately to age 27. Therefore the reader should not be confused when reading 'life expectancy', which is the time till end of the 8-year education period. The education life expectancy in the specification (c) context is different from the two above – the expectancy there is computed against the year 8, end of the period, appearing to diminish with every period and reaching zero by year 8; in reality, of course, the end of education period is not end of life, hence this representation may be confusing. Therefore it is not illustrated here, but calculations are given in Table A6.7 (Appendix A6).[22]

Figure 4.6 Schooling time expectancy in undergraduate and graduate studies by years of study (T_x/l_x)



Note: State 1: in undergraduate education, State 2: in graduate education, State 3: outside education

4.4.3 Male-female differences

The MSLT method is useful to document male-female differences in education. The education paths are gender-dependent. Not only total female participation in education

[22] If the results are placed in wider context, the life expectancies with particular education attainment can be incorporated with lifelong perspective.

exceeds male participation, but also the time they spend and attainment rates differ. Section 4.4.2 analysed transition probabilities between states of the model, survivorship in each respective state and schooling time expectancy in tertiary education, but section 4.4.3 documents the gender differences in the same indicators. This application with stratification of population by their characteristics shows the potential of the method.

Differences in time spent in education

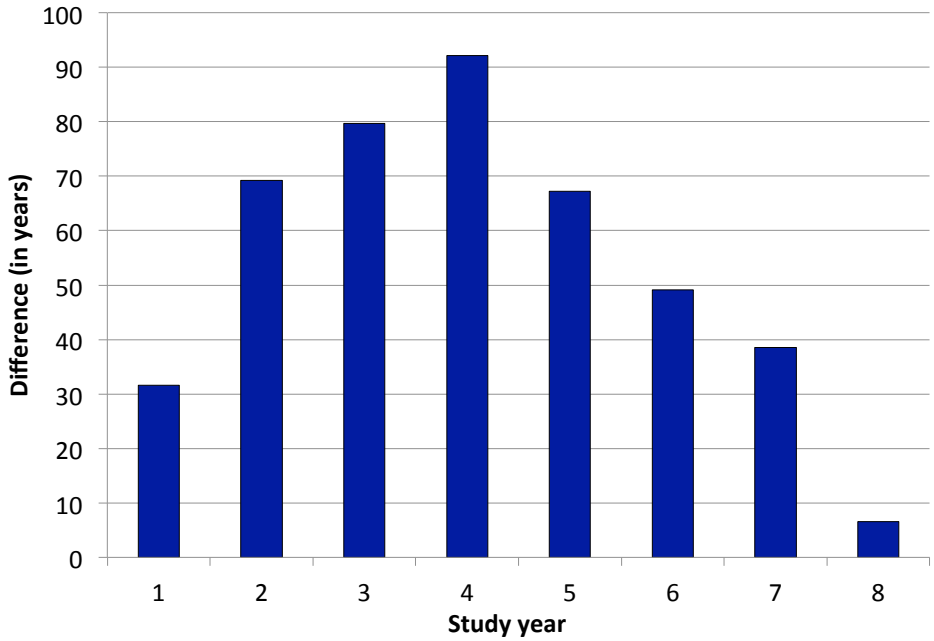
Once entered in the first year of undergraduate studies, the females spend more time in education. The female-male differences in number of person years of a synthetic cohort lived in each state are presented in Figure 4.7. In early years female and male participation in education is similar, the female one slightly exceeding the males' time spent in education, but the difference has a tendency to increase till peaking fourth year of studies. After fourth year of studies the difference diminishes and time spent in education (state 1) levels out, and in the last year (8) is similar to that of males ((a), blue bars). The longer time by females spent in education is not necessarily due to underperformance of females, since longer studies in this model context can also mean higher education achieved.

It is specific that after 6th year of studies males spend more time in undergraduate programmes ((b), dark blue bars negative). Males also spend more time in graduate studies in 4th and 5th year of studies, indicating that males are faster to start up graduate studies (can be associated with shorter programmes in sciences, that have a tendency to be male-specific, and longer professional bachelor programmes, for instance, accounting, that are typically female-specific), but in later study years females spend more time in graduate studies. As it is a closed system of states with everyone surviving till the end of education cycle in one of the states, the time spent outside education (state 2 in (a) and state 3 in (b)) are inversely proportional to being in education system.

Specification (c) reveals that in first years of studies both genders spend the similar amount of time in status 1 (everyone with secondary education, no graduations). Once graduations start, from 5th and especially 6th year females spend significantly more time with having an undergraduate degree, and males more time with secondary degree, whereas number of periods with master degree or higher is similar to both genders.

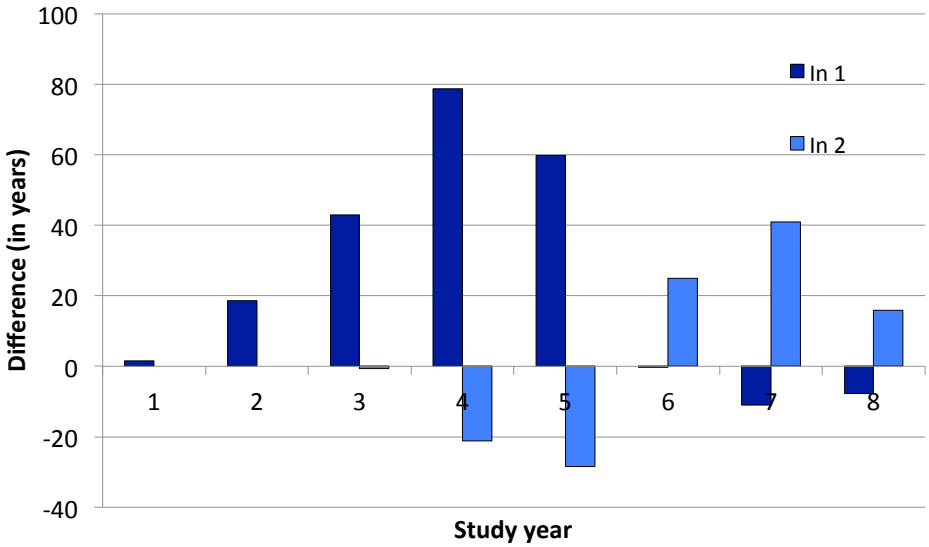
Figure 4.7. Female-male difference in the person years spent in educational in the study year x to x+1

(a) Excess of female over male person-years spent in higher education (State 1)



Note: person years of cohort spent in State 2 (outside education) is inversely proportional to person years spent in State 1 (in education)

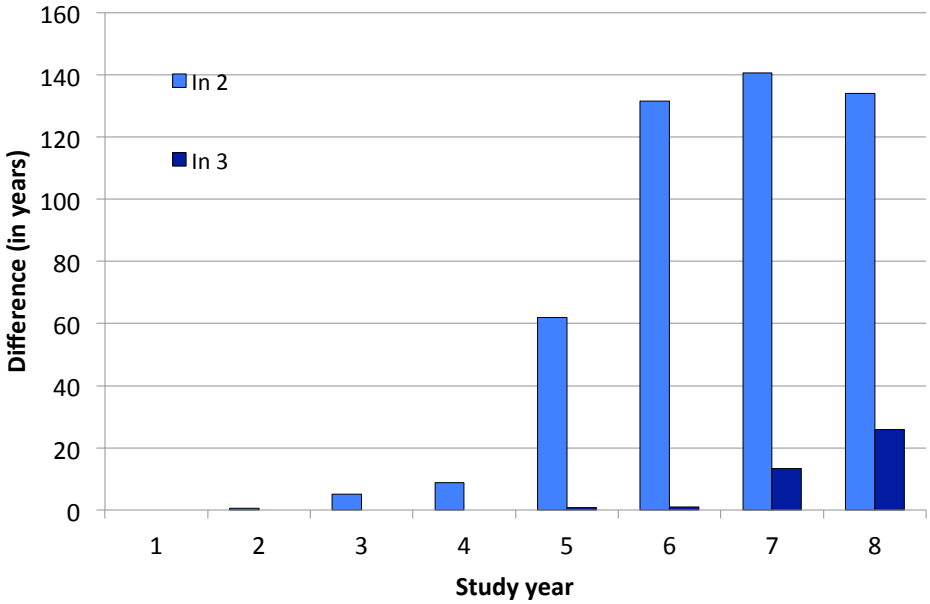
(b) Excess of female over male person-years spent in undergraduate (dark blue bars) and graduate (light blue bars) education programmes



Note: State 1: in undergraduate education, State 2: in graduate education, State 3: outside education (not shown, inversely proportional to sum of state 1 and state 2 indicators)

(Figure 4.7 continued on next page)

(c) Excess of female over male person-years spent with attainted undergraduate and graduate degrees



Note: State 1: secondary degree attained (not shown, inversely proportional to sum of state 2 and state 3 indicators), State 2: undergraduate degree attained, State 3: graduate degree attained

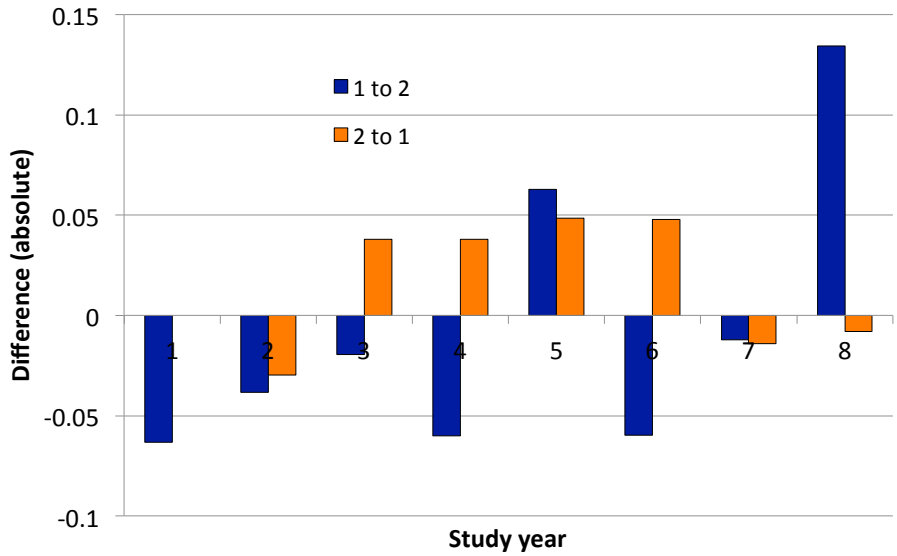
Transition probabilities

Differences in transition probabilities are presented in Figure 4.8 and reveal specific details. First, from Figure 4.8(a) it can be observed that exit from education programmes in the first four years is more probable for males that for females, which is explained, as later will be seen, by male higher dropout rates and possibly by fact that male students study in programmes that are shorter (3 year bachelor, for example). In year 5 the exit rate for females is slightly higher than that for males, which again could be explained by fact that duration of such female-dominated programmes as, for example, pedagogy professional bachelor programme and accounting professional bachelor programme part-time studies are 5 years. Figure 4.8(b) reveals that transition between undergraduate and graduate programmes for males happen earlier than for females, but transition from outside education to graduate programmes is more common to females. This leads to think that females more often tend to take a year off between undergraduate and graduate studies, whereas males more often transit directly from first level to second level tertiary studies. Some of the phenomena can be explained by gender in-homogeneity within programmes and existence of gender specific programmes.

It can also be seen (Figure 4.8(c)) that in 5th and 6th year probability of receiving bachelor or equivalent diploma is higher for females, but in the same 6th year probability for males to receive graduate diploma is higher than for females.

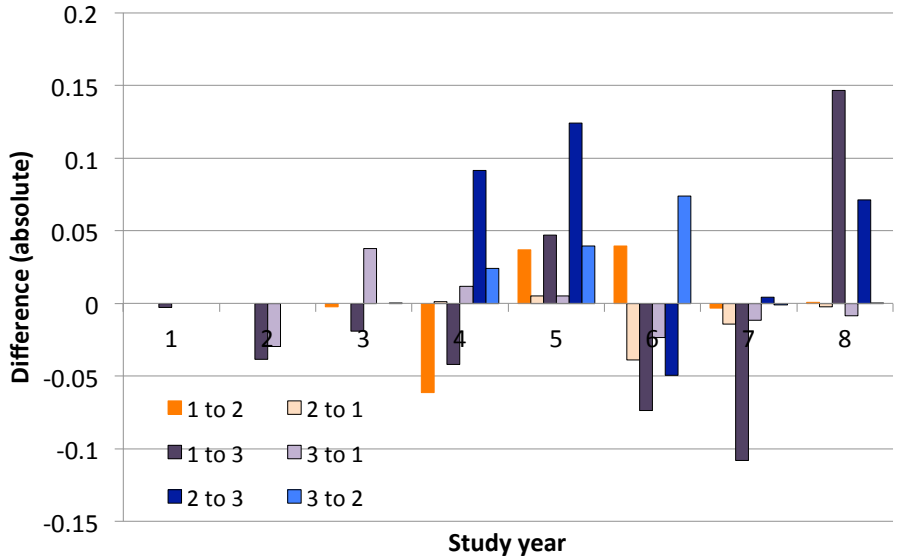
Figure 4.8 Female-male differences in transition probabilities (female over male probability)

(a)



Note: State 1: in education, State 2: outside education

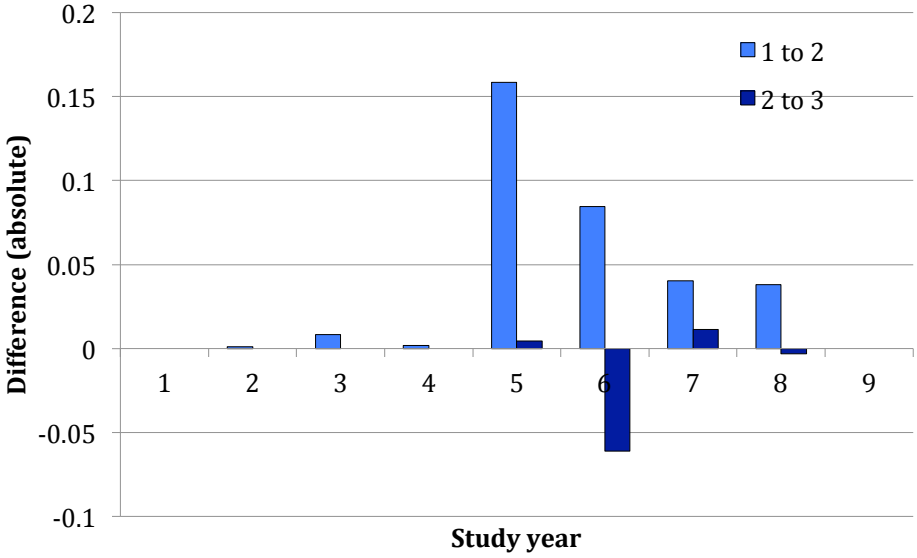
(b)



Note: State 1: in undergraduate education, State 2: in graduate education, State 3: outside education

(Figure 4.8 continued on next page)

(c)



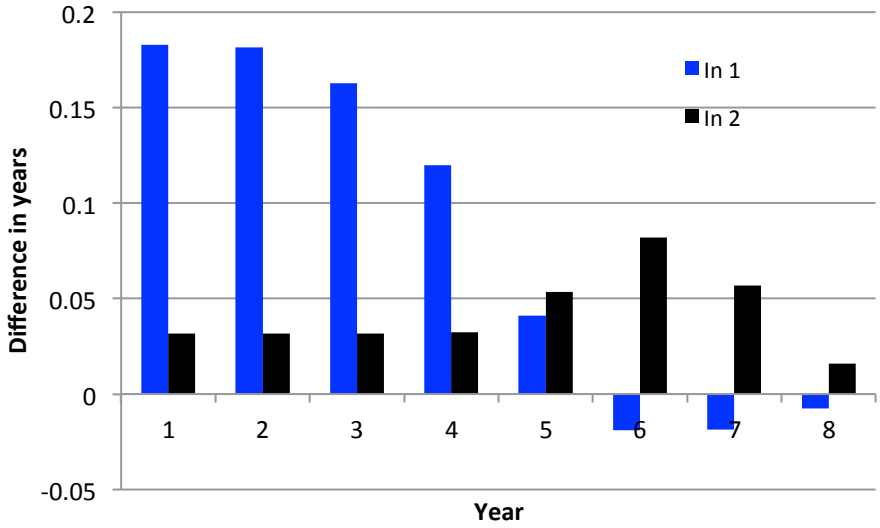
Note: State 1: secondary degree attained, State 2: undergraduate degree attained, State 3: graduate degree attained

Schooling time expectancy

Schooling time expectancy in absolute numbers by states for the 8-year education cycle for both genders was presented above. Figure 4.9 illustrates differences between males and females expected remaining schooling time in higher education. At the outset of university entrance (upon enrolment), females are expected to study 0.54 years longer in undergraduate studies, and 0.9 years longer in graduate study programme. Throughout education cycle, *females are expected to spend more time in education than males*. The gender difference in expected study time is bigger in undergraduate studies than in graduate studies. The schooling time expectancy in graduate studies for both genders is similar, only slightly higher for females.

