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Family and Education

Intergenerational educational transmission within families and the influence of education on partner choice and fertility. Analysis and microsimulation projection for Austria

Familie und Ausbildung

Intergenerationelle Bildungstransmission in Familien und der Einfluss der Bildung auf Partnerwahl und Fertilität. Analysen und Mikrosimulationsprojektionen für Österreich

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Vorwort

Die Aufgabe eines gut funktionierenden Bildungssystems ist in wenigen Worten umrissen: SchülerInnen müssen bestmöglich gefördert und ihnen eine Ausbildung in höchster Qualität vermittelt werden – unabhängig vom sozialen Hintergrund und Umfeld. Die vorliegende Studie zeichnet aber für Österreich ein anderes Bild: das österreichische Bildungssystem führt zur sozialen Selektion.

Aber ist das Schulsystem überhaupt in der Lage, die unterschiedlichen Lebensbedingungen der Kinder zu nivellieren und damit dem Ziel der Chancengleichheit im Bildungssystem zu entsprechen?

KritikerInnen wenden ein, dass es nicht Sinn und Zweck sein kann, alle zur Matura und auch zum Hochschulabschluss zu führen. Dieser Denkweise muss jedoch entgegen gehalten werden, dass der Ansatzpunkt die gerechte Verteilung der Chancen ist. In diesem Zusammenhang ist es für Österreich erschreckend, dass Kinder von Eltern mit niedrigerem Bildungsabschluss auch signifikant seltener eine höhere Schulausbildung absolvieren als Kinder von Eltern mit höherem Bildungsabschluss. Ein Grund dafür ist sicherlich die Tatsache, dass Eltern mit höherem Bildungsabschluss ihre Kinder besser unterstützen können, sei es durch Üben mit dem eigenen Kind oder durch die Finanzierung von Nachhilfe, die sich natürlich Eltern mit höherer Bildung und damit höherem Einkommen auch eher leisten können. Faktoren wie die elterliche Vorbildung und das elterliche Einkommen dürfen kein Grund dafür sein, dass gleich intelligente und begabte Kinder, allerdings mit unterschiedlichem sozialen Hintergrund, ungleiche Chancen bekommen. Das wäre neben den persönlichen Implikationen für die einzelnen Betroffenen nicht zuletzt auch ein Schaden für das Humanvermögen des Landes und ein Wettbewerbsnachteil für den Standort Österreich.

Für die Kinder, die auf Grund ihres familiären Hintergrundes im Bildungssystem benachteiligt sind, braucht es kompensatorische Maßnahmen und Ansätze, die die konstatierten sozialen Unterschiede egalisieren.

Ein Problem ist die zu frühe Entscheidung über den zukünftigen Bildungsweg im Alter von 10 Jahren. Hier werden in Österreich die Weichen für nachträglich fast unumkehrbare Wege viel früher als in anderen europäischen Ländern gestellt. In diesem Alter ist aber ein Kind aufgrund des Entwicklungsstandes noch nicht in der Lage, eigenständig oder im Zusammenwirken mit den Eltern zwischen Hauptschule und Unterstufe des Gymnasium zu entscheiden und die damit verbundenen Konsequenzen abzuschätzen. Ist es richtig, wenn es allein an der Volksschullehrerin liegt, welchen weiteren Bildungsweg das Kind beschreiten wird? Oft haben hochintelligente Kinder nicht einmal die Chance auf einen Hauptschulbesuch, sondern werden in Sonderschulen untergebracht, weil deren Verhalten nicht dem „normalen“ Anforderungskatalog des Bildungssystems entspricht. Das Problem sind dabei nicht fehlender Eifer und mangelnde Begabung, sondern die Tatsache, dass sich niemand um die Schulsachen des Kindes kümmert und niemand die Hausaufgaben kontrolliert. Dazu kommen dann oft noch mehrere Schulwechsel sowie zahlreiche weitere Probleme, die ein prekäres soziales Milieu mit sich bringt.

Ein bekanntes aber viel zu selten thematisiertes Problem sind auch die Qualitätsunterschiede zwischen den unterschiedlichen Schulformen der 10- bis 14-Jährigen in Stadt und Land. Dies kann als ein Argument dafür gesehen werden, dass im Alter von 10 bis 14 Jahren ein gemeinsamer Lehrplan bzw. eine einheitliche Schulbildung nicht nur möglich, sondern auch sinnvoll wäre. Eine Entscheidung über die Bildungskarriere mit 14 Jahren statt mit 10 wäre auch entwicklungspsychologisch gerechtfertigt, weil mit 14 eine Entscheidung über den zukünftigen Bildungsweg dem Kind nicht mehr ohne weiteres von Eltern oktroyiert werden kann.

Wenn Kinder bzw. Jugendliche von Anfang an mehr zu selbstständigem Lernen hingeführt würden, hätten sie in diesem Alter auch die Chance, bei mangelhafter elterlicher Unterstützung selbstständig den weiteren Bildungsweg zu bestimmen.

Solange es nach wie vor nur Eltern- und keine Kindersprechtage gibt, solange nur über schwierige SchülerInnen, nicht aber über schwierige LehrerInnen diskutiert wird und solange Partizipation von Kindern im Schulalltag nur ein Lippenbekenntnis bleibt, werden sich die Chancen der Kinder auf ein sozial gerechtes Bildungssystem nicht verbessern.

Die sozialen Ungerechtigkeiten bleiben bis zur Hochschule/Universität bestehen. Wenn Kinder von Eltern mit niedrigerem Bildungsabschluss die Matura schaffen und eine Hochschulausbildung beginnen, stehen sie im Vergleich zu StudentInnen aus besser gestellten Familien vor dem Problem, dass sie neben den Mitteln für die alltägliche Lebensführung auch noch das Geld für Studiengebühren aufbringen müssen. Hier wäre ein offener und gebührenfreier Zugang zur Hochschulbildung einzufordern.

Interessant ist auch eine Gegenüberstellung Österreichs mit anderen europäischen Ländern. Vergleicht man – wie in der PISA-Studie – das Abschneiden österreichischer SchülerInnen mit finnischen SchülerInnen, so muss man sich zurecht die Frage stellen, warum im finnischen Bildungssystem Höchstleistungen ohne soziale Benachteiligung erzielt werden können und in Österreich nicht? Vielleicht liegt es daran, dass sich das finnische Bildungssystem seit den späten sechziger Jahren in einem kontinuierlichen Entwicklungsprozess befindet. Beispielsweise besteht seit den frühen siebziger Jahren eine neunjährige Gesamtschule, es wurde eine umfassende Curriculumreform durchgeführt sowie eine universitäre Ausbildung für alle LehrerInnen eingeführt.

Der internationale Vergleich zeigt, wie wichtig es ist, das österreichische Schul- und Bildungssystem immer wieder kritisch zu hinterfragen, damit Fehlentwicklungen zeitgerecht korrigiert werden können. Denn die Grundlagen für Humanvermögen, Zukunftsfähigkeit und Innovationsbereitschaft eines Landes und damit für seine positive sozioökonomische Entwicklung werden in den Schulen geschaffen. Damit das in optimaler Weise und für alle Menschen unabhängig von ihrem sozialen Umfeld geschehen kann, muss das Schulsystem immer wieder den Erfordernissen angepasst werden.

Mit dieser Studie will das ÖIF problematische Entwicklungen und Schwächen im österreichischen Bildungswesen aufzeigen und damit einen fundierten Diskussionsbeitrag für die sozial egalitäre Weiterentwicklung der Ausbildung junger Menschen in unserem Lande liefern.

Dr. Brigitte Cizek
(ÖIF-Geschäftsführerin)

Abstract

In this volume on “Family and Education” we will study the intergenerational educational transmission within families and the influence of education on partner choice and fertility. The study can be divided into an analytical part and a synthesis of the resulting behavioral models to a comprehensive computer microsimulation model, which allows to project the educational composition of the population into the future. The analytical part focuses (1) on individual school choices in dependence on parents’ educational attainment, sex and rural urban setting, (2) partnership formation by education, i.e. the educational composition of couples and related changes over time, and (3) fertility differentials between educational groups.

The models are based on the retrospective event history data collected in the special program of the 1996 micro census, which was also used to generate the starting population for projections. The analysis of school choices reveals a very strong influence of the educational attainment of parents leading to strong intergenerational transmission mechanisms within families, i.e. considerable intergenerational persistence of educational careers within families. In contrast to the ongoing educational expansion at the population level, very stable behavioral relationships can be found on the micro-level when accounting for the parental educational attainment. Regarding the educational composition of couples, we again find a situation, in which most changes have already leveled off and led to almost time-invariant distributions. Computer micro-simulation reveals that today’s patterns are likely to remain unchanged also in future. The second related behavior that affects the future educational composition of the population are fertility differentials between educational groups. We use computer micro-simulation in order to find “proper” parity distributions by educational group that produce observed birth numbers by education in a retrospective simulation. Using the resulting parameterization we will finally apply the microsimulation model to project the educational composition of the population into the future. As all parameters are assumed time-invariant, the educational composition converges towards a stable equilibrium. In order to determine the effect of fertility differentials on this equilibrium, we “run” a second scenario of uniform fertility behaviors and use the resulting equilibriums for a comparative analysis.

Zusammenfassung

Die vorliegende Studie geht einerseits der Frage nach, inwieweit Bildungsentscheidungen von der elterlichen Bildungsschicht, dem Geschlecht und dem Wohnort abhängen und versucht andererseits, die Bildungszusammensetzung der österreichischen Bevölkerung zu prognostizieren. Die Studie beruht auf Mikrozensusdaten des Jahres 1996, welche insbesondere individuelle Schulkarrieren enthalten. Basierend auf diesen Daten werden die Einflussgrößen auf persönliche Bildungsentscheidungen statistisch analysiert und in einem weiteren Schritt Modelle gebildet, welche in das FAMSIM+ Familienmikrosimulationsmodell integriert wurden. Zur Prognose der zukünftigen Bildungszusammensetzung der österreichischen Bevölkerung müssen zwei weitere Sachverhalte berücksichtigt werden: die unterschiedliche Fertilität von Frauen aus verschiedenen Bildungsschichten sowie die bildungsmäßige Zusammensetzung von Partnerschaften. Letzteres ist wichtig, da in den Modellen der höhere Bildungsabschluss beider Eltern als wichtigster Einflussfaktor auf die Bildungskarriere der Kinder identifiziert wurde.

Hat die Schule eine kompensatorische Wirkung bezüglich unterschiedlicher Sozialchancen von Jugendlichen je nach Elternhaus oder wirkt sie stabilisierend auf soziale Ungleichheit? Die Ergebnisse der Studie weisen deutlich in die zweite Richtung, nämlich auf eine starke soziale Selektion welche durch das Schulsystem bei jedem Verzweigungspunkt des Systems verstärkt wird. Deutliche Veränderungen über die Zeit gab es bezüglich der Geschlechterunterschiede – hier haben Mädchen deutlich aufgeholt – und einer gewissen Abnahme der Stadt-Land-Unterschiede welche aber nach wie vor hoch sind. Während insgesamt mit jeder Geburtskohorte mehr Jugendliche hohe Bildungsabschlüsse erreichen, haben sich die Raten auf individueller Ebene – unter Berücksichtigung der elterlichen Ausbildung, Gemeindegröße und Geschlecht – seit den 1970er Jahren nur noch wenig geändert, sondern sind vielmehr Ergebnis der höheren Bildungszusammensetzung der Elterngeneration. Bezüglich der Bildungszusammensetzung von Partnerschaften wurde in den letzten Jahren eine "Symmetrie" dahingehend erreicht, dass der gleiche Anteil von Frauen einen Partner höherer und niedrigerer Ausbildung hat. Insgesamt kann von einer hohen Bildungs-Homogamie gesprochen werden. Bezüglich Fertilität wurden durch Computer-Mikrosimulation in retrospektiven Projektionen nach Bildung differenzierte Kohortenfertilitäten ermittelt, welche die tatsächlich in den letzten Jahren beobachteten Geburtenzahlen nach Bildungsschicht reproduzieren. Die Simulationsergebnisse lassen darauf schließen, dass insbesondere die Matura einen deutlichen Einfluss auf die Kinderzahl hat, wobei die Unter-

schiede innerhalb der Gruppe der Frauen mit (resp. ohne) Matura abnehmen. Den Abschluss der Studie bildet eine Prognose der Bildungszusammensetzung der Bevölkerung nach Geburtskohorten, aus welcher hervorgeht, dass sich das Tempo der Bildungsexpansion bereits deutlich abgeschwächt hat und unter Zugrundelegung der heutigen intergenerationellen Mobilität nur noch mäßige Anstiege in den Anteilen höherer Bildungsabschlüsse ergeben.