The third model specification reveals (Tables A7.8 and A7.9) a result easily associated with the first two models. Female not only are expected to spend more time in education than males, they are also expected to spend more time with higher education. Males spend more time with secondary education, but females – bigger proportion of life with undergraduate degree than males, because their have overall lower dropout rates. There is virtually no difference in expected proportion of life spent with master level or higher degree.

Figure 4.9 Female-male differences in schooling time expectancy by years



Note: State 1: in undergraduate education, State 2: in graduate education. Absolute difference in years: females minus males.

Probability of graduation

The life table offers a simple method for the calculation of probability of graduating within a certain period of time. The probability of acquiring an undergraduate or graduate degree within a period of 8, 7, 6 or 5 years, given entrance in higher education system on the year of acquiring secondary degree, is presented in Table 4.3. For the synthetic cohort, derived from transition rates of 2002 enrolment cohort in University, the probability of acquiring an undergraduate degree within an eight-year period is 62%[23], of acquiring a graduate degree or qualification – 20%. This essentially means that only about six out of any 10 entrants in the higher education system finish at least the first cycle education, and the dropout rate is 4 out of 10. Only one out of five students, who start up education at bachelor level, completes also the second cycle.

The probability of completing any level of education, once started, differs between genders. 67% of females, but only 50% of males, who enter the University, complete undergraduate education. For graduate level the gender gap is smaller, still existent – 21 vs. 18 percent of entrant cohort respectively. The same proportion of males and females acquire undergraduate education within 4 years, which may be considered the minimum time required to complete the first level education. The difference between genders appears in the further years of studies, and it can be argued that females are more eager to complete the education they have started, even if it takes more time (several academic leaves, for example). For 19-

[23] i.e. 62 percent of people entering University at bachelor level will received that bachelor degree within 8 years.

year-old females and males probability to complete within 5, 6 and 7 years differ significantly (53 vs. 42, 61 vs. 46, and 64 vs.48 percent respectively. The distribution of probabilities to complete the second cycle higher education (master degree or equivalent) or higher between years of progression is somewhat similar for both genders with slightly higher number for females.

Table 4.3 Probability of acquiring undergraduate or graduate degree (percent of entrants) (given entrance in higher education system on the year of acquiring secondary degree)

		Within 3 years	Within 4 years	Within 5 years	Within 6 years	Within 7 years	Within 8 years
Undergraduate	Male	1.8	29.5	41.6	45.9	47.3	49.6
	Female	2.8	30.4	53.3	60.7	63.3	66.3
	Both genders	*2.5*	*30.1*	*50.2*	*56.6*	*58.8*	*61.6*
Graduate	Male	0	0	1.0	11.8	16.4	17.3
	Female	0	0	1.2	11.9	19.0	20.1
	Both genders	*0*	*0*	*1.2*	*11.9*	*18.3*	*19.3*

Source: author's table, computed based on education life tables

Dropouts

One of the main empirical results from the above exercise is the possibility to estimate cohort dropout probabilities by years of studies – information that was not obtainable from other available statistical sources. Dropouts are interruptions of studies without acquisition of degree or qualification. The dropout probabilities here are computed accordingly by merging model (b) and model (c) results.

The first observation is that dropout probabilities are increasing over time, both in undergraduate (Figure 4.10) and in graduate study programmes (Figure 4.11). In undergraduate studies the probability of dropping out from the programme is about stable in the first three years: between 0.04 and 0.07 for females, and between 0.07 and 0.10 for males. After the first three years the probability to interrupt studies without diploma grows. The risk of dropping out reaches the peak in year 6 as high as 59 percent for males and 47 percent. This means that every next year when a student does not graduate, the chance that he/she discontinues studies increases. In years 7 and 8 of undergraduate studies for males the dropout probability drops. In graduate studies the tendency is similar with constant increase of risk of discontinuing, being as high as 78 percent for females and 70 percent for males in year 8.

Table 4.4 Dropout probabilities from undergraduate and graduate studies by genders and study years

	Dropout probability					
	from undergraduate studies			from graduate studies		
Completed years of studies	Males	Females	Both genders	Males	Females	Both genders
1	0.0661	0.0407	0.0463	..	..	..
2	0.1036	0.0643	0.0754	..	..	..
3	0.0982	0.0684	0.0763	..	..	..
4	0.2975	0.1925	0.2220	0.0020	0.0913	0.0649
5	0.3792	0.3047	0.3291	0.1714	0.2914	0.2521
6	0.5864	0.4678	0.5003	0.2671	0.2786	0.2740
7	0.5503	0.3985	0.4467	0.5878	0.5805	0.5725
8	0.3511	0.4603	0.4228	0.7011	0.7755	0.7428

The second important conclusion is the obvious gender difference in dropout rates. In undergraduate studies the dropout risk is higher for males at all years but the year 8, besides the difference appears increasing every period. In graduate studies female dropout probability is higher than that of males in almost all years, but the difference is smaller than in first level higher education studies.

Figure 4.10 Dropout probability from undergraduate studies

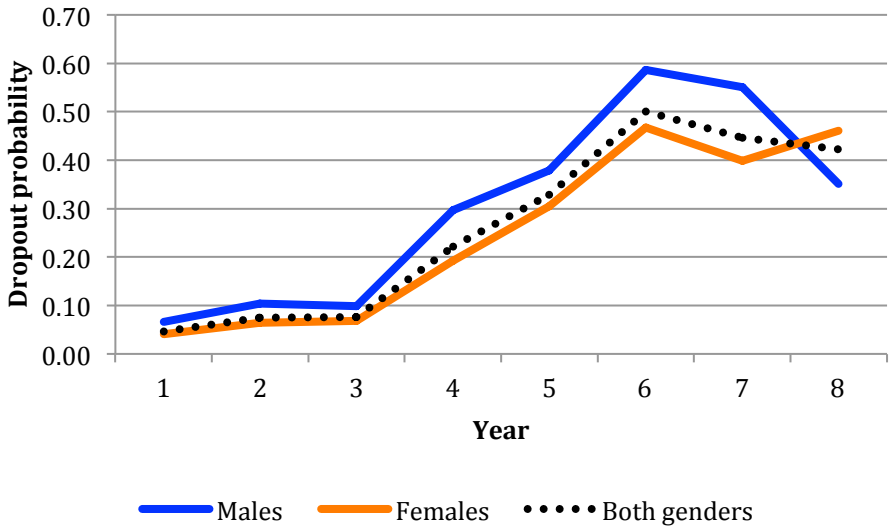
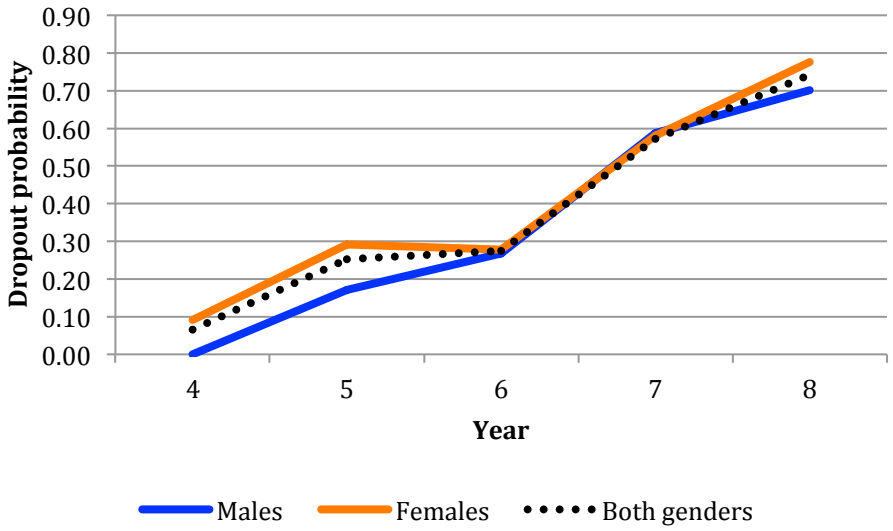


Figure 4.11 Dropout probability from graduate studies



These are important conclusions and require looking for explanation. First of all the increasing dropout rates to author's mind have rather straight forward explanation. In the beginning of studies that study subjects are simpler and learning allows building on earlier acquired knowledge. Later in the study curricula the learning has to be based on study courses acquired earlier in the programme. If those subjects are not well enough learned, or if the student has not passed those subjects, advancing is impossible. Also, in the first or second year it is possible to accumulate academic debts (not passed courses), while towards the end of the programme (year 3 or 4, or 5), the courses have to be passed, or the programme cannot be graduated, hence – one has to leave the studies without a diploma. Also, students have possibilities to take academic leaves (2 years in bachelor studies, 1 year in master studies). Therefore it is common that if a person feels he/she cannot perform and manage the studies, he/she can take a break without dropping out of studies. Again, towards the end of studies these possibilities are used, and one has to either finish the studies, or exit without diploma. Overall, the author tends to think that increasing over years dropout rates are linked to procrastination of learning and postponing of decision to interrupt studies rather than significant increase of study difficulty. Though, this result should be studied further.

Regarding the increasing female-male difference in dropout probabilities, author tends to explain it by difference in lengths of programmes studied, but this explanation again should be checked by applying MSLT analysis to programmes, stratified by length and field.

4.5 Discussion

Establishment of multi status life table model for Latvian higher education model had two main motivations: first, to develop a tool for in-depth analysis of tertiary education life course, and secondly, to use the model to analyse education life of University of Latvia (LU) students and find if gender differences exist in education life paths.

The present application of the model was only preformed on the University of Latvia database since it was limited to the data availability. Even though the generalization possibilities of the results of the current exercise is limited due to the fact that it is a one-institution database, therefore does not take into account flows between higher education institutions and it may be institution-specific, the model is a tool that can be directly applied to use in social policy analysis.

As noted before, one of the problematic issues with the current application is that no flows of students between higher education institutions are captured. As a consequence, the results may underestimate the true education completion rate. A person can discontinue studies in the University of Latvia, but go to other higher education institution and acquire diploma there. He/she may even take along credit points from passed courses in University, or start education from new. In the current database these individuals appear among dropout statistics and assumed he/she does not continue studies until again entered in LU. The author argues, though, that this assumption is not too restrictive. Even no statistical data exist for flows of students between universities, evidence from surveys suggest that the flows after graduation from first level tertiary education away from the University to second higher level tertiary education in other higher education institutions in Latvia are actually rather small (survey of research project "Midterm enrolment projections for student number and structure taking into account student motivations and expectations with respect to higher education"). One of the reasons apparently is the size and wide supply of second level higher education study programmes of LU. Regarding the flows between institutions in the middle of study programmes, no statistics exist, but according to the opinion of University administration in Student Service (responsible for register), it is low. The problem of inaccuracy due to inter-university flows would fade if the model were applied to a Latvian overall student register, non-existent currently. This would then be a direct and correct representation of the Latvian situation.

Generalization of the result regarding gender differences is very credible though. There is no reason to think that the gender pattern would appear different for the University of Latvia students than for higher education institutions in Latvia in general. The author therefore makes a strong conclusion that male undergraduate studies completion rate is lower

than female rate, but at the graduate level differences are very small. Females more often tend to make a break between undergraduate and graduate studies than males. The graduation intensities identify that the approach of males more often is that, when they start off, they complete studies rather quickly, or alternatively drop and never come back, whereas females more often return to studies after interruption and complete education in longer years, resulting in higher education attainment and longer years lived with tertiary education.

The schooling time expectancy in higher education is 3.4 years for females and 2.8 years for males. So the difference is evident – females study longer.

The approach applied in the study to investigate dropout patterns in higher education yield two very important results. The first is increasing dropout probability or discontinuation risk with every next year of studies. For the first years of studies in bachelor level programmes the risk is rather constant below 10 percent. But in later years that correspond to the time when nominal length of programmes end, the probability to exit studies without diploma is very high. Most probably this is associated with difficulties to pass final examinations and thesis production, but also decreasing motivation and lower connection to the university. Another explanations is found in the labour market – often (and especially so in the private sector) it is sufficient to have acquired the skills, but there is no necessity to have a formal document to certify it. Often this is connected also to the numerous study breaks taken and employment. If the total cohort dropout rate is about 40 percent in undergraduate studies and 20 percent in graduate studies, it is a very high indicator by all means. The first year dropouts can be interpreted as wrong choice and is natural, but later dropouts are to be associated with misuse of resources. Of course, it may be the case that the dropouts are not final – a person interrupting studies in one programme or university can enter another programme in the same institution, enter another higher education institution in Latvia or leave the country for studies abroad. The present model captures the changes between programmes in LU – if the person leaves one programme, but starts up another one, these changes are represented in the model. The current application fails to account for outflows to other HE institutions, the reason being the limitations in database. If it was possible to use a (currently non-existent) overall Latvian HE database, also the flows between institutions would be eliminated fully.

The results in principle can be used to compare the actual study time between entrance in University and graduation against nominal study time foreseen according to a study programme. In the current application the cohort is defined as all undergraduate study programme entrants of a particular year (2002), and this includes both full time and part time students, academic and professional bachelor level study programmes that are of different

length (three, four or five years). Besides, in the period of analysis, most of the undergraduate study programmes have been restructured according to Bologna process and shortened from four years to three years of full time studies. Accordingly the results of the current application on their own are representative, but there is no reference number to compare the study time against. If the analysis is done for one study programme, one study form (full time or part time), comparison is possible and indicates delays in acquisition of diplomas. At a wider spectrum, if this kind of model is applied to all education system, the results can be compared against UNESCO years of schooling – an indicator computed by different methodology for wide spectrum of counties.

Accordingly, the developed model is a tool that can be used for social policy analysis.

5 GLOBAL TRENDS AND PROJECTED TERTIARY EDUCATION ENROLMENT IN LATVIA

Higher education in Latvia in the last two decades has been characterized by major expansion. Thus by the early 2000s the number of students per 10000 population had more than tripled as compared to the early 1990s. So far the growth in enrolment rates has been associated with both positive demographic trends and increasing accessibility of higher education (via access to study loans, wide selection of study forms and programmes). However, demographic development poses growing concerns about the future of higher education in all developed countries. Most European countries are facing an unprecedented ageing of their populations, particularly the Eastern European countries, including Latvia. In the years to come, significant expansion of the younger population is not projected in any European country (Eurostat, EUROPOP2008). Quite the opposite – the younger cohorts are decreasing in size. As a consequence, an impact of demographic changes on the education system is inevitable.

Little seems to have been done to investigate the consequences of demographic decline on the higher education system and to identify the actual scope of the problem. The aim of this chapter is to analyse the demographic potential of higher education in Latvia and to sketch the most likely enrolment volume in the midterm perspective. Associated policy issues are described.