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Introduction: Main research questions, outline and purpose of the study

How does the educational background of parents influence the school careers of their offspring? How big are urban-rural differentials regarding school choices? Does gender still matter? In order to provide some quantitative answers to these questions, the first part of our study will focus on graduation rates in the Austrian school system

In this study we follow a micro approach. In general social sciences tend to move from macro- to micro-explanations and interpret changes on the macro level as results of actions and interactions of individuals. In our study the micro view allows us to distinguish changes of graduation rates that occur on the micro level — e.g. diminishing rural-urban differentials — and changes on the macro level that result from a changing population composition by different socioeconomic groups rather than behavioral changes of individuals of a given group. This micro view allows us to study individual behavior in the individual family context, e.g. by using the parents' educational attainment as covariate when analyzing school choices. As will be shown in our study, there is a considerable intergenerational persistence of educational careers within families.

We will focus on processes rather than on structures. We are interested in the dynamics of the educational composition of the Austrian population over time and the processes generating these dynamics. The most important dynamic we can observe on the macro level is an overall educational expansion, as with every birth cohort more and more people reach higher levels of education. Does this educational expansion result from an overall increase of graduation rates regarding higher education in all socio-demographic groups or is it rather the result of changes of the educational composition of the parents' generation? While we observed considerable changes on the micro level regarding (diminishing) gender and rural-urban differentials as well as an increase of transition rates regarding higher education especially in lower socio-economic strata until the 1970s, transition rates by gender, municipality type and parents' education have stayed almost unchanged for the past two decades. What does this mean for the future? Assuming unchanged behavioral relations on the micro level, when will the population reach a stable equilibrium regarding its educational composition? How will the resulting educational composition of the population look like?

In order to be able to answer these questions, we have to consider additional processes that influence the future educational composition of the Austrian population, processes that again have a strong "family dimension": partnership formation and fertility. We will investigate the changing educational and age patterns of partnerships, that is, the composition of couples by educational attainment and related changes over time. This analysis is necessary, as we use the highest educational attainment of both parents as covariate of school choices of their offspring. We can expect higher overall transition rates into higher education if matching patterns are heterogenic or random (there would be a positive probability of less educated women to have a partner with higher education) compared to a situation of educational homogeneity of couples (where the educational attainment of parents always equals the educational attainment of mothers). As the "spouse market" (and possibly also preferences) changes over time, we will analyze matching patterns over time. Again, we find a situation in which most changes, e.g. the catching up of women regarding educational attainment, have already leveled off and led to almost time-invariant educational compositions of couples. We will use computer micro-simulation in order to check for future consistency, i.e. if this behavior can be maintained in future, or, put differently, if people find partners corresponding to today's educational and age patterns also in future.

The second related behavior that affects the future educational composition of the population are fertility differentials between educational groups. For the past, we can observe very typical demographic patterns that lead from very high fertility differentials between educational groups at the beginning of the last century to the emergence of the two-child-norm and the corresponding small fertility differentials, with fertility rates lying around replacement fertility in all groups. This process is reversed in the second half of the past century (at generally lower fertility levels but with increasing fertility differentials). In our study we will analyze changes of parity distributions ("quantum of births") and duration times ("timing of births") from the time of leaving school to the first birth. As today we can only observe period measures, we will use computer micro-simulation in order to find "proper" parity distributions by educational groups. The resulting measures produce observed birth numbers by education in a retrospective simulation projection under the assumption that there will be no more changes in the timing of births

The analysis of fertility and partner choice can be seen in the second part of this volume. In the third part, we will move from analysis to synthesis by "putting the pieces together" to a comprehensive microsimulation model. We finally apply the microsimulation model to project the educational composition of the population into the future. As all parameters are assumed time-invariant, the educational composition converges towards a stable equilibrium. In order to determine the effect of fertility differentials on this equilibrium, we will "run" a second scenario of uniform fertility behaviors and use the resulting equilibriums for comparative analysis.

Both the starting population and the behavioral modules are based on the Austrian micro census June 1996 which contains retrospective event history data regarding educational and fertility biographies. For the computational implementation of the model we used the FAMSIM+ computational platform currently under development at the Austrian Institute for Family Studies (Spielauer, 2002).

This study of “Family and Education” follows three main aims.

Firstly, we aim at providing a quantitative analysis of the influence of parents’ education on educational careers. While this influence is undisputable in sociological theory, our study focuses on quantitative aspects, rather than providing additional explanation. We focus on “how much” rather than “why”, believing that knowing the magnitude of an phenomena is not without importance. Or, as Andreas Schleicher, head of the OECD's Education Indicators and Analysis Division and “father” of the PISA study stated: “without data you are just another person with an opinion”. In this study we aim at providing data for the ongoing educational debate in Austria.

Secondly, we want to shed light on some aspects regarding the family dimension of education by investigating the influence of education on partner choice and fertility. In demography education is seen as most important single variable besides age regarding fertility behavior (Lutz, 1999) and as a key determinant of human capital and, thus, of income and job careers. Education attainment is an indicator of differences between individuals in many dimensions: it might be a measure of talent, income potential, social status and class as well as individual autonomy, i.e. independence of partners and, perhaps, also of general norms in society (Hoem et. al., 2001). This makes education also one of the key areas in family studies.

Thirdly, this study was undertaken in the context of the ongoing microsimulation modeling activities of the Austrian Institute for Family Studies. Both, the technical modeling platform FAMSIM+ and the behavioral models developed alongside this study are also seen as main building blocks for a wide range of future applications.

The organization of this volume is as follows:

Chapter 1 gives a brief overview of the characteristics and development tenden cies of the Austrian education system following a macro perspective. This chapter aims at putting the Austrian education system into an international context by highlighting key characteristics and differences to other systems. In

Chapter 2 we will move from the macro to a micro perspective by describing the key determinants of educational choices on the micro level. This chapter also aims at describing the research design of the study.

Chapters 3 to 6 regard the key educational choices, namely the first choice between *Hauptschule* (lower secondary school) and *Allgemeinbildende Höhere Schule* (AHS, lower secondary academic school), the (second) choice between the five upper secondary educational possibilities we distinguish and finally the third choice between university courses. At each transition point we find a considerable influence of the parents' educational attainment on school choices that seems to have remained almost time-invariant for the last two decades. Chapter 6 analyzes the resulting "social dynamics", that is, the probabilities of children of different parental and rural urban backgrounds to attain a higher (equal or lower) education than their parents.

Chapter 7 analyzes and models partner choices and matching patterns by education and age respectively. Diminishing gender differentials regarding educational attainment results in a changing "spouse market", with presently almost "symmetric" patterns, i.e. the same probability that the male partner has a lower or higher education as the female one.

Chapter 8 regards fertility differentials by education. Starting from an examination of changes over time in the number of births by education of the mother, we will try to develop realistic estimates of the current cohort fertility by calibrating the microsimulation model in order to produce the same number of births by education of the mother as observed since 1996, the starting period of the simulation.

Chapter 9 describes the microsimulation model resulting from the synthesis of the "behavioral modules". Finally, Chapter 10 uses this model in order to project and study the future educational composition of the Austrian population.

1 Characteristics and development tendencies of the Austrian Education System

The modeling of school choices and educational biographies as well as their impact on the whole life course has to take place in the context of the structure of an educational system. This chapter is intended to give the necessary background information regarding the Austrian educational system and its development over time.

The organization of the Austrian school system is structured according to age and maturity (vertical structure), as well as according to educational and vocational targets, which have resulted in a wide variety of school types (horizontal structure). Generally, the Austrian (primary) educational system is characterized by a minimal amount of private education. Austrian state schools provide education free of charge. Until the eighth grade, the focus is primarily on the imparting of general knowledge. As a rule, the decision as to the continuing path of education is made one year before the end of compulsory[1] school attendance. Concerning pedagogical aspects it is noteworthy that Austrian schools are internally structured in school classes and that the successful completion of a class is the prerequisite for continuing the educational career in the next grade[2]. Furthermore, most of the curriculum is taught by the way of subjects, that is, only a limited amount of school-time is devoted to the teaching of inter-disciplinary contexts.

Primary School: Compulsory schooling starts in September following the child's sixth birthday. Their ‘educational career’ begins with the attendance of primary school *(Volksschule)*, which takes four years and has the task of imparting a common elementary education to all children. Additionally to the *Volksschule,* there are special needs schools *(Sonderschulen)*, which prepare mentally or physically disadvantaged children who are not able to follow lessons in primary (and, subsequently, lower secondary schools) for integration into the world of work.

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[1] In 1962 the length of compulsory education was increased from eight years to today’s nine years.

[2] Pupils that have not successfully finished their school-year, have to repeat the grade.

Secondary Level I: After primary school, at the so-called secondary level I, there is a first differentiation into two types of schools: lower secondary school *(Hauptschule)* and the lower cycle of academic secondary school *(Allgemeinbildende Höhere Schule*, AHS). Up to the eighth grade, mainly general education is imparted. One year before completing general compulsory schooling, students have to decide on their further educational career. This final year of compulsory schooling (grade 9) may be completed at a pre-vocational school *(Polytechnische Schule*), in grade one of a secondary technical and vocational school or college, or in the fifth year of AHS[3]. In an international comparison, this very early differentiation into two school types at the age of ten can be found only in a few other countries (see Table 1 below) and — as will be shown below — highly predetermines the further educational career, even though this early decision can be reversed at the following branching point at the age of 14.

Table 1: Years of common education

4 years	Austria, Germany (partial), Switzerland (partially), Slovakia, Czech Republic, Hungary
5 years	Liechtenstein, Russia, Switzerland (partially)
6 years	Belgium, Germany (partially), Ireland, Luxembourg, Malta, Northern Ireland, Switzerland (partially), Cyprus (Greek part)
8 years	Bulgaria, Greece, Italy, Netherlands, Romania, San Marino, Switzerland (partially), Spain, Turkey
9 years	Denmark, Estonia, Finland, Latvia, Lithuania, Norway, Poland, Portugal, Sweden, Cyprus (Turkish part)
10 years	Iceland
11 years	England and Wales, Scotland

Secondary Level II: After compulsory schooling, at secondary level II, the Austrian education and training system basically offers four alternative education and training tracks:

- Apprenticeship training, that is, in-company training and part-time vocational schooling for apprentices;
- full-time school-based secondary technical and vocational schools *(Berufsbildende Mittlere Schule);*