This chapter is organized as follows. Section one provides global trends in recent years in the world. Section two gives background information – demographic facts and enrolment trends in recent years. The section three reviews studies and reports regarding expected future developments of higher education as a consequence of demographic changes. Section four briefly shows subpopulation projection methods. Section five presents enrolment projections for Latvia, suggesting three scenarios that represent a set of plausible alternative outcomes based on changing environment and circumstances. The last section outlines policy issues arising for higher education and recommendations for addressing them.

5.1 Global education trends

In the era of globalization and increasing international integration a discussion on Latvian education system would be incomplete without seeing the global context and development over recent years. The future decades are expected to come with new challenges.

The previous decades in higher education are characterized, firstly, by ***expansion***. This is confirmed also by the trend report produced for UNESCO (Altbach et al 2009) that highlighted the most significant forces shaping higher education in the previous decades. Report notes that although some developing countries still have fewer than 10% of the post-school age group in higher education, almost all have dramatically increased their participation rates. According to the UNESCO Global Education Digest, the number of students pursuing higher education abroad has "skyrocketed over the past 37 years, growing five-fold from 28.6 million students in 1970 to 152.5 million in 2007. This translates into an average annual increase of 4.6 per cent, with the average number of tertiary students doubling every 15 years. But a closer look at the data reveals that the expansion has been particularly intense since 2000, with 51.7 million new tertiary students enrolled around the world in just seven years with the challenge of recruiting qualified academic staff for systems that are doubling in size every eight years on average" (UNESCO 2009: 9). The percentage of the age cohort enrolled in higher education has grown from 19% in 2000 to 26% in 2007 (UNESCO, 2009: 9), with the most rapid increase in upper middle and upper income countries, whereas the increase in low-income countries is only from 5 to 7 percent. In the world, there are roughly 150 million tertiary students, with China and India being the first and the third (respectively) largest academic communities and with high growth and also high growth expectations in the future.

The increasing ***participation of women*** has speeded up the expansion of tertiary education. "The number of women enrolled in tertiary institutions grew almost twice as fast as that of men. While the number of male students increased by a factor of four from 17.7 to 75.1 million between 1970 and 2007, the number of female students rose six- fold from 10.8 to 77.4 million" (UNESCO, 2009:15). The female tertiary education participation rate exceeds that of males in all Western Europe and North America, as well as Latin America, Caribbean and Central and East Asia. In Arab countries the participation rates for both genders are almost identical. The only region where males still dominate student numbers in tertiary education is sub-Saharan Africa. UNESCO compute adjusted gender parity index and it is seen that the gender balance increase in favour of women has started in 1980ies in Western countries, followed by Latin America and Caribbean in 1990ies, but the other mentioned countries – since 2000 (see Appendix A8).

The globalisation has brought wide opportunities for ***student mobility***. The total number of internationally mobile students has risen by nearly a third from 1.8 million to 2.8 million yearly. One of the main flows is Asian students entering universities in US, Canada, UK and Australia (i.e., mostly English-speaking countries), and currently these students are important

share of classrooms. They are often characterized as very motivated and determined students achieving good results in studies. The second important international student flow is within the European Union, or European Education Area. With funding provided (like Erasmus programme, for example) a one- or two-semester exchange has become very popular and in fact often desirable for successful career. To benefit from this global trend, many institutions from non-English speaking countries have established programmes in English to attract international students (and funding brought along). The Netherlands is one of the most advanced countries in these terms with many English-language programmes, but also in Estonia, for example, there are already more than 100 degree programmes fully instructed in English. PhD dissertation written in English is a requirement in Estonia, the Netherlands, and Sweden.

The ***average student age*** in the world has been climbing steadily in recent years. With the development of the life long learning concept, there are increasing number of people returning to universities and studying after being in the labour market. Student population has grown older, and this creates pressure to put in place new systems of academic support and changes in curricula. Higher education institutions have been responsive and adapting existing and establishing continuing education programmes together with more flexible study schedule.

Along with the massification, the ***funding sources*** have shifted. States no longer can afford to educate the growing numbers of students in a mass higher education system and given the positive private returns from education, individuals (and their families) have to take up increasing part of the expenses. Also the private education institutions have experienced increases in numbers as a mechanism to provide for ever-rising demand for education. In 2008 around 30% of the total tertiary enrolment in the world was in private institutions (Altbach et al, 2009). Private sector is known to be "demand absorbing" granting access to students who may not be qualified to enter public universities or stay behind the line in entrance examinations. While some private institutions are selective, often private sector serves masses.

There are growing concerns about the ***quality*** of higher education from two perspectives. With the higher demand for academic professionals in the labour market worldwide, the average qualification for academics in many countries has declined (Altbach et al, 2009). From the student side, as the greater demand for education is met with more supply of study places, the threshold of knowledge required to become a student has lowered, bringing down the average student knowledge and accordingly the quality of the system.

Information and communications technologies (ICTs), especially the Internet, have revolutionized the traditional university. Research and teaching without the use of ICTs is nowadays impossible to imagine, whereas it was not so 20 years ago. Internet provides enormous possibilities for engage in social networks, common research projects are possible without physical working together in one laboratory or office. More often journals and even books are published electronically and are typically considered as good a publication as a paper version. One more characteristic of the electronic communication is that it is almost instantaneous, or fast at least, and cheap. It means, that any research results that gets published or announced anywhere in the world reaches academic communities in other world on the same day, making the whole research process more dynamic than ever before. The communication technologies have made distance education possible.

Two key challenges seem to dominate when thinking about the future of the higher education: demography and economic crisis. First, the ***demographic processes*** play important role. The demographic trends are divergent in the world. From one side world population keeps rising firstly because of the continuously high birth rates in developing countries, especially Sub-Saharan Africa and India. In the demographic transition they have reached the second stage with lowering death rates but still very high birth rates that results in expansion of the population. From the other side, the developed countries are experiencing the Second Demographic Transition[24] with sub-replacement birth rates, resulting in declining populations and ageing of the societies. Naturally this development brings changes to the education sector.

In 2008 the OECD identified the key demographic trends up until 2030 that appear to prevail globally in higher education – wider participation, more feminine and diverse student population in terms of age, social background, nationalities.

In fact, in one form or another these conclusions already followed from the discussions in Salzburg seminar session on future of higher education (Salzburg seminar report, 2006). Among other things it also concluded that demographic situation and therefore challenges differ significantly among regions.

The second important global factor shaping the future of the higher education is the ***global economic crisis***. By the mid 2011 it is obvious, that the crisis that started in the US financial markets is profound and has worldwide implications for society at large and within higher education. Many countries and universities will experience financial problems with

[24] The original Demographic Transition model has four stages; however, some theorists consider that a fifth stage is needed to represent countries that have sub-replacement fertility (that is, below 2.1 children per woman) and have introduced the concept of Second Demographic Transition. It is characterized by low death rates but even lower birth rates and entails also of societal behaviours such as greater individualism, single living, pre- and post-marital cohabitation, delayed fertility, high prevalence of non-marital fertility and high rates of union disruption.

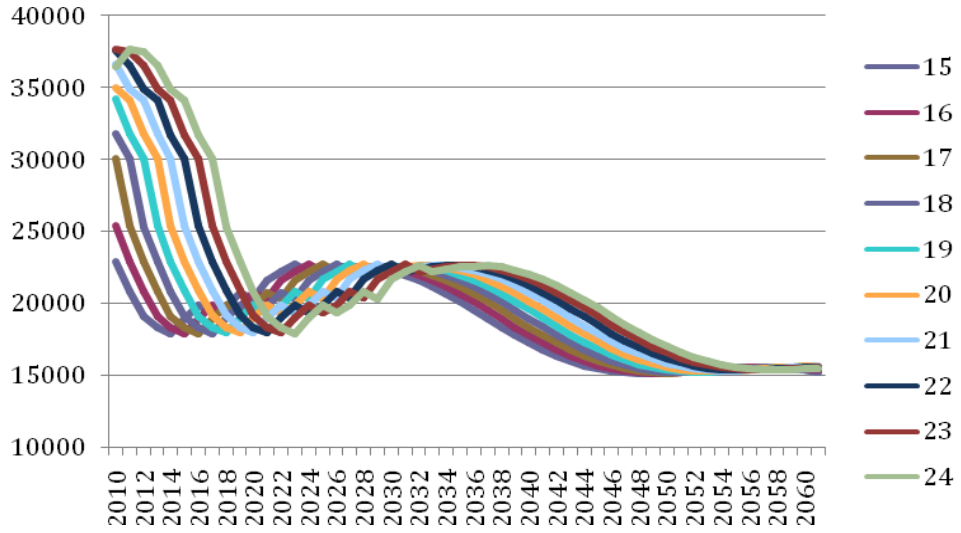
serious consequences in short and probably medium term, although the impact will wary worldwide with some countries more affected than others. The Report prepared for the UNESCO 2009 World Conference on Higher Education (Altbach et al 2009) summarized that the likely crisis implications would be constraints on public institution budgets and availability of student loans, increase or establishment of tuition fees in most countries and freezes on investments and hiring personnel. The threat is that the cost-cutting policies in many universities can result in a deterioration of quality. It is unknown how long or deep the crisis will be, but economic experts are doubtful of a quick recovery. "There is no doubt that higher education is entering a period of crisis, unprecedented since World War II, and the full impact is as yet unclear," the Report concludes. The author notices exactly the described crisis effects in Latvia – cuts in financing to public universities and cease of investments. There is an on-going public debate about financing of higher education (for example, the Strategic Analysis Commission debate in June 2011 in EU house in Riga). The author expects that the debate will intensify in the forthcoming years in the context of continuous state budget consolidation and increasing pressure of other budget expenditures, esp. the social budget and health care costs.

5.2 Enrolment ratio developments

The demographic situation in Latvia is characterized by a negative natural increase and by population ageing. Depopulation started in 1990 and still continues (Demography 2009). According to the official Latvian CSB (and Eurostat) data, population of Latvia in 2011 was 2.23 millions, the first provisional 2011 census results show 1.9 million inhabitants[25]. In particular, the size of younger age cohorts has decreased. This is connected to the fact that at the beginning of the nineties the birth rate fell sharply – total fertility rate decreased from its' maximum of 2.16 in 1988, and reached as low as 1.11 in 1998 (Demography 2009). Eighteen to twenty years later the smaller youth population is about to enter the higher education system and the labour market. As evident from the population projections (Figure 5.1), the population aged 15-24 will fall by about 40% in the coming 10 years, and will remain low in the foreseeable future. This fact has to be seen in the context of previous experience of a rising younger population associated with high birth rates in the nineteen eighties.

[25] For the estimations (and all through the paper) author uses Latvian population data and Eurostat projections (EUROPOP2008) that is based on the official databases. Assuming that the actual difference in the population is due to unregistered emigration, and that majority, in the range of 80%, of emigrants are younger population groups below age 34 (Hazans, 2011), the actual decrease in the youth cohorts is more severe than represented in Figure 5.1; and the enrolment projections developed by author are more optimistic than reality.

Figure 5.1 Youth population (15-24 years) projections for Latvia



Source: Eurostat population projections (EUROPOP2008), author calculations

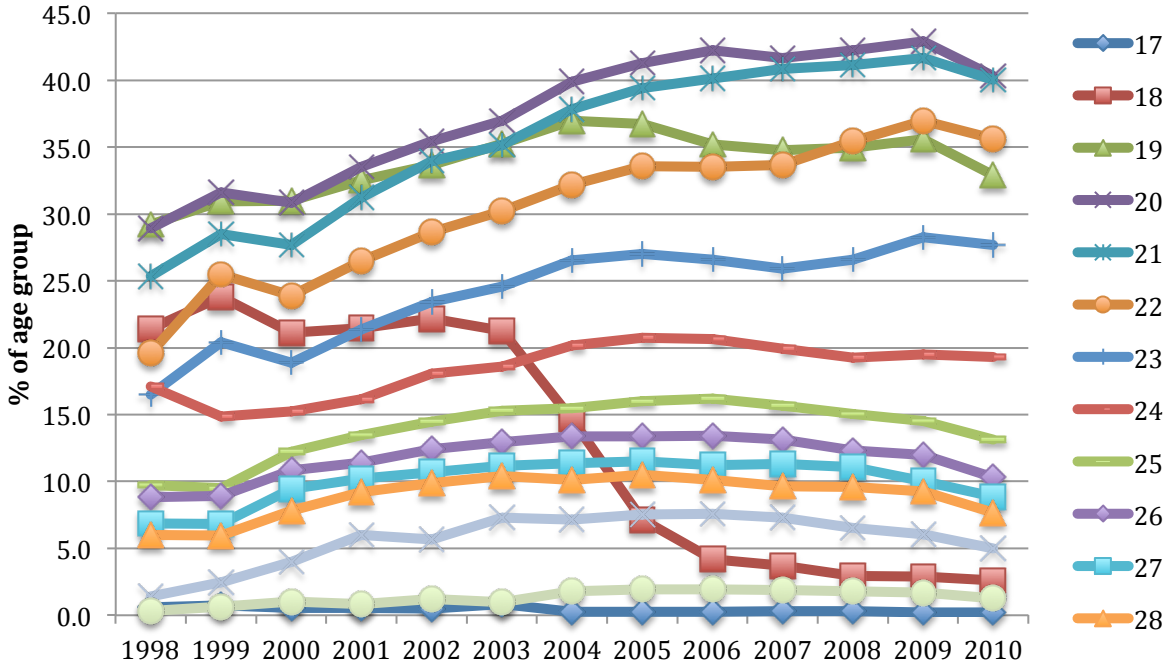
Latvian higher education has already started to experience this decline. In the 2009/2010 academic year the Latvian higher education system for the first time experienced a significant fall in numbers of students. Total enrolment decreased by 10%, with the number of first year bachelor students down by 26% compared to the year before.

The previous expansion motivated creation of a great number of higher education institutions, both public and private. There are now 57 higher education institutions (in Latvian - *augstākās izglītības iestādes*) in Latvia (2010), incl., 31 universities and higher schools (*augstkolas*) and 26 colleges (*koledžas*), which is very high for just 2.2 million inhabitants (27 per 1 million inhabitants). This compares with Estonia (29) and Denmark (32), which are also small countries, but significantly exceeds the US (14), the UK (15), the Netherlands (10) and Germany (8), which, in contrast to Latvia, host many foreign as well as home students. The author reasons that the excessive number of higher education institutions is a result of the massive expansion of higher education in nineties – the number of higher education institutions rose from only 12 in 1990 to 60 in 2006 (IZM, 2009). In the beginning of the transition period demand for education exceeded supply of available study seats, and establishment of schools was seen as both – good public investment, and especially profitable business opportunity (the number of private universities increased from just 2 in 1990 to 16 in 2004). While expansion under high demand is typically easy and convenient, shrinking or merging is more complex as it involves individual academic and financial interests.

From age specific enrolment ratios, i.e. the ratio of students in the respective age population group in Latvia, it is seen that naturally the highest proportion of students is in the

19-24 age cohorts[26] (see Figure 5.2). Starting from age 23 and older, age specific enrolment rates gradually decrease with every older cohort – for the 25-28 age cohorts it is in the 8-13% area, for 29-39-year-olds the ratio is 5%, but in the older age groups 40-plus – slightly above 1%. The observed expansion of higher education has happened in both the younger groups, and the older groups. In particular, the 29-39-age cohort that started as low as 1% in 1998 (there were virtually no adults above 30 in tertiary education) has grown to 5% in 2010. Additionally, the number of students over 40 has risen from 0.3% in 1998 to slightly above 1% in 2010, but still very few students are over 40.

Figure 5.2 Age-specific student ratios in Latvia (1998-2010)



Source: Ministry of Education and Science and Eurostat, author's calculations

Between 1998-2008, enrolment trends showed unambiguous stable growth both in absolute and relative terms. In the 2009/2010 academic year the situation has changed – enrolment has fallen in all age groups – primarily of younger students because of diminished cohorts, but also of older students apparently because of crisis and probably because the pool of adults that acquired their education in Soviet period and saw need for requalification and for whom paid education opened the opportunity to attain higher education is partially exhausted. Naturally, this raises the question of what developments to expect in the future.

[26] The changes in the 18-year-old enrolment rate are connected to structural changes in the secondary education system and the transition from 11 to 12 years schooling (primary + secondary) starting in 1991. As a consequence, schooling before tertiary education takes longer, and the number of 18-year-old students has decreased.

5.3 Demographic effects on education systems: evidence from literature

According to World Bank estimates (Chawia, 2007), by 2025 in Latvia the number of pupils in primary schools will shrink by 25%, in secondary schools by 20%, but the most significant fall is expected in the number of students in higher education – by 40%. Mizikaci (2007) has examined the phenomenon of the shrinking youth population in Europe and the associated effects on higher education. She notes that the severest declines will be observed in Estonia, Latvia, and Slovenia, where more than half of the 18-23 age group in 2005 will disappear by 2050. For those countries, immigration would not be enough to compensate for the natural decline, especially because currently they record negative net migration (i.e. emigration for Latvia, Lithuania, Poland, Estonia). In all former Eastern bloc countries, higher education is at risk because of low fertility rates and emigration, as well as obvious failure to enrol significant numbers of foreign students. Following discussions at the Salzburg seminar on the future of higher education, Baumgartl (2007) states that due to shifting demographics in Europe some higher education institutions will suffer from lack of students in the very near future, and that "the present and future body of higher education population should be examined".

Before 2009 the effects of demography on the tertiary education system in Latvia had not been explicitly studied. Within the EU Structural Funds funded Ministry of Welfare labour market research programme (2005-2006) one project studied graduate life paths and study outcomes, another project modelled labour market developments, while another project studied conformity of HE programmes with labour market requirements, but no explicit attention was paid to investigating demographic impacts. In the spring of 2009, the Ministry of Education and Science communicated that in the nearest seven to ten years the number of students will continue to diminish, and in the 2015/2016 academic year the number of students will decrease by a third compared to recent years (LETA, May 26 2010). Occasionally the issue of demographic effects on the higher education system has been mentioned in the media, where (most often) university representatives are cited expressing concerns about the falling number of secondary school graduates. Overall, these are the same higher education establishments where the issue is raised and discussed, usually in the form of guessing, since it is crucially important for their development strategies. In the context of writing the Latvian sustainable development strategy, some analytical discussions on the issue have taken place over 2008-2010. None of them has been based on or resulted in a research paper.

The most comprehensive analysis of tertiary education demography has been performed by the OECD, which in a report (OECD, 2008) concludes "demography has only recently

become a concern in debate on higher education policy, and past growth of systems in OECD countries has had little to do with demographic changes. The increase in rates of admission to higher education has been of greater importance than the size of age cohorts." (Teichler and Bürger, OECD 2008, Chapter 5). Among other things, the report concludes that: (1) student participation will continue to expand and will in most cases be evident from growth in the size of higher education systems. Contraction will affect only a small number of countries; (2) women will be in the majority in the student population; (3) the mix of the student population will be more varied, with, e.g., greater numbers of international students, older students, and those studying part-time; (4) the social base in higher education will probably continue to broaden. Latvia, not being an OECD country, is not analyzed in the report. With domestic knowledge about the Latvian HE system, we have reason to think that Latvia may be among the countries affected by contraction, but this will be analyzed later in the paper.

5.4 Subpopulation projection methods

Various methods have been used in enrolment forecasting depending on the aim and purpose of the projections and the availability of data. The first basic distinction is made between the institutional (i.e. micro) level projections and the country or more generally global (macro) level projections. The micro level projections are extensively used by institutions that try to predict the level of enrolment, especially in the US. The macro level projections are usually developed by international institutions or independent researchers/research centres.

All other things being equal, demography directly affects student enrolments in higher education because the size of younger age cohorts is a partial determinant of the number of students. Around 80% of students in higher education in Latvia are less than 35 years of age, and 60% are below 25, the relative impact of younger age cohorts has a major bearing on student enrolment levels. If rates of entry to higher education, together with survival rates, the average length of courses and other student-related factors (age, etc.) remain unchanged, countries in which those cohorts decrease in size will normally experience a fall in their student enrolments (OECD, 2008).

Though, the relationship between higher education enrolment levels and the size of the younger age cohorts is not a straight forward. Many factors can offset the effect of change of cohort size, such as changes in the access rates to education, change of length of study programmes, change in drop-out rates, legislative and policy changes that affect labour

market requirements, financing and costs of the programme, the economic and labour market situation in the country.

It is possible to identify four main methods that are used for education enrolment projections, each one having its pros and cons:

- Enrolment ratio method, based on projected ratio of students in education and the projected increases in the age groups for the respective education level;
- Survival rates method is based on survival of each cohort to the next year or next level of education;
- Regression models can be of various forms, such as linear, exponential, autoregression models etc., and projected number of students is estimated as a function of variables that are perceived to have influence. Provided sufficiently long timelines are available, modelling enrolments with regressions have infinite variations by including various variables and testing their significance;
- Multistatus (increment-decrement) life tables method is the most advanced, but also the most data demanding and requires life-course data. It explicitly uses the population structure and transition coefficients from one state to another, allows to estimate transition matrices and calculate the expected time spent in each status, typical age for entering studies or graduating and several other indicators that none of the previous methods is capable of supplying.

The OECD (OECD, 2008) report on the future of higher education uses trend extrapolation methodology and argues that it is the turning points that play the most important role in demographic trends, concluding that demographic trends cannot be extrapolated directly, but only explored through forward-looking scenarios incorporating political and economic factors. The projection approach used in the OECD report uses UN population projections as a basis and calculates enrolment with the extrapolated trends.

Before that Ahuja and Filmer (Ahuja, Filmer, 1995) had adopted a very similar approach by taking existing UN population projections and superimposing onto them an educational distribution estimated for two broad age groups (ages 6-24 and 25+) from a given set of enrolment ratios and UNESCO projections. The research by Wolfgang Lutz with colleagues, resulting in a number of publications (Lutz et al (2007), Samir et al (2008)) adopts a more advanced approach for projections of educational attainment for 120 countries. They apply the demographic methodology of multi-state population projections, based on multi-dimensional expansion of the life table and of the cohort-component projection method. This method allows for longer term projections as they are based in population age and gender structure and take into account also the impact of education on fertility and mortality; the

approach, though is very data demanding and requires a complete matrix of the composition of the population by age, sex, and levels of education attainment for different points in time. They estimate the education attainment in four wide education groups (no education, primary, secondary and tertiary), whereas our study attempts to quantify the tertiary enrolment. Guo (2002) compares accuracy of forecasting models and concludes that more complex models are not necessarily more accurate than simpler ones.

For projecting future developments, the approach taken in this research is analogous to that of OECD 2008 report, i.e. is the enrolment-ratio method, which is common for estimating sub-populations and uses two components – readily available population projections and enrolment rate development trends both (1) extrapolated from statistically observed ratios, and (2) estimated based on expert opinions and peer experience. Similar methodological approach (trend method) is used by Statistics Sweden (2010) for projecting distribution of sexes by education and profession.

For cohort size, the Eurostat population projections (EUROPOP2008) convergence scenario (for 2008 projections Eurostat does not develop multiple alternative scenarios) is used. EUROPOP2008 projection version (v.s the later EUROPOP2010) is only available at the time of calculation at sufficient disaggregation level (one-year age groups), so the 2008 population projections are used. This describes possible future demographic developments assuming that across European countries fertility and mortality converge to those of the "forerunners" by 2150.

Given the choice of two sources that produce full-fledged population projections for Latvia – Eurostat and United Nations – there are several reasons to prefer Eurostat version. The Eurostat projections are developed in close cooperation with the Latvian Centre for Demography that work out national forecasts. As a result national and Eurostat forecasts coincide. The United Nations use somewhat different approach suggesting four different scenarios (Medium, High, Low, and Constant-Fertility variant). The assumptions on parameters behind these variants are obtained pretty technically from the past statistics and from country groupings in regions. Consequently the UN projections appears to be very standard in contrast to the Eurostat projections that are more individualized and use extensive expert opinion. Two another forthcomings are that UN does not attach any validity estimates to any of the scenarios and estimates are not readily accessible for single-year age groups. Overall according to author judgement the Eurostat projections are more credible and are used therefore.

Also, the Eurostat population databases are used throughout this research, making separate pieces easy to compare. The time period for projections used is 2010 – 2020, limited

by the reliability of trends assessed. The projections already take account of birth, death and migration rates, and we assume the rates being equal for population in and outside tertiary education[27]. The model inherits all the assumptions made for the projections[28].

The term enrolment ratio is defined as the proportion of students in a given age group enrolled in higher education programmes. This can be expressed by formula $r_{xt}=E_{xt}/T_{xt}$ where r_{xt} stands for the enrolment ratio of the population at age x on year t, E_{xt} denotes the number of x years old students in tertiary education on year t, and T_{xt} the total age x cohort size on year t. E, which is the variable of our interest, can be determined once r_{xt} and T are known. Analogously, the projected future E can be estimated from credible projected values of r_{xt} and T. The fundamental problem of enrolment projection work is to assign values for them (Jacoby (1959)) – to the expected enrolment ratio trend in the future.

5.5 Three scenarios of enrolment projections

The author presents three enrolment development scenarios: a stable enrolment ratio scenario, a global education trend scenario, and a crisis scenario. The different scenarios represent a set of plausible alternative outcomes based on changing environment and circumstances. The first two variants can be thought of as rather statistical baseline scenarios, whereas the third scenario relies mostly on expertise and knowledge in the area. In this study the author does not compute statistical probabilities to any of the variants. Still, the crisis scenario complement statistical information with expertise and judgement, therefore it can be thought of as more realistic.

5.5.1 Stable enrolment ratio scenario

Stable enrolment ratio (SER) scenario represents a situation in which tertiary education develops smoothly into the future. The only changes arise from differences in cohort size. Observed trends over the years 1998-2010 are extrapolated for the following 10 years, assuming that:

[27] In reality rates, esp., migration rates differ and hence may be a source of limitations to the projections. Nevertheless, for medium term projections this assumption as valid and has not be questioned in above-mentioned OECD and UNESCO studies.

[28] In the Eurostat EUROPOP2008 (European Population Projections, base year 2008) convergence scenario, the population projections describe the possible future demographic developments assuming that across countries fertility and mortality converge to the "forerunners", and international migration flows will converge to zero net migration in the same convergence year with the one assumed for fertility and mortality. The methodology consists essentially of setting the values of the demographic indicators for the convergence year (e.g. 2150), i.e. the year in which the theoretical convergence would be achieved, and of appropriately interpolating from the starting value for each country and each demographic component (fertility, mortality). The national values for the year of interest (target year, 2060) are derived (Source: Eurostat).

- The proportion of students in the respective age cohort will continue to change at the same average speed and direction as previously.
- Transition rates and dropout rates will change as previously.
- Growth converges to zero when time converges to infinity.

Mathematically, we extrapolate the trend with the mean square regression according to formula:

ln(Y/Y(t-1)) = alpha/trend

i.e., extrapolate the observed trends over the years 1998-2010, using the OLS and putting a constraint that the growth converges to zero when time converges to infinity.

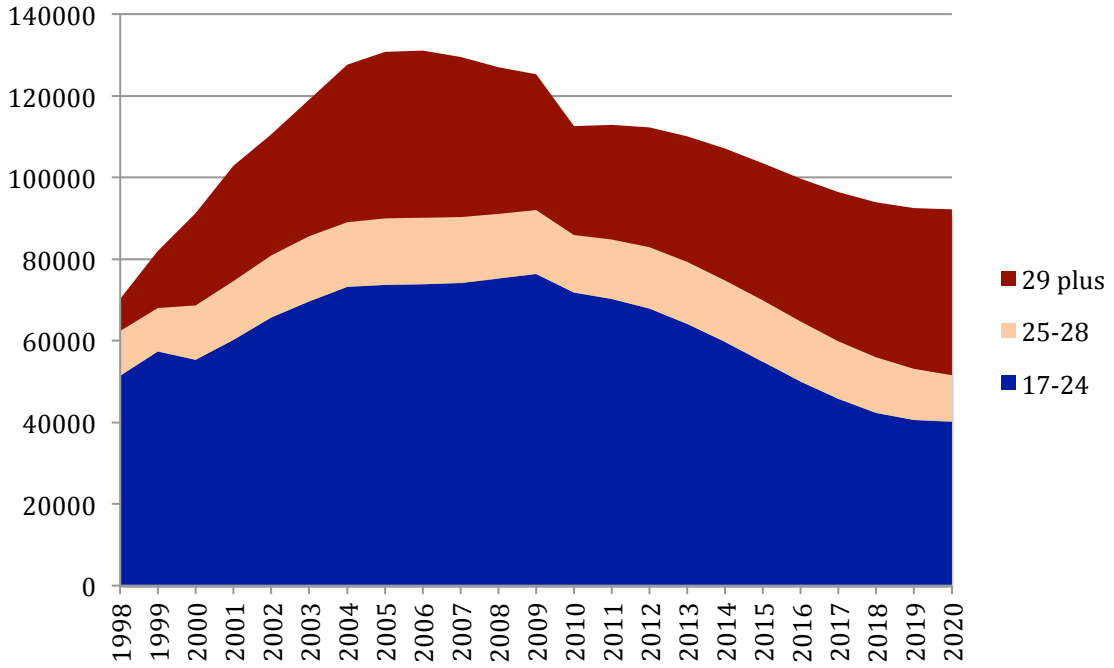
According to availability of data, the trends are calculated separately for single-year age groups for groups aged 17 to 28, one group 29-39, and one group for 40-year-old students and older. The age-year specific enrolment ratio is estimated as population in tertiary education over the overall respective age cohort in a particular year. An assumption is made for the older age students that none older than 64 is studying, which allows calculating 40+ years old students as percentage of the age group 40-64[29]. This scenario is mostly computed as a baseline.

All calculated stable enrolment trends are positive or virtually constant (see Appendix A8, Figure A8.1). Growth is expected in the enrolment ratio of younger students (20-23) and of the 'non-traditional' age student group (29-39). The proportions of students in the 24-28 and 40-plus age groups are expected to remain stable at their 2010 levels, since growth in enrolment ratios of those groups in the period of reference was very slow.

The total expected enrolment in the following 10 years are obtained by attributing the estimated age-year-specific enrolment ratio trends to the age cohorts in respective years according to Eurostat population projections (EUROPOP2008). The author reasons that wider age groups are more representative, therefore the results are presented by three age groups: 17 to 24 years, 25 to 28 years, and older than 29 years.

[29] The number of students aged over 64, i.e., pension age, is virtually zero. Even though this may not be entirely methodologically precise, this is a credible assumption and will let to avoid the effect of rapidly increasing older age cohorts on enrolment projections.

Figure 5.3 Observed (1998-2010) and projected (2011-2020) number of students in tertiary education – stable enrolment ratio scenario



Source: Eurostat, author's calculations

The stable enrolment scenario suggests that the total number of students in tertiary education will decrease from 113 thousand in 2010 to 92 thousand in 2020, while enrolment in 2020 would be 80% of that of 2010 (Figure 5.3). The most severe decline will be observed in the traditional age student group (17-24) – by 44%, whereas the size of older student age group (25 to 28) will remain stable and would even slightly increase compared to the 2010 level as a result of positive enrolment ratio trends and slightly increasing cohort size. The older student groups (over 29) will become more common in higher education – the total number would increase from approximately 27 to 41 thousand students, and the share in total student population will increase from 24% to 44%.

5.5.2 Global education trend scenario

The global education trend (GET) scenario takes into account schooling patterns across European countries and assumes that:

- In the years 2010 – 2020 the enrolment ratio age structure in Latvia converges to the EU-27 average.
- The speed of convergence depends on the size of the difference between the rate in the previous period and the target value (EU-27 average).