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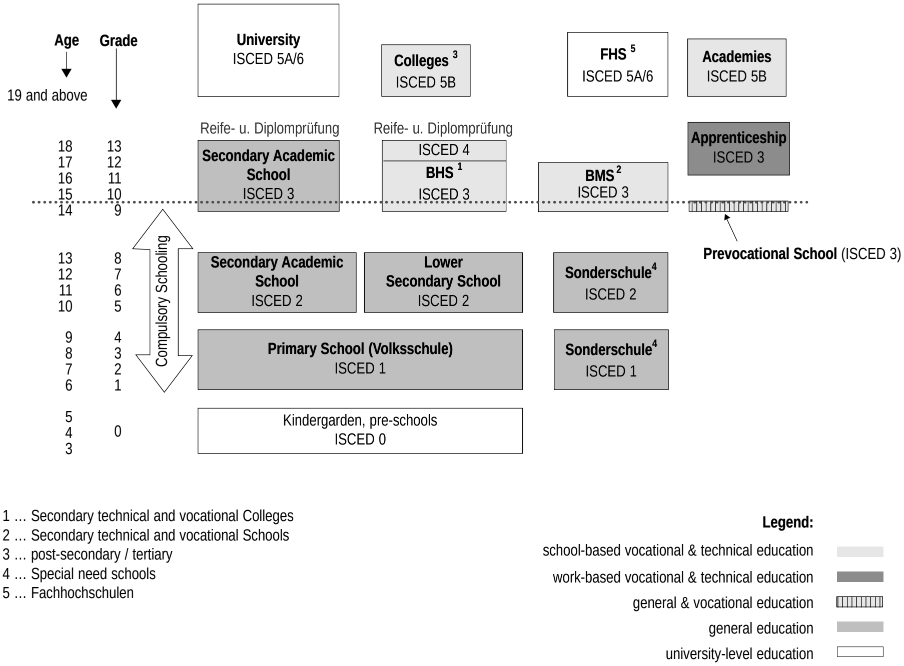
[3] Only pupils who had to repeat a class during their educational career can complete their compulsory schooling before grade 9.

- full-time school-based secondary technical and vocational colleges leading to a '*Matura*' diploma *(Berufsbildende Höhere Schule);* and
- the upper cycle of the academic secondary school (AHS) leading to a '*Matura*' diploma.

Post-secondary Level: The post-secondary level comprises university-based (including the universities of art and music) and non-university-based educational alternatives, which are reserved to persons having a *Matura* certificate (with the exception of the universities of art and music). As an alternative to university study programs, *Fachhochschule* courses (i.e. the Universities of Applied Sciences) were established at the beginning of the 1993/94 academic year. Access is not restricted to persons with one of the two above-mentioned *Matura* diplomas, but possible also for persons with a relevant subject-related professional qualification.

A simplified chart of the Austrian school system is given in the following figure.

Figure 1: The Austrian education system



Source: ibw

In an international comparison the Austrian dual system represents a special case, in particular as far as its importance for the national educational system is concerned. In the age group of the 16-year-olds (thus, at about the end of the compulsory schooling period) the share of young people taking up an apprenticeship training is roughly 40%. Regarding contents and structure, the apprenticeship training system is strongly oriented towards (individual) company interests and is to a large degree ‘market driven’. This means that manifold determinants (in particular cost-benefit considerations) have an influence on the demand for apprentices.

Adding up all vocational forms of training, currently nearly 80% of young Austrian people at secondary level II are in one of these post-compulsory vocational training forms. About 55% of these students are in full-time vocational schools, the remaining 45% are in the apprenticeship system. Therefore, Austria’s educational system can be seen as a qualification-oriented system, characterized by a wide range of specific vocational trainings. The combination of an apprenticeship system with a comprehensive scholastic vocational training system (at the level of upper secondary education) ensures the dissemination of relevant vocational skills and qualifications through the educational system. In an international perspective, systems with a high share of apprenticeship training at the upper secondary level tend to have comparatively lower youth unemployment rates than other educational systems (see Table 2). This suggests that, they ‘better’ manage the transition from school to working life. Such qualification-oriented systems generally tend to be rather highly differentiated and, with respect to curriculum contents, driven by economic ‘needs’[4].

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[4] In the public discussions, the linkage between VET and employment is mostly synonymous with reactive adaptation. In this connection the main problems are the precision and the speed of this adaptation . This is reflected in permanent debates on the topicality of training, ranging from worries about qualification deficits to a “misrouting" of educational demands.

Table 2: Curriculum composition at the upper secondary level and jobless-rates of young people in an international perspective

	General Education	Vocational Education	of these … scholastic	apprentice ship	Jobless-Rates* 15–19 Y	20–24 Y
Austria	22	78	43	35	2.4	3.4
Switzerland	34	66	8	58	m	2.8
Italy	35	65	65	-	4.9	11.8
Germany	35	65	16	49	1.4	5.7
France	44	56	45	11	1.9	8.4
Finland	48	52	42	11	2.1	6.1
Denmark	48	52	1	51	1.2	2.9
United Kingdom	51	49	49	-	5.5	5.0
Greece	67	33	33	-	3.9	14.0
Japan	73	27	27	-	m	m
Spain	78	22	19	3	6.6	9.9
Canada	89	11	11	-	2.7	6.3

Source: OECD: Education at a Glance, 2000 & 2002

**Year 2001; m … missing*

Austria has a relatively low university graduation rate of 7% measured on the basis of the working population, or around 12% of the youngest cohort of university leaving age. This can partly be explained by the different structure of Austrian universities, as until recently only long (Master) first-degree programs existed, and partly by the different structure of the Austrian qualification system, especially by the high importance of the *Berufsbildende Mittlere und Höhere Schulen* (secondary technical and vocational schools and colleges). As for the university sector, the expansion of enrollment rates was not accompanied by a diversification process with regard to institutions or length of study courses for a long period. Most recent developments in the tertiary education sector have marked profound changes. They mainly concern the introduction of the *Fachhochschule* and the establishment of shorter Baccalaureate programs in some fields of study.

Table 3: University Graduation Rates (2001)

	University Graduation Rate
United States	31
Norway[1]	28
Netherlands[1]	24
Canada	22
Australia	22
Japan	22
Spain	21
United Kingdom	20
Iceland	20
Korea	19
Sweden	18
Hungary	18
Switzerland	17
Ireland	17
Mexico	17
Finland	17
Greece	16
Germany	16
New Zealand	15
Belgium[1]	15
Poland	14
Luxembourg	14
France	13
Italy	13
Czech Republic	13
Turkey	12
Slovak Republic	12
Denmark	9
Austria[1]	8
Portugal	8

Source: OECD Education at a Glance 2002; [1]*…Reference Year 2000*

Austria belongs to the top league of countries with respect to spending on education (measured as a percentage of GDP, see Table 4). Currently, this high level of educational investment provokes some national debate, as PISA revealed rather modest results. Although Austria reached a fairly high ranking (e.g. in reading competencies rank 10), it is only slightly above the country-average in absolute terms. Nonetheless, compared with the 'winner' of Pisa Finland, Austria invests about 0.5 percentage-points more of its GDP on education.

Table 4: Expenditure on educational institutions as a percentage of GDP & PISA-Ranking

	Educational Expenditures (% of GDP)	PISA-Ranking*
Korea	6.8	6
Denmark	6.7	16
Sweden	6.7	9
Canada	6.6	2
Norway	6.6	13
United States	6.5	15
Austria	6.3	10
France	6.2	14
Switzerland	5.9	17
Australia	5.8	4
Finland	5.8	1
Portugal	5.7	25
Germany	5.6	21
Belgium	5.5	11
Spain	5.3	18
Poland	5.3	23
Mexico	5.2	27
United Kingdom	5.2	7
Hungary	5.2	22
Italy	4.8	20
Czech Republic	4.7	19
Netherlands	4.7	
Japan	4.7	8
Ireland	4.6	5
Slovak Republic	4.4	
Turkey	3.9	
Greece	3.9	24

Source: OECD Education at a Glance 2002;
** with respect to reading compentencies*

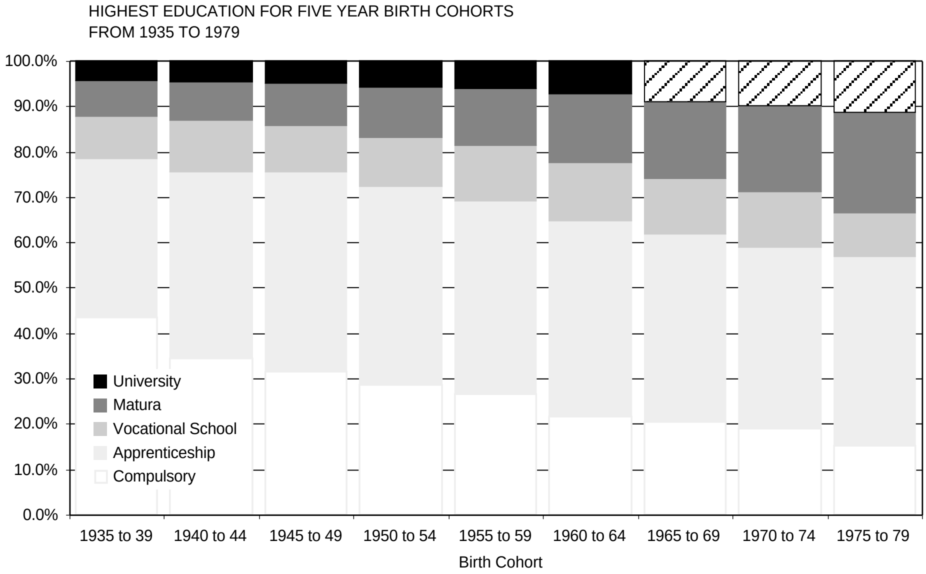
1.1 The macro view: Educational expansion

In the past decades, a trend to higher educational attainment can be observed, leading to a far-reaching higher qualification of the population. There has been a steady decline in the share of persons with compulsory schooling as their highest qualification. Currently, their share in the total population is at about one third. Of the population aged 20-24, currently only about 17% have not obtained any qualifications beyond compulsory schooling.

The educational expansion mainly took place within the unchanged structures of the Austrian educational system. It has been fostered, above all, by schools providing a higher level of education, in particular by the secondary technical and vocational colleges. At present, about one quarter of the young people opt for this school form after compulsory schooling.

The following figure shows the increasing educational attainment of succeeding birth cohorts.

Figure 2: Highest Education by birth cohorts.



Source: Micro Census June 1996 special program on education; own calculation; Since data for the 1965-1979 birth cohorts are censured regarding university education, as not all have finished university in 1996, rates for university graduates are estimations for the three most recent birth cohorts.

In this context, the basic structure of the Austrian educational system is an early differentiation at secondary level I and the predominance of apprenticeship training at secondary level II, meaning that the whole system is characterized by a high degree of hierarchy and social differentiation. This basic structure on the one hand, in combination with an expansive development that tends to stress the expansion of the universalistic right to education[5] on the other hand, is a reflection, among other aspects, of the decision-making processes and principles of the players in education policies.

With regard to the matching between qualification supply and demand, some authors express the view that educational demand develops in a relatively autonomous way vis-à-vis changes of the employee system, since educational decisions are also determined by social and cultural motives (e.g. securing the social status, etc.).

However, the educational system does not provide qualifications only. Due to the structure of the educational system, social opportunities are distributed and/or social inequalities are produced and legitimated by formal diplomas. Allocative aspects are the result of graduates being directed, in accordance with their qualification levels, to specific professional and other roles. At the same time, such formalized educational systems imply a linear hierarchy from kindergarten to university. This leads to a trend towards those diplomas that promise more privileges for the individual. Moreover, it becomes increasingly necessary to acquire diplomas at always higher levels to achieve professional (entry) positions at a particular level. Therefore, an increasing number of people in all social strata orient themselves towards higher qualification forms, which is clearly reflected in the structure of educational expansion. This also leads to strong competition to the detriment of young people with low formal qualifications.

The trend towards higher education and training is not only caused by an ‘intrinsically’ motivated educational demand. It is also the result of declining employment opportunities for young people (in particular a decreasing offer of apprenticeships, viz. vacancies for apprentices), which make them attend secondary schools or colleges (eventually until they find an apprenticeship training place). In general, it may be assumed that the connection between educational/professional choice and the labor market is of an interdependent nature. The selection of the school and career determines the labor market areas where the individual goes or intends to go. At the same time, however, it reflects to a great extent the individual's real opportunity structure in professional and social terms. Thus, for instance, the observable concentration on a few apprenticeship occupations as well as the gender-typical selection of particular apprenticeship trades are largely determined by the structure of vacancies for apprentices.

This leads to the topic of reproduction of social inequality in and through educational systems — or more generally, to the question of equality of chances and whether there have been changes because of the educational expansion.