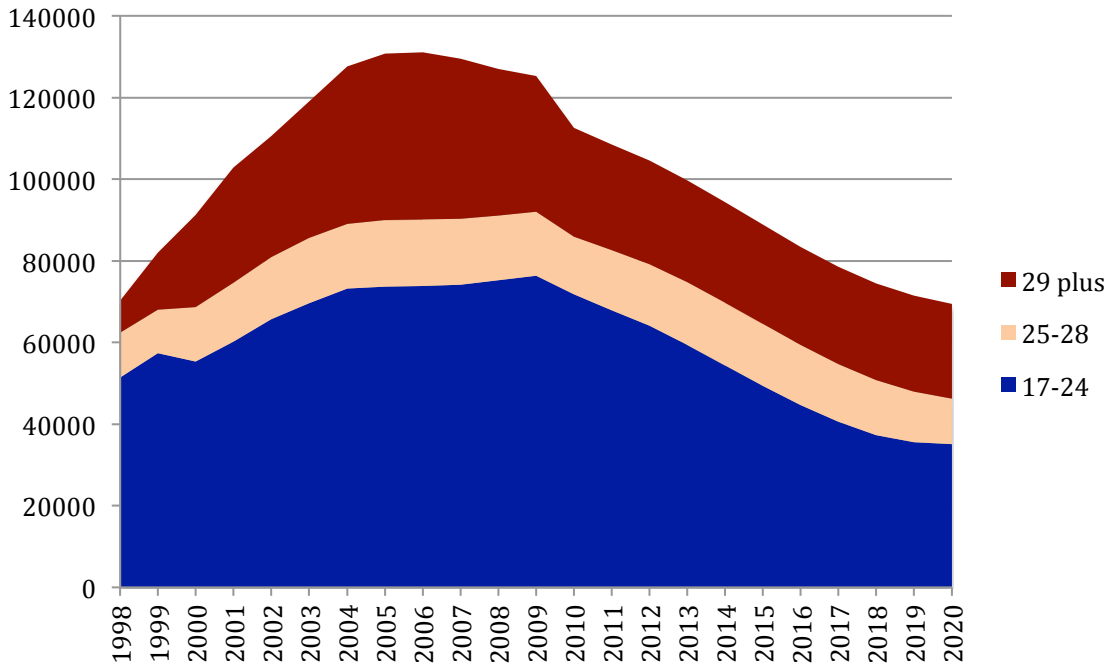
The 2011-2020 enrolment ratio structure for Latvia is therefore assumed to converge to that of EU-27 according to the function:

$ln(Y/Y_{t-1}) = \beta(Y_{t-1} - Y_{EU27})$

i.e., it is assumed that the age-specific enrolment rates Y will converge to the respective EU-27 average age specific rate Y_{EU27} (see the EU-27 averages in Appendix A8, Table A8.1), the speed being dependent on the size of the difference between rate at $t-1$ and Y_{EU27}. The obtained results are depicted in Figure A8.2 (Appendix A8). The cut-off year for the projections are 2020, longer trend lines only depicted for information.

Enrolment ratios in the EU-27 have been gradually rising during 1998-2005, and have stabilized since 2005. They are generally lower than the Latvian 2010 rates, so that all but 25 and 26 year-old rate trends are negative (Figure A8.2 in Appendix A8).

Figure 5.4 Observed (1998-2010) and projected (2011-2020) number of students in tertiary education – global education trend scenario



Source: Eurostat, author's calculations

According to the GET scenario, a decline in higher education participation at all ages is expected (Figure 5.4, similar to SER scenario merged age-groups presented). Total enrolment in 2020 is expected to approach the level of 1998 at around 70 thousand students – a decline of 38% compared to 2010 enrolment. It also entails a reduction of over 50% in traditional age student numbers. The older cohorts (29 plus) are not yet declining by 2020, and the fall in enrolments is only affected by convergence to the lower EU enrolment rate assumption, resulting in a 13% fall in enrolment. As a result, the student population will be older and the proportion of non-traditional students (29 and older) in the total student population will increase to 33% in contrast to 24% in 2010.

5.5.3 The crisis scenario

The crisis scenario (CRI) is designed to capture possible other effects that do not follow from statistics, but can be concluded from the literature on historical development in other countries, the author's observations of the situation, and assessed developments by experts. This scenario is the most subjective of the three and is intended to sketch general developments on top of those directly flowing from data.

During recession, some individuals invest in graduate education to position themselves for a better job when the economy revives. Often people change their life plans to apply for Master or PhD programmes earlier than planned because of unfavourable labour market conditions and because alternatives to schooling are less attractive. This behaviour can be observed from two relatively recent historical trends for recessionary periods in the global economy: 1991-1993 and 2000-2002. It was observed that enrolment grew more rapidly during and after recessions, while the largest dips happened in boom years. However, a slowdown in enrolment was observed at the very beginning of recession (Moody's International Public Finance (2009), data on Canada, France, Italy, Spain, the UK, and the US).

In its report, Moody's outlines that universities are expected to experience some stress but be more sheltered than other sectors from the global recession. "This is due to their counter-cyclical business aspects, government support, and growing role in economic development and rebuilding." However, many face the conflicting pressures of rising demand for their services while also needing to adjust to a weaker funding outlook.

A UNESCO study of current economic crisis (Varghese, 2010) conclude that both in-country and cross-border enrolments are on increase, and this is true for all regions including Europe, the United States and China. There is a more than before preference for professionally oriented programmes. They explain the surge in the enrolment by the tendency of many countries to protect education budgets more than budgets in other sectors, lower opportunity cost of studying, pressure from labour market as job opportunities for drop-outs are fewer than for graduates, and high commitment by middle class to educating their offspring. Hazarika (2002) investigated the effects of regional recessions on enrolments in the US and found that wealthier students are more likely to attend college in a recession, whereas those from less wealthy families are affected by credit constraints and less likely to attend college. Access to financing therefore plays a role in enrolment decisions. In Finland in the 1990 crisis period, applications for higher education grew by about 25%, and participation in entrance examinations by 42% (Kivinen and Rinne, 1996). The increased demand, though,

was not supported by a sufficient increase in the supply of study places so actual enrolments remained stable.

The impact on a particular country and particular institutions may vary. In the Latvian situation some additional institutional and behavioural aspects would play a role:

- Participation in tertiary education will be a function of people's beliefs on the speed of recovery of the economy. If people believe in a fast recovery (2-3 years), i.e., believe they will have job, they are willing to invest in education and probably even bear considerable personal cost. In the opposite situation, where people believe in slow recovery or stagnation, they may leave the country for study or work. The emigration alternative is relatively easy given the open EU labour market.
- Completion of some degree of tertiary education is already a minimum standard for certain types of employment (government sector, schools), and therefore enrolment (and graduation) rates were very high by international standards even before the recession. There is hardly more room for growth in enrolment rates due to a saturated local market.
- In Latvia, simultaneous work and study practice is common (Auers, Rostoks, Smith, 2007), often resulting in prolonged study time (academic breaks, longer programmes). With loss of employment or fewer working hours, study time may actually shorten, so that total enrolment will be lower.
- Reasons for not continuing studies are financial problems and inability to pay study fees; shortage of money can also prolong study time as students may be forced to take study breaks because of inability to pay tuition fees.

The author takes into account that individual behaviour is affected by changes in the labour market in a recession – a loss of job can serve as a catalyst for career decisions. Unchanged education policy in the country is assumed in this scenario: higher education still relies on local demand and active foreign student attraction does not take place; no further significant cuts in higher education financing take place, but also no new investment. The author assumes peoples' positive beliefs in economy returning to growth in three years. In this scenario, assumptions are made by three age groups (Table 5.1).

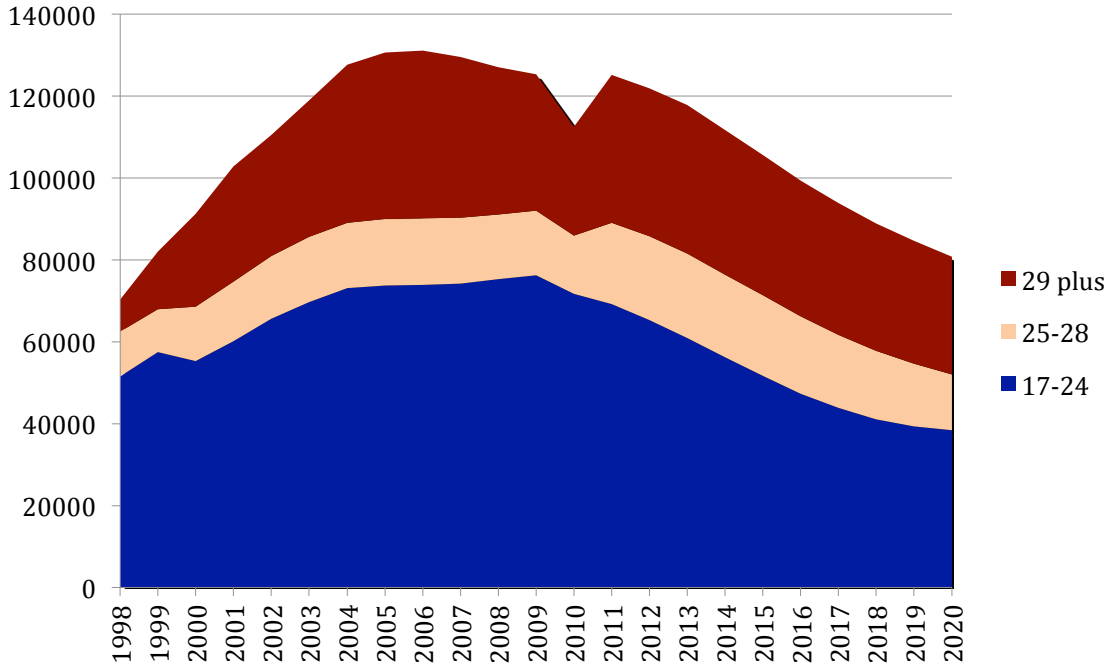
Table 5.1 Summary of reasoning and assumptions regarding educational behaviour for separate age groups

Age	Rationale	Assumption
17-24	Most mobile of all groups, also the most free in terms of family commitments. Under crisis: the highest proportion leaving the country (for study and/or work) compared to other groups. Employment (traditionally popular among students in Latvia) increasingly difficult to find for younger people without experience and degree. People staying in Latvia invest time in education in the belief of recovery, may be more selective regarding the study area and more demanding.	The two effects (emigration and difficulty in finding a job) offset each other, enrolment rate is at the pre-crisis level (2008) for 3 years, converges to EU-27 average after 2013, i.e., falls.
25-28	More commitments (family, social, work), consequently emigration is more complicated. More prone to stay and use all local opportunities. In case of loss of job, ready to invest in education but selective regarding the programme. Could choose good quality business education, probably looking for shorter 2-3 year executive education. Those who have dropped out could go back and finish their degree. Those who postponed a decision on second level higher education may start now.	For the first three years enrolment rate increases by 15% compared to 2008, converges to EU-27 average after 2013.
29 plus	This group is most settled of all. They may see little return on investment in a degree, but are probably more likely to attend qualification courses to build on previous education. Some proportion may consider second level tertiary education but with emphasis on professional skills.	Enrolment rate remains constant (for different reasons than for 17-24 population) over the first 3 years, converges to EU-27 average after 2013.

Source: author's table

According to this scenario, the crisis would have a short-term positive impact on enrolment rates, which will slightly increase above the 2010 level and stay there between 2011 and 2013 (Figure A8.3 in Appendix A8). Increasing enrolment ratios would be expected in the 25-28 age group. After 2013 enrolment rates will start to fall to the EU-27 level.

Figure 5.5 Observed (1998-2010) and projected (2011-2020) number of students in tertiary education – crisis scenario

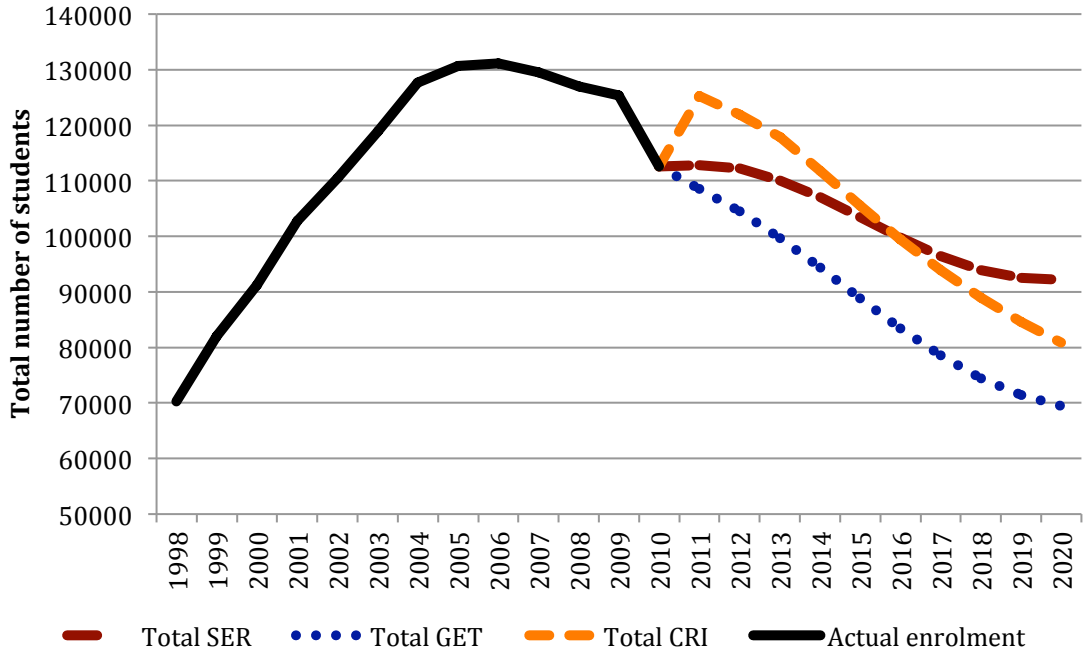


Source: Eurostat, author's calculations

The total number of students in the period 2011-2013 would increase compared to 2009 and 2010 levels, but would not reach the 2006 peak of 131 thousand students. The 25-28 year student group would remain roughly the same size throughout the entire period 2000-2020. After 2013 enrolment rates are expected to converge to the EU average, and the demographic decline is even more prominent. As a result, the total number of students in 2020 will fall to 81 thousand with less than half (47%) being in the traditional age group (17-24).

In comparison, all variants indicate a very similar future enrolment situation despite relying on different assumptions about enrolment rate future development. All scenarios suggest a significant fall in total enrolment – by 18% in SER, by 38% in GET, and by 28% in the case of the CRI scenario year 2020 compared to 2010 (Figure 5.6).

Figure 5.6 Comparison of trends – total number of students in tertiary education according to the three alternative scenarios



Source: Eurostat, author's calculations

The crisis scenario is the only case where enrolment is expected to increase in the short term, and it may turn out to be the 'best' case for the higher education system in the nearest future.

The other common characteristic for all variants concerns changes in student age structure. The number of traditional age students (17-24) will decrease to somewhere between 44% and 50%. Consequently the traditional age students would be a minority in the student population. In contrast, the proportion of adult students will rise from 24% in 2010 to somewhere between 33% and 44% in 2020 (by a factor of three or four compared to 11% in 1998).

Table 5.2 Comparison of scenarios: total number of students and proportions of wider age groups

Year	1998 actual	2010 actual	2020 SER	2020 GET	2020 CRI
Total	70233	112555	92152	69434	80841
Proportions of age groups in total number of students					
17-24	73%	64%	44%	50%	47%
25-28	16%	13%	12%	16%	17%
29 plus	11%	24%	44%	33%	36%

Source: Eurostat, author's calculations

5.6 Policy implications of expected changes in enrolment

Higher education in Latvia is facing big changes due to the rapidly changing demographics in the years to come. Exact predictions are impossible given the number of different non-demographic impact factors and the unclear economic situation. All the analysis suggests that under any development scenario the total enrolment will fall. Enrolment will in the foreseeable future never be as high as it was in the early 2000s. By 2020 the number of students in higher education will decrease by 18-38 percent under the alternative scenarios. This implies that the current number of higher education institutions cannot be sustained.