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[5] Every citizen has the same and equal right to use education services provided by the state, viz. the concept of social citizenship.

Unfortunately there are only a few studies — notably this one — for Austria that touch this research topic. As one Austrian educational researcher (cit. Lassnigg 2000, translated by the author) mentioned: '*The question of realization of equal opportunity or reproduction of social inequality… is no research priority in Austria… The access to the educational system was broadened, urban rural and gender-specific differences have diminished to a certain degree… However, there is no reason to assume that in the current selective system the traditional (and universal) mechanisms of social reproduction should have been suspended. 'Persistent Inequality' is therefore, also for Austria, an expectation that would have to be disproved first.*'

As the following chapters of this study will show there are still pronounced facts and indicators that at the micro-level (i.e. the individual) school-choices in Austria have remained more or less unchanged with respect to social-background variables. Nonetheless during the last 50 years a pronounced educational expansion (macro-level) can be observed. These apparently contradicting results will be elaborated in detail.

2 Educational careers from a micro-view: key determinants of educational choices, data and model representation of the Austrian school system

2.1 Introduction

In the following analysis of school choices we will follow a micro approach. The main idea of this approach is that processes resulting from the actions and interactions of a large number of micro-units can best be studied by looking at the micro-units and their behavior. One expects to find more stable behavioral relationships on the micro-level than in aggregated data that is affected by structural changes when the number or size of the micro-units in the population changes, even if the behavior of the individual micro-units of a given type does not change. As will be shown in detail below, these expectations are fully met regarding school choices that can almost serve as showcase in this sense. While diminishing gender and rural urban differentials as well as increasing access to higher education, especially of lower socio-economic strata, can be observed for past decades, these developments almost leveled off in the 1970s. This results in almost unchanged individual transition rates regarding school choices in the last decades, given the rural/urban setting, gender and parents' educational attainment. Stable behavioral relations on the micro level, i.e. time invariant transition rates, do not immediately lead to a stable educational composition of the population. Assuming that "nothing will change" on the micro level, the process towards the resulting stable equilibrium on the population level will take decades. In this study we will project the transition path under this status quo assumption and investigate how the long-term equilibrium is influenced by fertility differentials between women of different educational groups.

In Austria, studies on the intergenerational transmission of educational attainment within families and the role of the educational system in this context have so far been quite rare. While the qualitative findings of our research are partly known already, the quantitative dimension of these phenomena have not been investigated in that way for Austria before (an exception is university education, see Landler, 1997) and might even come as a surprise. For Germany much more research has been carried out regarding this topic. For example, Blossfeld (1998, etc.) has carried out extensive research on intergenerational education transmission, educational participation and educational processes. In their comparative study of change in educational stratification in 13 industrialized countries, Shavit & Blossfeld (1993) show that inequalities in educational opportunities have been remarkably stable since the early twentieth century. Further research has been done for instance by Henz (1997), who finds that changes of school types, particularly transition rates after elementary school, are highly selective. Social selection is also high regarding delayed educational attainment. Thus, Henz does not see an improvement of equal opportunities in the German educational system in terms of independence of educational achievement of children from that of their parents. Klemm (2000) likewise emphasises that, despite the educational expansion in Germany, there are still considerable differences in educational chances regarding the regional and social background.

2.2 Data and Variables

The data source for this study is the special program of the Austrian micro census from June 1996, which contained a questionnaire on educational history, marriage, and biography of births. The main variables for our study regard the educational history. While the micro census contains all school spells, i.e. also those that did not lead to graduation of the according school, this information was recoded to graduation histories together with school durations, measured as the time from graduation of the previous school to the graduation of the current school. Therefore, school durations can contain school spells — or drop-out durations respectively — of other schools (see below).

As main covariates of individual school careers we identified and use the highest educational attainment of parents, the rural/urban setting and gender:

Parents’ Education: We use the highest education of both parents in the five categories (1) compulsory, (2) apprenticeship, (3) vocational and technical school, (4) *Matura* and (5) university. These educational categories were also used in our analysis of partnerships by education.

Municipality: the municipality type indicates if a person lived in a rural or urban area at the age of fifteen. This information is obtained by self-evaluation of the respondent and — in the aggregate — roughly corresponds to municipality types below and over 20.000 inhabitants.

Together with the sex of the respondent, we obtain 20 groups of students for which educational choices were analyzed over time, i.e. by birth cohort. Regarding individual school careers we distinguish seven types of the highest educational attainment: (1) compulsory, (2) apprenticeship, (3) vocational or technical schools, (4) vocational or technical college with *Matura*, (5) secondary academic school with *Matura*, (6) university and (7) university dropouts (see below). This typology was also used in the investigation of fertility differentials by education.

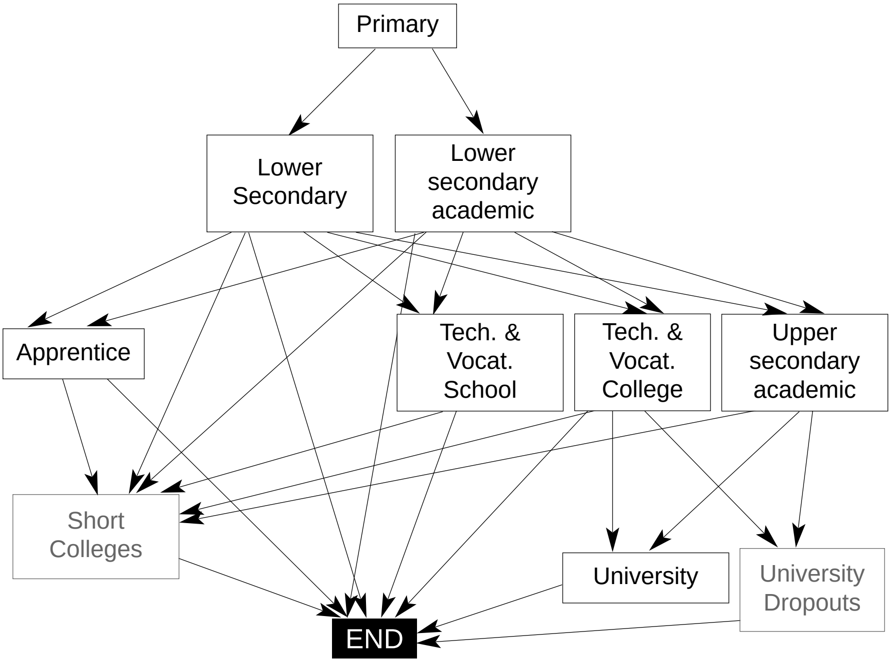
In contrast to the basic program of the micro census, the special program is voluntary. Since for various reasons individuals refuse to answer the questions, e.g. due to embarrassment or lack of interest, we have to consider a systematic error. Particularly in a survey on education, we can expect less interest in the program from individuals with a lower educational level. In our sample 26 639 out of 33 811 individuals answered the questions on education. In order to avoid a possible systematic error in the data, the smaller sample of the special program of the micro census was reweighed by the variables highest education, gender, province and age in order to meet the educational distribution as observed in the full survey (for a documentation see Schwarz & Spielauer 2003).