The higher education system has to adjust to two imminent changes arising from demographic changes – a decrease in total enrolment volume and a change in the age structure. In its current form the present size of higher education system is not sustainable. Clearly, there are no solutions to increase the size of cohorts as a way to rescue the higher education system, at least not in the nearest future. Demographic processes are inert compared to financial markets and the economy, so there are no quick solutions in demography.

The first question to be asked is: Should the current system be rescued by preserving the current volume of higher education? Furthermore, is it a problem that there are fewer students, there would be fewer universities, fewer academic staff, less taxes paid, but also less public expenditure on education? Not necessarily. Higher education may be viewed as a service that is in less demand and therefore over-supplied, analogous to photo film development services with the introduction of digital cameras, or typewriting when computers appeared. In other words, the higher education sector is like any other sector of the economy and is subject to a demand side shock reducing the demand for its services to where it was in the 1990s. Among other things this would also imply cost savings to the state budget or alternatively the spending per student can increase without increasing the overall higher education budget.

An obvious way to adjust would be to shorten the supply, i.e. to reduce the number of higher education institutions. Here it makes sense to distinguish between private and state institutions, respectively. The private institutions, being to a large extent directly subject to the market mechanisms, might adjust by itself when some might go out of business due to lack of students whereas others might develop new programmes or targeting non-traditional students. The state-funded institutions, on the other hand, are not directly affected by the market mechanisms since their development to a large extent is determined by political decisions. Based on the demographic changes the state-funded should be restructured, with the lowest performing doubling alternative programmes and institutions simply being closed down. From a political point of view, this might be easier said than done since higher

education policy usually are considered as an integral part of other policy programmes, e.g. regional development. Furthermore, the current financing model of state-funded higher education institutions might further complicate the necessary restructuring. Given the financial incentives provided by the current system where each student enrolled represent a substantial source of income, there is a great risk that the institutions will lower standards in order to enrol and keep as many students as possible.

The alternative approach to cutting the supply would naturally be to find ways to increase the demand for the services that could be provided by the Latvian higher education sector. This require somewhat of a change of the mindset of policy makers as well as university leaders – to stop thinking of higher education as a cost to bear, but perceive it as a productive and competitive sector of the economy, capable not only of educating people for the Latvian labour market, but also of exporting its services and possibly also educating foreign young people for the Latvian labour market. The demographic decline not only affects the student population, but also the labour market, and working age people will be needed to cope with an increasing old-age dependency problem where opening up the Latvian labour market to foreigners could be at least part of the solution.

The issue of increasing the demand for higher education in Latvia is partly addressed in the work of a specially established group, which in December 2009 published an Informative Report[30]on the structural reforms in higher education and science needed to increase Latvian international competitiveness (Ministry of Economics, 2009). The proposed reforms have three aims: (1) to produce internationally competitive graduates, (2) to supply education that corresponds to the needs of the economy, and (3) to ensure that internationally competitive scientific results are successfully transmitted to the Latvian economy. According to the Report, one of the indicators of successful structural reforms is "proportion of foreign students exceeds 10% of student numbers" by 2015 (p15). This seems to be a very ambitious target in the light of international experience. In this context an Action Plan[31] was developed by the Ministry of Education and Science in the spring of 2010 to implement the above reforms. One of the four main action directions is "internationalization of higher education and increasing its export capacity", i.e. directly related to increasing the demand. It recognizes the importance of and need to attract foreign students as a way to improve the situation in the higher education sector. The Action Plan is less ambitious than the Report and aims for just a 3% share of foreign students (p15). Is even this target realistic? In 2009/2010 there were 1715

[30] Informatīvais ziņojums par nepieciešamajām strukturālajām reformām augstākajā izglītībā un zinātnē Latvijas starptautiskās konkurētspējas paaugstināšanai, Ministry of Economics, Riga, December 2009.
[31] Pasākumu plāns nepieciešamajām reformām augstākajā izglītībā un zinātnē 2010.-2012.gadam, Ministry of education and science of Latvia, available at http://www.mk.gov.lv/lv/mk/tap/?pid=40173173.

registered foreign students in Latvia (1.5% of the total number of students). Of those, 816 - or 48% - held Russian, Ukrainian, or Lithuanian passports. Clearly, the biggest proportion of those students is likely to be Latvian residents who have lived all their lives in Latvia and acquired a secondary education in Latvia. The term 'foreign student' is therefore somewhat inappropriate. Some 400 Erasmus students studied in Latvia in 2009/2010. These of course are genuine foreigners, but do not bring income to Latvian institutions. The real 'de facto' foreign student number is therefore much less than reported.

Even nominally (in contrast to real foreigners arriving to study), reaching the goal of 10% or even 3% foreign students may be tricky. In European Higher Education Area countries (Bologna countries) on average there are 3.5% foreign students, and 6.6% is the EU-27 average. Countries with the highest proportion and total number of foreign students are those with historically established university traditions (2006: UK – 18.3%, Austria – 15.6%, France – 14.6%, Belgium – 14.3%, Germany – 12.8%) and where education is in global languages (English, French, German). Other countries are lagging behind, and there is none except Sweden where the proportion of foreign students exceeds 10%.

It seems that the call for the necessity for English language programmes is finally being heard, as this is a tool to make studies in Latvia accessible to foreigners (see report and action plan mentioned above). Currently there is at least a discussion that provision of programmes and courses in English should be expanded. But is it enough? As noted earlier, shrinking generations is not a uniquely Latvian problem. Similar developments can be observed throughout Central and Eastern Europe. Other countries (like Estonia) are acting fast. For example, while in Latvian Bachelor programmes only basic English language course is taught, there are more than 100 fully English language instructed programmes in Estonia, in state and private institutions at all tertiary education levels. Estonians have also been active in promoting Estonian education in China. As a result, the proportion of foreign students in Estonia already exceeded 3% in 2008. It is entirely possible that Tartu will attain a critical mass of foreigners and become a regional education centre leaving no space for an alternative centre in Riga. For economics and business studies Latvia is, with few exceptions, already far behind.

Little attention has been paid to addressing the other demographic effect – the ageing population and the following old age-dependency problem. Here the demographics at least to some extent work in favour of higher education. An ageing population will most likely increase the demand for further higher education during an individual's work life, i.e. Life Long Learning, since there will be less young people entering the labour market bringing in the most recent knowledge etc. Furthermore, an ageing population will most likely put

pressure on the policy makers to increase the retirement age and thereby increasing the number of years an individual is active in the labour market, which in turn should further increase the demand for higher education among the non-traditional groups. In the analysis of the different scenarios above, it was assumed that the enrolment rate for the group "29 plus" would converge to the EU 27 average after 2013. However, this is something that could definitely be influenced through policy making. An active Life Long Learning policy with the aim, not to 'rescue' higher education, but with the aim to strengthen the competitiveness of the Latvian economy in the light of its rapidly changing demographics, would certainly increase the enrolment rate among the non-traditional (29 plus) cohorts. One immediate consequence would be that the student body would not be dominated by young kids fresh out of school. They will be mature people, probably more confident and demanding, looking for more practical and applicable knowledge. Needless to say, this will require rethinking the curricula as well as of the way studies are organized. If successful, the concept of Life Long Learning will acquire real meaning and substance. A key issue is whether the state funded institutions have the flexibility to accommodate this new 'market' or whether the lion's share of it will be captured by the private institutions with their more flexible organisations and governance structures.

Most likely, tertiary education will continue to rely on local demand for education. Even if the export of higher education is stimulated via accessible programmes (especially the language of instruction), legislation changes and marketing, keeping the present enrolment level is unlikely to be feasible. To illustrate, in order to compensate for shrinking local demand (for example as given by the Stable Enrolment Scenario), by 2020 Latvia would have to attract some 20 thousand foreign students. This means that the number of foreigners in universities would have to rise by a factor of 12 as compared with 2009.

Nearly all developed countries are experiencing the ageing of their populations and shrinking youth cohorts (although at a less dramatic rate than in Latvia); therefore the competition for students internationally is becoming more severe. The real issue therefore is not about competition between universities in Latvia, but about the competitiveness of Latvian higher education internationally in order to keep talented Latvian students in Latvia (to prevent a brain drain) and to attracted talented foreign students.

Informed education policy decisions will be required in order to cope with the foreseen oversupply of higher education. There will, for example, be a need to restructure higher education by closing down certain universities, merging programmes, and concentrating resources to attain better quality. There is no (fast) medicine for treating the effects stemming from the rapidly diminishing cohorts. However, there are ways to prevent the higher

education system from total collapse following the rapid fall in the demand for its services. A natural way would be to consider the higher education sector being a service sector like any other and hence try to identify new markets and services (programmes) to be provided by the educational sector. In this case the ageing population provides an opportunity since it most likely will put more of a policy focus on Life Long Learning. However, Life Long Learning as such is not the remedy – it has to be accompanied by insightful and forward looking policy making accompanied by a willingness from the side of the higher education institutions to adopt to the new demographic environment and hence to the demands of the 'non-traditional' students whose share of the student body will increase in the future.

CONCLUSIONS

➔ **Hypothesis 1 "Education is a source of heterogeneity in the society. Population groups are significantly different if stratified by the level of education" is verified:**

1. The education level and demographic processes are closely linked – level of education is one of the most important factors determining population demographic behaviour, especially for females. The effects are observed at individual level, and robust at macroeconomic level.
2. Theory and empirical evidence suggests that high education level has a positive effect on health, life expectancy, income, employment and productivity, whereas mixed evidences are observed with regard to fertility, timing and quality of family formation and geographic migration patterns. Education level is more important determinant than any socio-demographic characteristic.
3. Individual's probability of being enrolled in higher education, study results and educational attainment is positively correlated with level of parents' education and accessibility of financial resources to be spent for education.
4. Gender is a very important determinant of individual's educational attainment, but the effect depends on the society – in developing countries females typically have lower chances to acquire education than males, while in developed countries females are more active in acquiring education than males and statistically females are on average better educated. The education attainment is also determined by race, ethnic qualities, employment status – the direction of influence being mixed depending on circumstances.

➔ **Hypothesis 2 "The current statistics about higher education enrolment, progression, attainment and outcomes in Latvia is insufficient for comprehensive and in-depth analysis and should be developed" is verified:**

5. Statistical information available in Latvia is insufficient for research, analysis and monitoring of higher education in demographic context. Indicators such as all progression and dropouts, education attainment, student socio-demographic composition and characteristics, and labour market outcomes cannot be analysed in

full details because this information cannot be estimated from existing statistics, which is very fragmented.

6. Presently research and in-depth analysis of education system can only be based on fragmented data sources. These data samples suffer from various selection biases and results can only be generalized under certain assumptions. No complete and representative database for student population exists In Latvia. The University of Latvia Informative System (LUIS) is the best available data register for analysis of higher education lifecycle and progression. Latvian graduate survey of 2006 is presently the only database containing information about student socio-economic background.
7. Large share of the necessary information could be gathered without considerable extra effort and costs. For this reason it is necessary to (re-)establish overall Latvian student register that contains individual level information on demographic factors, socio-economic situation, study record, and early career information. Irish Higher Education Authority maintained database is a good peer example for this kind of database setup. In longer term future this database has to be linked with pupils' register and with population register of the Republic of Latvia, following the example of Sweden.

➔ **Hypothesis 3 "Population education structure and attainment in Latvia has significantly changed over previous two decades" is verified:**

8. Higher education in the world is undergoing major changes. In the previous three decades higher education has experienced expansion, increased student mobility and increase of female participation. The student body has changed and has become older and more diverse. Technologies have changed the teaching methods and the way students learn and perform research. Funding of studies has shifted from public towards private sources. Demographic processes and economic crisis will challenge the higher education development in the future.
9. The overall education attainment in Latvia has been rising. Younger population is better educated that older, and females are better educated than males. Currently 21 percent of Latvian working age population are possessing tertiary education degree or qualification. Primary education was the most often held education level in 1970ies; but one generation later, in 2000, secondary education was the most prevalent. Projections suggest that in 2030 proportion of people with primary or no education

will be negligible, but 98 percent of 15+ population will have secondary or higher education diploma. Females will be on average better educated than males.

10. The growth of tertiary student numbers (ISCED5) that speeded up since 1993/1994 academic year stopped in 2009/2010 with a 10 percent fall against previous year. The doctoral programme enrolment (ISCED6) has been steadily growing since 1999. In higher education programmes there is stable ratio of 3 female students per 2 male students. Number of graduates from higher education institutions has been stable at around 25 thousand student a year, 70 percent of which were females.

➔ **Hypothesis 4 "The study paths in higher education are highly influenced by student gender, family background and parental socio-economic status" is verified:**

11. Access to higher education continues to be more open to children of highly educated parents. Tertiary education students in Latvia come from higher social background (measured both by parents education and parents occupation) than average in Latvia, therefore the higher education system is rather selective and the level of social mobility measured by achieved education level is low.
12. Mothers of students in Latvia are on average higher educated than fathers of students.
13. There is close correlation between parents' and individual's education level: the higher the parents' education level, the more probable that children will study in tertiary education and the higher their education assessment.
14. Gender is the strongest and the most robust determinant of study field choice in Latvia decision. The male specific study directions are sciences, mathematics, IT and engineering, the female-specific directions are humanities and education. Both genders with equal intensity choose social sciences and agriculture.
15. The level of parent education rather than particular kind of education matters – statistically significant connection between the field of parental employment and children education or their first employment sector was not observed.
16. The different education patterns for genders start in secondary education level with selection of general or professional secondary education and different study results in different subjects – girls are more probable to attend general secondary education and perform better in reading subjects, boys relatively more often choose professional secondary education and perform better in mathematics. These differences determine further education choice in higher education level.

➔ **Hypothesis 5 "Study paths, dropouts and attainment in higher education differ between males and females" is verified for University of Latvia students:**

17. In University of Latvia the highest probability of acquiring first level higher education (bachelor degree or equivalent professional qualification) is on 4th and 5th year after entering university, but the highest probability of acquiring second level higher education (master degree or equivalent) – on 6th year of studies.
18. Once entered in the first year of undergraduate studies, females spend more time in education. In early years of study cycle, female participation in education highly exceeds that of males, but diminishes with time and in the later years is similar to that of males. It is characteristic that after 6th year males spend more time in undergraduate programmes. Males also spend more time in graduate studies in 4th and 5th year of studies, indicating that males are faster to start up graduate studies, but in later study semesters females spend more time in graduate studies.
19. Transition between undergraduate and graduate programmes for males happen earlier than for females, but transition from outside education to graduate programmes is more common to females. Therefore females more often tend to take a year off between undergraduate and graduate studies, whereas males more often transit directly from first level to second level tertiary studies. Some of the phenomena can be explained by in-homogeneity within programmes and existence of gender specific programmes.
20. At the enrolment in tertiary education, the expected schooling time for females is 3.89 in undergraduate studies and 0.77 years in graduate studies. Males are expected to study 3.70 in undergraduate programmes and 0.73 years in graduate programmes. The female schooling expectancy time exceeds that of males, results is robust over time.
21. The probability of completing any level of education, once started, differs between genders. 67% of females, but only 50% of males, who enter the University, complete undergraduate education. For graduate level the gender gap is smaller, still existent – 21 vs. 18 percent respectively. The same proportion of males and females acquire undergraduate education within 4 years, which may be considered the minimum time required to complete the first level education. The difference between genders appears in the further years of studies, and it can be argued that females are more eager to complete the education they have started, even if it takes more time (several academic leaves, for example). For 19-year-old females and males probability to complete

within 5, 6 and 7 years differ significantly (53 vs. 42, 61 vs. 46, and 64 vs.48 percent respectively).

22. Dropout probability increases with every study year – for both genders and for any level higher education. Especially the risk of stopping education without acquisition of degree or qualification increases after the nominal length of programmes. The dropout probability in undergraduate studies is higher for males with widening differences between genders, but in graduate studies female dropout probability exceeds that of males, but rates are similar.

➔ **Hypothesis 6 "Demographic development in Latvia will have negative impact on tertiary enrolment in the future years" is verified and associated policy implications are assessed:**

23. Higher education in Latvia in the years to come will be facing big challenges due to rapid demographic changes in the age structure of population, intensified by the economic situation.
24. The author has developed a set of three possible higher education enrolment scenarios, based on projected population size and structure, previous enrolment development and varying assumptions about the future trends. Under any development scenario (Stable enrolment scenario, Global education trend scenario and Crisis scenario) the total enrolment in following years will fall. Enrolment will in the foreseeable future never be as high as it was in the early 2000s. By 2020 the number of students in higher education will decrease by 18-38 percent under the alternative scenarios. This implies that the current number of higher education institutions cannot be sustained.
25. The age structure of the student population will change. The number of traditional age students (17-24) will decrease to somewhere between 44% and 50%. Consequently the traditional age students would be a minority in the student population. In contrast, the proportion of adult students will rise from 24% in 2010 to somewhere between 33% and 44% in 2020 (by a factor of three or four compared to 11% in 1998).
26. In order to compensate for shrinking local demand (for example as given by the Stable Enrolment Scenario), by 2020 Latvia would have to attract some 20 thousand foreign students. The number of foreigners in universities would have to rise by a factor of 12 as compared with 2009. Even if the export of higher education is stimulated via accessible programmes, legislation changes and marketing, keeping the present

enrolment level is unlikely to be feasible. Nearly all developed countries are experiencing the ageing of their populations and shrinking youth cohorts; the competition for students internationally is becoming more severe. The author concludes that in the nearest future tertiary education will continue to rely on local demand for education, but a credible country level strategy for attraction of foreign students has to be accepted and implemented. This strategy should be a complex set of actions that address language, immigration, and programme quality aspects.

27. Informed policy actions will be required to cope with the foreseen oversupply of higher education. There will be a need to restructure higher education by closing down certain universities, merging programmes, and concentrating resources to attain better quality.
28. There is no (fast) medicine for treating the effects stemming from the rapidly diminishing cohorts. However, active social and demographic policies may stimulate elderly participation in higher education and reverse negative demographic development effects on education in middle-term future.
29. Ageing population provides an opportunity since it most likely will put more of a policy focus on continued education over lifetime. However, Life Long Learning as such is not the remedy – it has to be accompanied by insightful and forward looking social policy-making accompanied by a willingness from the side of the higher education institutions to adopt to the new demographic environment and hence to the demands of the 'non-traditional' students whose share of the student body will increase in the future.

RECOMMENDATIONS

Based on the research results, the author **recommends**:

➔ **To policy makers in education (esp. Ministry of Education and Science)**

1. Use evidence-based policy making approach in higher education, using longitudinal data about student progression through education system and their study careers. Adopt the developed multistate model tool for analysis of higher education in Latvia.
2. To adjust the education policy at national level to diminishing youth cohorts and expected lowering enrolment in higher education institutions. The tree main directions of reforms should be:
    a. to reduce the number of higher education institutions via merging related institutions and study programmes on the basis of quality assessment,
    b. to create and/or adjust study programmes and curricula to older students needs and interests – more flexible study schedule, form of studies and topics
    c. to stimulate demand and interest in Latvian higher education programmes by foreign students, i.e. increase export of higher education by: improving quality of study programmes, eliminating language barriers (establish usage of English language in higher education in Latvia), relaxing immigration procedures for study purposes.
3. To foster equal access by students from all socio-economic groups to higher education. The current system of budget financing allocation, based entirely on performance, does not take into account the selection process already happening in the lower levels of education.

➔ **To Central Statistical Bureau**

4. To establish a national student register that comprises all institutions of higher education in Latvia. The database should contain demographic, study, social background and employment career information. The author suggests re-establishing a Latvian student database analogous to the LAIS database and based on the principles of the Irish model. The holder of the database should be the Ministry of Education and Science (or alternatively the responsibilities could be delegated to a different institution, one body). The collection of data, use and responsibilities should be governed by separate legislation documents. The access to actual complete database

should be strictly governed, limited to supervising persons, while non-personalized individual data should be available for use by government officers and analysts, universities, statisticians and researchers. Secondary summary statistics should be prepared by responsible authorities on regular basis and publicly available, or prepared as per request. It should be available for use of education lifecycle analysis.

5. As a general approach, in any statistical data gathering system, incl. surveys and censuses, use disaggregated higher education categories – college, academic bachelor, professional bachelor, academic master, professional master and doctoral level education or degree.

➔ **To higher education institutions**

6. To study and eliminate reasons for excessively high dropout rates among higher education students, especially among males. The institution analysts are invited to use the life course approach by following student paths through the courses and programmes hence establishing the weakest stages in studies.
7. To adjust the institutional strategies to forthcoming fall in enrolment. In line with the recommended strategy that should be perceived by the Ministry of Education and Science (and other policymakers in related fields), the institution leaders should:
    a. Restructure physical infrastructure of institutions to lower number of students,
    b. Establish strengths and comparative advantages of the institution and concentrate recourses and attention on these fields,
    c. Change and/or establish programmes for older students, that particularly take into account their working experience, limited time availability and often wide but inconsistent previous study experience and knowledge,
    d. Attract foreign students to study programmes offered by the institution by: providing appropriate study environment; distance education; establishing full study programmes in English and potentially other EU languages as well as courses taught in English; master theses and doctoral dissertations should be written in English language (with exception of, probably, certain programmes in humanities) as a way to stimulate international review potential and hence bringing up quality and comparability internationally.

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APPENDICES

Appendix A1 International Standard Classification of Education (ISCED 1997) levels

Table A1.1. International Standard Classification of Education (ISCED 1997) levels

ISCED	Description
Level 0	Pre-primary education
Level 1	Primary education or first stage of basic education
Level 2	Lower secondary or second stage of basic education
Level 3	(Upper) secondary education
Level 4	Post-secondary non-tertiary education
Level 5	First stage of tertiary education (not leading directly to an advanced research qualification) ISCED 5A: Programmes at the tertiary level equivalent to university programmes. ISCED 5B: Programmes at the tertiary level that focus on practical, technical or occupational skills for direct entry into the labor market.
Level 6	Second stage of tertiary education (leading to an advanced research qualification), equivalent to PhD programmes

Note: UNESCO Institute of Statistics (UIS) has developed and proposed the second version of the ISCED classification – ISCED 2011. The new classification foresees 8 education classification levels – current ISCED 5-6 levels being expanded to more detailed tertiary levels classification. This process represents the growing importance and emphasis on tertiary education.

Appendix A2 Enrolment statistics, Latvia

Table A2.1. Tertiary (ISCED 5-6) enrolment and graduates by genders, Latvia, 2002-2009

		2002	2003	2004	2005	2006	2007	2008	2009	2010
Graduates										
Total		18945	20762	23877	26119	26414	26745	24177	26007	26541
incl.	Females	13208	14347	16541	18426	18645	19237	17306	18565	18933
	Males	5737	6415	7336	7693	7769	7508	6871	7442	7608
	females as % of total	*70*	*69*	*69*	*71*	*71*	*72*	*72*	*71*	*71*
Enrolment										
Total		118845	126759	130693	131072	129503	127050	125350	112555	103856
incl.	Females		78772	82539	82855	82770	81566	79857	70629	63428
	Males		47987	48154	48217	46733	45484	45493	41926	40428
	females as % of total		*62*	*63*	*63*	*64*	*64*	*64*	*63*	*61*

Source: Ministry of Education and Science

Table A2.2. Number of students in tertiary education by levels and genders, Latvia, (beginning of academic year (1999-2010)

	1999/2000	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
First stage of tertiary (ISCED 5)												
Total	90 234	101 529	109 199	117 625	126 231	129 278	129 316	127 700	125 778	123 335	110 415	101438
Males	32 905	38 701	41 982	44 991	47 588	47 534	47 398	46 025	44 679	44 746	41 064	39420
Females	57 329	62 828	67 217	72 634	78 643	81 744	81 918	81 675	81 099	78 589	69 351	62018
Second stage of tertiary / doctoral (ISCED 6)												
Total	1 003	1 254	1 301	1 319	1 425	1 428	1 809	1 797	1 982	2 025	2 152	2418
Males	482	558	527	550	595	597	717	701	796	809	872	1008
Females	521	696	774	769	830	831	1 092	1 096	1 186	1 216	1 280	1410

Source: CSB Latvia

Table A2.3. Number and share of enrolled first year undergraduate students who hold tertiary education degree, Latvia

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Total with higher education	1003	1615	1571	1888	1733	2441	1631	1035	1367
Share of tertiary degree holders in first year enrolment	3%	5%	6%	6%	5%	7%	5%	4%	6%

Source: IZM 2010. gada pārskats,

Table A2.4. Share of enrolled first year undergraduate students who acquired secondary education in earlier years (before the year of entry to university), Latvia

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Share of first year enrolment	52%	54%	54%	49%	49%	48%	47%	38%	45%

Source: IZM 2008. Gada pārskats, 35. lpp, 2010. gada pārskats

Appendix A3 Graduate survey multinomial regression statistics and results

The interpretation for an independent variable focuses on its ability to distinguish between pairs of groups and the contribution, which it makes to changing the odds of being in one dependent variable group rather than the reference group.

The reference group is graduates from social sciences (the biggest group). The coefficients (B) are interpreted as the relative risk (or rather loosely, the odds) of being in the group tested for as compared to the risk of being in the reference group. Accordingly, the numerical values of the coefficient of explanatory variables are somewhat tricky to explain, and the precise value is sensitive to the particular model specification. Sometimes, results are presented in terms of probabilities. Though, more often researchers are interested in the fact that a relationship holds and take the 'yes' and 'no' and '+' or '-' as sufficient result. A positive regression coefficient means that the explanatory variable increases the probability of the outcome, while a negative regression coefficient means that the variable decreases the probability of that outcome; a large regression coefficient means that the risk factor strongly influences the probability of that outcome; while a near-zero regression coefficient means that that risk factor has little influence on the probability of that outcome. The author takes the same approach.

Provided the availability of information, the field of study is regressed against the following explanatory variables (with overall relationship tests):

Table A3.1 Likelihood Ratio Tests

Likelihood Ratio Tests

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	6137,071	117,216	7	,000
gender	6323,228	303,373	7	,000
age	6252,091	232,236	7	,000
ethnicity_latv	6034,020	14,165	7	,048
famstat_partner	6030,453	10,598	7	,157
partner_HE	6033,521	13,666	7	,057
mother_HE	6029,006	9,151	7	,242
father_HE	6043,741	23,886	7	,001
origin_Riga	6067,473	47,618	7	,000
origin_abroad	6030,753	10,898	7	,143
mother_field1	6029,655	9,800	7	,200
mother_field4	6021,490	1,634	7	,977
mother_field6	6036,293	16,438	7	,021
mother_field7	6032,780	12,924	7	,074
mother_field9	6031,066	11,211	7	,130
mother_field12	6033,846	13,991	7	,051
mother_field13	6027,009	7,154	7	,413
mother_field14	6028,821	8,966	7	,255
mother_field15	6029,899	10,044	7	,186

father_field1	6032,334	12,478	7	,086
father_field4	6023,745	3,890	7	,792
father_field5	6021,634	1,779	7	,971
father_field6	6032,735	12,879	7	,075
father_field7	6024,234	4,378	7	,735
father_field9	6023,409	3,553	7	,830
father_field12	6025,825	5,969	7	,543
father_field13	6027,333	7,477	7	,381
father_field14	6031,292	11,436	7	,121
father_field15	6029,620	9,765	7	,202

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

Note: field 1-16 reflects NACE classification letter level groups.

The overall explanatory power of the model is satisfactory:

Table A3.2 Model Fitting Information

Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	7230,502			
Final	6019,855	1210,646	287	,000

The presence of a relationship between the dependent variable and combination of independent variables is based on the statistical significance of the final model chi-square. In this analysis, the probability of the model chi-square was 0.000, less than or equal to the level of significance of 0.05. The null hypothesis that there was no difference between the model without independent variables and the model with independent variables was rejected. The existence of a relationship between the independent variables and the dependent variable was supported.

While multinomial logistic regression does compute correlation measures to estimate the strength of the relationship (pseudo R square measures, such as Nagelkerke's R^2), these correlations measures do not really tell us much about the accuracy or errors associated with the model. A more useful measure to assess the utility of a multinomial logistic regression model is classification accuracy, which compares predicted group membership based on the logistic model to the actual, known group membership, which is the value for the dependent variable. The benchmark typically used to characterize a multinomial logistic regression model as useful is a 25% improvement over the rate of accuracy achievable by chance alone. The estimate of by chance accuracy is the computed by summing the squared percentage of cases in each group ($0.18^2 + 0.07^2 + 0.49^2 + .. = 0.2946$). The proportional by chance

accuracy criteria is 36.8% (1.25 x 29.5% = 36.8%), which is smaller than the classification accuracy rate 52.6%. The criteria for classification accuracy is satisfied in this model.

Table A3.3 Classification

Classification

Observed	Predicted Percent Correct
Education and pedagogy	40,1%
Humanities and arts	,6%
Social sciences, business and law	87,9%
Sciences and IT	9,6%
Engineering, production and construction	16,0%
Agriculture	5,4%
Health and social care	,0%
Services	,0%
Overall Percentage	52,6%

The author concludes therefore that the model has sufficient overall explanatory power and the results are valid and can be interpreted.

Table A3.4 Parameter Estimates

	Education and pedagogy			Humanities and arts			Sciences and IT			Engineering, production and construction		
	B		SE	B		SE	B		SE	B		SE
Intercept	-2,658	*	,384	-,650		,537	1,799	*	,741	-,596		,535
gender	-1,142	*	,208	-,554	*	,219	1,010	*	,183	2,148	*	,179
age	,077	*	,007	-,024		,014	-,126	*	,025	-,041	*	,014
ethnicity_latv	-,115		,165	-,023		,214	-,508	*	,200	-,367	*	,195
famstat_partner	,176		,156	-,443		,235	-,184		,249	-,106		,232
partner_HE	-,413	*	,162	,145		,244	-,103		,264	,021		,233
mother_HE	-,288		,183	,220		,212	,336		,221	,215		,200
father_HE	-,565	*	,192	,263		,208	,322		,216	-,517	*	,205
origin_Riga	-,756	*	,137	-,040		,186	-,335		,189	-,099		,172
mother_field1	-,281		,311	-,835		,459	-,181		,451	,046		,393
mother_field4	-,151		,343	-,532		,480	,039		,454	-,144		,427
mother_field6	-1,502	*	,540	-1,172		,623	-1,147		,606	-,505		,481
mother_field7	-,767	*	,314	-1,018	*	,420	-,514		,411	-,726		,388
mother_field9	-,771		,404	-,766		,542	-,532		,514	-1,075	*	,533
mother_field12	-,717		,390	-,992		,454	-1,054	*	,487	-,708		,437
mother_field13	,177		,301	-,229		,365	-,824	*	,406	-,562		,369
mother_field14	-,151		,323	-,524		,405	-,638		,443	-1,000	*	,422
mother_field15	-,653		,345	-,506		,423	-,520		,450	-,449		,405
father_field1	,477	*	,169	,141		,389	,089		,417	-,330		,372
father_field4	,038		,315	,080		,410	,502		,395	,054		,379
father_field5	-,042		,353	-,220		,440	-,089		,431	-,147		,387
father_field6	,665	*	,286	,269		,378	,207		,395	,291		,344
father_field7	,615		,381	,107		,497	,079		,496	-,330		,505
father_field9	,285		,283	,208		,359	,180		,374	,228		,335
father_field12	,334		,367	,399		,428	,368		,446	-,507		,504
father_field13	-,220		,393	,088		,425	,537		,434	,077		,435
father_field14	,142		,538	,456		,533	-15,907		1499,246	,309		,643
father_field15	,762	*	,353	,564		,440	,629		,464	,632		,421

(continued)

	Agriculture			Health and social care			Services		
	B		SE	B		SE	B		SE
Intercept	-2,658		1,771	-4,002	*	,644	-4,153	*	,787
gender	,927	*	,358	-,071		,262	1,428	*	,249
age	-,096	*	,039	,040	*	,012	,042	*	,014
ethnicity_latv	,935		,656	,328		,292	,044		,329
famstat_partner	-,785		,581	,398		,275	-,107		,310
partner_HE	1,135	*	,572	-,220		,261	-,280		,323
mother_HE	,165		,438	-,349		,296	-,010		,313
father_HE	,139		,429	,122		,283	-,311		,317
origin_Riga	-1,348	*	,436	,249		,236	-,412		,253
mother_field1	,771		1,123	-,597		,532	1,091		,642
mother_field4	-,327		1,475	,110		,550	-,113		,832
mother_field6	-,173		1,511	-1,120		,843	,733		,846
mother_field7	,043		1,174	-,243		,485	,126		,674
mother_field9	-,203		1,479	-1,503		,844	,301		,790
mother_field12	-,422		1,240	-1,218		,727	,358		,708
mother_field13	-,400		1,159	-,199		,500	,405		,660
mother_field14	-1,934		1,547	-,094		,500	,223		,687
mother_field15	-,441		1,281	-,858		,592	,865		,657
father_field1	1,890		1,100	,407		,444	-,732		,478
father_field4	1,361		1,212	-,275		,534	-,338		,541
father_field5	-,062		1,464	-,632		,634	-,450		,587
father_field6	1,348		1,181	,215		,486	-1,223		,636
father_field7	-14,221		2029,429	-,226		,698	-,283		,710
father_field9	,535		1,267	,568		,433	-,272		,485
father_field12	1,558		1,230	-,052		,636	,444		,523
father_field13	1,641		1,232	-,636		,703	-1,164		,822
father_field14	2,364		1,561	,821	*	,631	,647		,698
father_field15	1,668		1,287	,793		,545	-,078		,603

Note: the following explanatory variables were not included due to underrepresentation in the database (below 2%) creating numerical problems: mother_field2; mother_field3;; mother_field5; mother_field8; mother_field10; mother_field11; mother_field16; father_field2; father_field3; father_field8; father_field10; father_field11; father_field16.

Reference group: Social sciences

Table A3.5 Correlation coefficients between graduate's first employment sector and parents employment sector

		Graduate's sector of work	Mother sector of work	Father sector of work
Graduate's sector of work	Pearson Correlation	1	,064(**)	,057(**)
	Sig. (2-tailed)		,000	,001
	N	4188	3902	3491
Mother sector of work	Pearson Correlation	,064(**)	1	,333(**)
	Sig. (2-tailed)	,000		,000
	N	3902	4226	3640
Father sector of work	Pearson Correlation	,057(**)	,333(**)	1
	Sig. (2-tailed)	,001	,000	
	N	3491	3640	3773

** Correlation is significant at the 0.01 level (2-tailed).

Appendix A4 Summary of multistate life table statistics and formulas

(i) Number of survivors or survivorship probability (state occupancies) ($l_i(x)$)

As in conventional life tables, the number of survivors is the number of people surviving at the beginning of age interval x to x+n, or at exact age x. In the beginning the radix or the synthetic cohort for the first age interval is specified. This number is arbitrary, but typically a round number like 100 000, 10 000 or 1000 is used. Sometimes the value 1 is used for the radix, in which case *l(x)* is the survivorship proportion or survival probability. Once starting value of *l(x)* is set, number of survivors in every next year is calculated as (Mamun, 2002):

$$l(x+n)=\Pi(x, x+n)*l(x). \quad (4.1)$$

The survivorship vector *l(x+n)* denotes the number of persons surviving in a state at age x+n.

(ii) Number of person years lived ($L_i(x,n)$)

The time spent in each state between two exact ages by a cohort member is estimated from a life table number of survivors. Again, making use of the uniform distribution assumption, the average sojourn time in years spent in *ith* state between ages *x* and *x+n* can be approximated by the following expression:

$$L_i(x,x+n)=\frac{1}{2}\left[l_i(x)+l_i(x+n)\right]. \quad (4.2)$$

To close the life table, we need to assume that the population was stationary above some high age, ω. This enables to set up the following equation (Schoen, 1988):

$$L(\omega,\infty)=l(\omega)\left[M(\omega)\right]^{-1} \quad (4.3)$$

and solve for the unknown.

(iii) Number of movers ($d_{ij}(x,n)$)

The flows or number of individuals moving from state *i* to state *j* between ages *x* and *x+n* is equal to:

$$d_{ij}(x,n)=M_{ij}(x,n)L_i(x). \quad (4.4)$$

(iv) Total number of years lived ($T_i(x)$)

The total number of years lived in state *i* beyond age *x* of the total cohort is:

$$T_i(x) = \sum_{i=x}^{\omega} L_i(t) \qquad (4.5)$$

where ω is the highest age or age group.

(v) Life expectancy ($e_i(x)$)

Expectation of life in each state *i* is among the most important results of the life table calculations. The life expectancy in state *i* at each age x is:

$$e_i(x) = \frac{T_i(x)}{l_i(x)} \ , \qquad (4.6)$$

where denominator is the number of survivors at exact age *x*. The total life expectancy is $\sum_i e_i(x)$ and the proportion of remaining lifetimes spend in state *i* is $\frac{e_i(x)}{\sum_i e_i(x)}$.

Each one of the life table (multistate life table in this case) elements is characteristic and indicative by themselves as they represent different information. They are therefore plotted separately in graphs and analysed.

Table A3.1. Summary of principal symbols used in multistate life table model

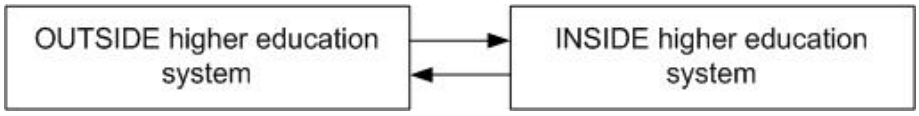
Symbol	Interpretation	Defined by equation
$\pi_{ij}(x,n)$	Probability that a person in state *i* at exact age *x* will be in state *j* at exact age *x*+*n* (transition probability between *i* and *j*)	4.7
$\Pi(x,n)$	Transition probability matrix	4.8
$\mu_{ij}(x,n)$	Transition intensity from state *i* to state *j* at age *x*	4.9
$S(x)$	Individual's position in state space at age x	
$M(x,n)$	Observed occurrence rate matrix	4.10
$M_{ij}(x,n)$	Elements of $M(x)$, observed occurrence rate from *i* to *j* in the age interval x to *x*+*n*	4.11
$D_{ij}(x,n)$	Number of transitions from *i* to *j* in age interval x to *x*+*n*	-
$P_i(x,n)$	Observed (mid-period) population in state *i* between ages *x* and *x*+*n*	-
$l_i(x)$	Number of survivors, of survivorship probability in state *i* at exact age *x*	4.12
$L_i(x)$	Number of person years lived in state *i* in period *x* to *x*+*n*	4.13
$d_{ij}(x,n)$	Flow or number of individuals moving from state i to state j between ages *x* and *x*+*n*	4.14
$T_i(x)$	Total number of years lived in state *i* beyond age x of the initial cohort	4.15
$e_i(x)$	Life expectancy in state *i* at age *x*	4.16

Note: The symbols are in accordance with Schoen (1988) and generally accepted notations in multistate modelling
Source: Author's own table

Appendix A5 Multistate models for education in Latvia

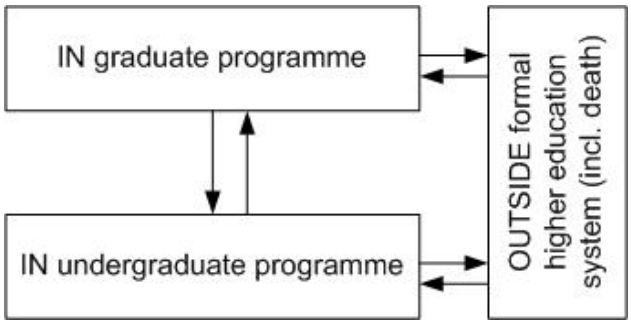
Figure A5.1 Multistate models for higher education in Latvia

A. 2-state non-hierarchical enrolment model for all Latvian higher education system. Status defined by enrolment status in an education institution, transition – by change in registry entry. No death state distinguished, but merged with "outside education" state. No levels within education system distinguished. Increments and decrements possible in both states.



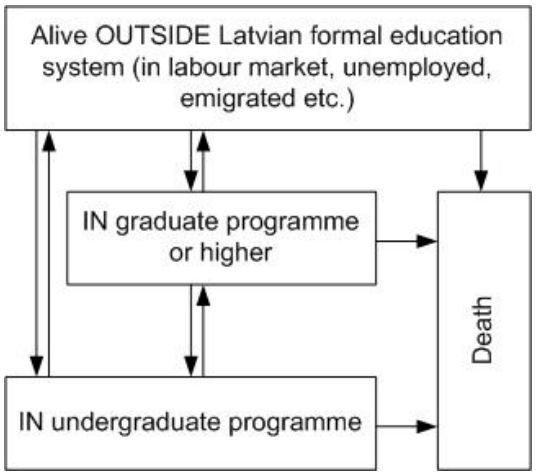
Source: author's own figure.

B. 3-state non-hierarchical enrolment model for Latvian higher education. Status defined by enrolment status in higher education institution, transition – by change in registry entry. No death state distinguished, but merged with "outside education" state. Two levels within higher education distinguished. Two-directional transitions between states possible.



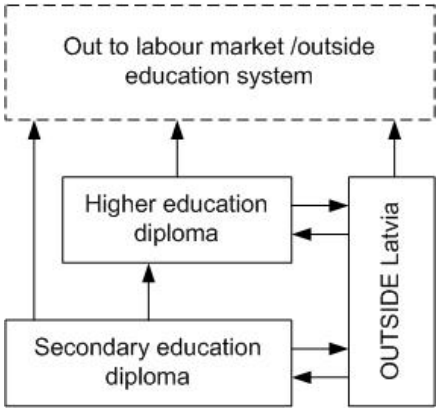
Source: author's own figure.

C. 4-state non-hierarchical enrolment model for Latvian higher education. Status defined by enrolment status in higher education institution, transition – by change in registry entry. Two levels within higher education distinguished. Two-directional transitions between states possible except for absorbing state.



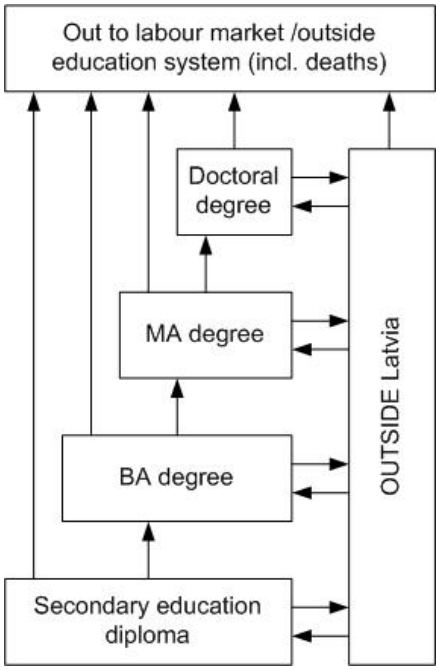
Source: author's own figure.

D. 4-states hierarchical attainment model for Latvian higher education system. Levels within higher education not distinguished. States defined by highest level of education attained, events – acquisition of qualification, i.e., graduation. Source: author's own figure.



Source: author's own figure.

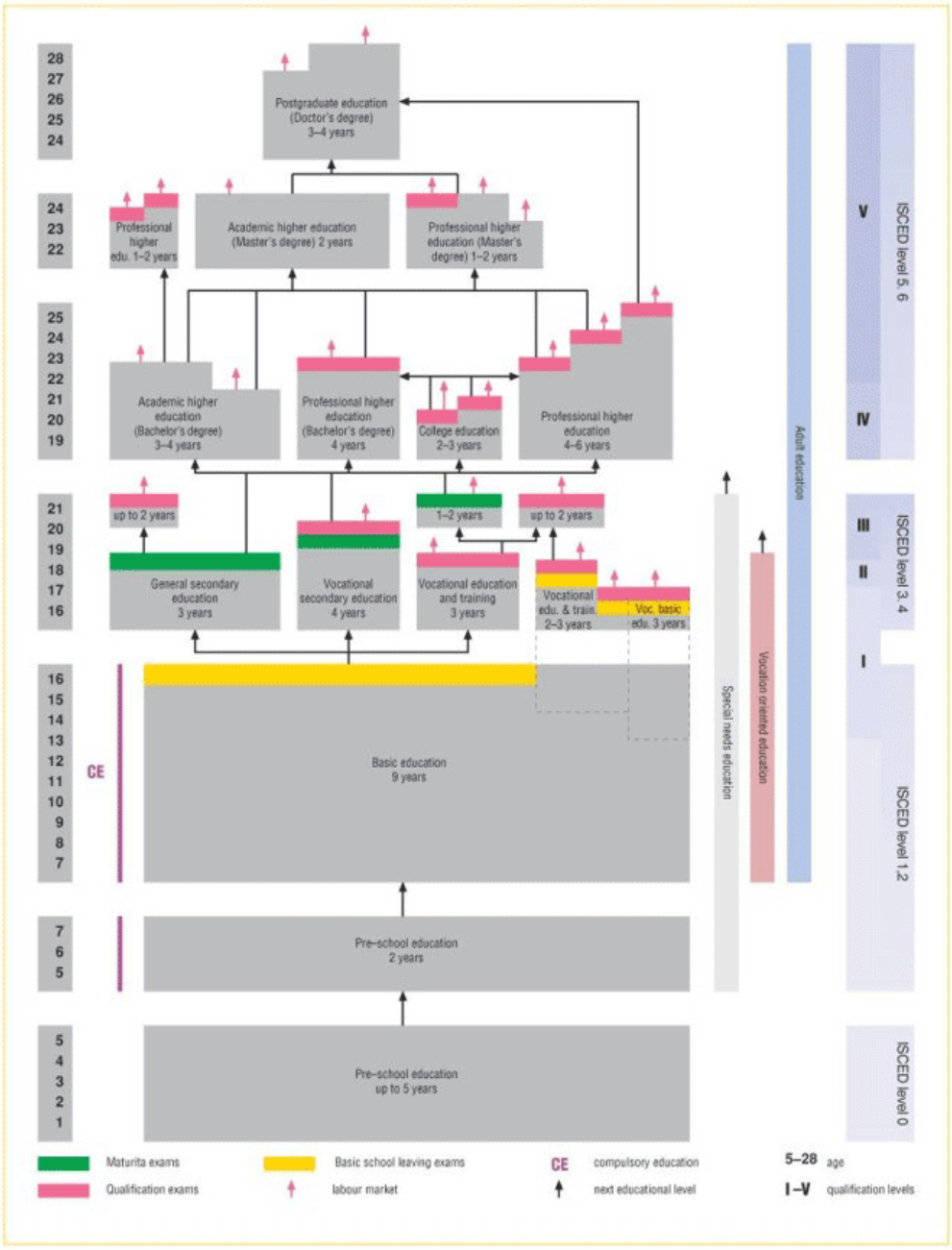
E. 6-states hierarchical attainment model for Latvian higher education system. Levels within higher education distinguished. States defined by highest level of education attained, events – acquisition of qualification, i.e., graduation.



Source: author's own figure.

Figure A5.2 Model of education system in Latvia

(F.) Actual, detailed hierarchical attainment model for all Latvian education system. Levels within higher education distinguished. States defined by highest level of education attained, events – acquisition of qualification, i.e., graduation.



Source: Academic Information centre, Latvia