2.3 The model representation of the Austrian school system

For the purpose of this study, a simplified model representation of the Austrian school system is used. We will not distinguish between different school types within the broad typology used in the introductory part above, nor will we account for specialized school forms like special needs schools either. For example, all apprentices are seen as one school type without accounting for the wide range of different training programs.

The model distinguishes nine school types ranging from primary school to university. Due to data restrictions transition models are developed for transitions between schools that are successfully finished. This means school careers which include unfinished school spells followed by successful ones, are treated and coded as if the student would had stayed in the second school for the entire duration. Like the transition probabilities, the duration time within the different school types is modeled taking into account various individual characteristics. As these durations also include preceding unfinished school spells, there is no one-to-one correspondence to the “true” duration distribution within schools. For this reason simulated numbers will differ from observed enrollment rates in different school forms, as enrollment rates include school dropouts (and exclude students who will eventually switch to this school after dropping out from another school type), whereas graduation numbers and ages should correspond to “true” numbers. To avoid distortions regarding the school leaving age due to possible unfinished school spells at the end of the educational career, e.g. university dropouts that might have been enrolled at university for years, two additional school types are modeled. First, university dropouts are treated like attending a separate school type with duration times different from those of university graduates. Second, an additional school type “Short Colleges” is introduced, summing up all kinds of additionally existing programs as well as started but not finished school spells in all secondary schools considered. In contrast to all other schools considered, “Short Colleges” do not lead to a different educational status or category.

Figure 3: School types and transitions in the model representation of the Austrian school system



Individual school careers are modeled as a series of three school choices at the three main transition points: after primary school, after lower secondary school and after upper secondary school. All schools are assumed to start in September and finish in August with duration times in full years.

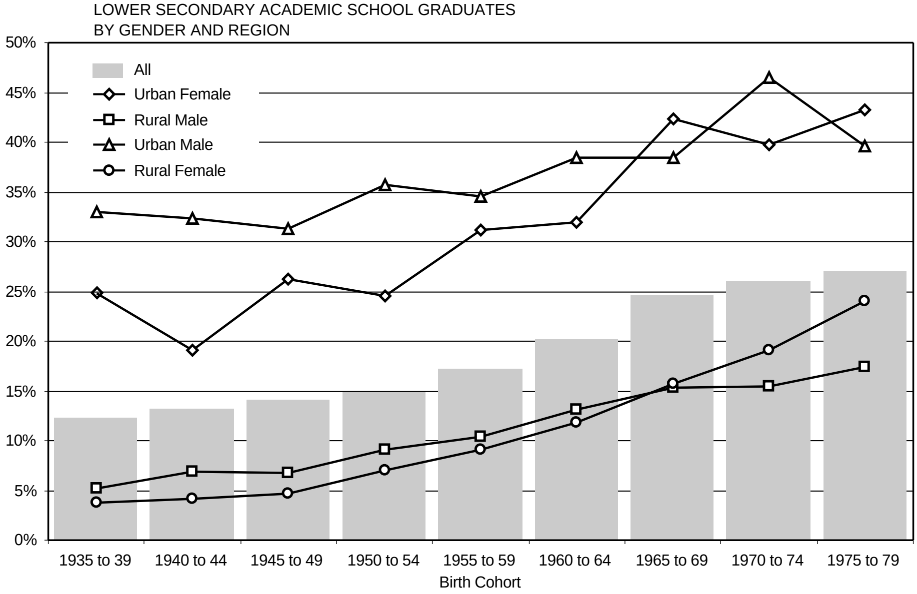
3 The first educational choice

The first educational choice has to be made after primary school, usually at the age of ten. It is basically a choice between two school types, the lower secondary school (Hauptschule) and the lower academic secondary school (AHS). Limiting the choice to the two school types considered is a simplification, as it ignores special schools for handicapped or maladjusted children (Sonderschule). This school type is treated as "lower secondary school" (Hauptschule) in the analysis. Additionally, the education system has slightly changed over the years i.e. for the oldest birth cohorts in the sample no prevocational school (Polytechnische Schule) existed and, furthermore, pupils had the possibility of extending primary school (Volksschule) up to the 8th grade. In this case, the second four years were treated as lower secondary school. As indicated in the model description above, the successful termination of the lower academic secondary school is accounted for, that is, all other students are treated as students of the lower secondary school, even if initially enrolled in the other school type.

3.1 Descriptive and regression analysis

Over the past decades a steady increase of the rate of children attending the lower secondary academic school can be observed. From birth cohort 1935-39 to the birth cohort 1975-79 the proportion increased from around 12% to 27%. As can be seen in the figure below, an increase can be observed for both sexes, with girls starting at a much lower level, especially in cities but completely catching up with the birth cohort 1965 and overtaking male rates in rural areas. Regarding rural urban differences, they are considerable with rates lying twice as high in cities (~40%) than in urban areas for the most recent birth cohort. This gap of 20 percent points has stayed almost constant over the last decades.

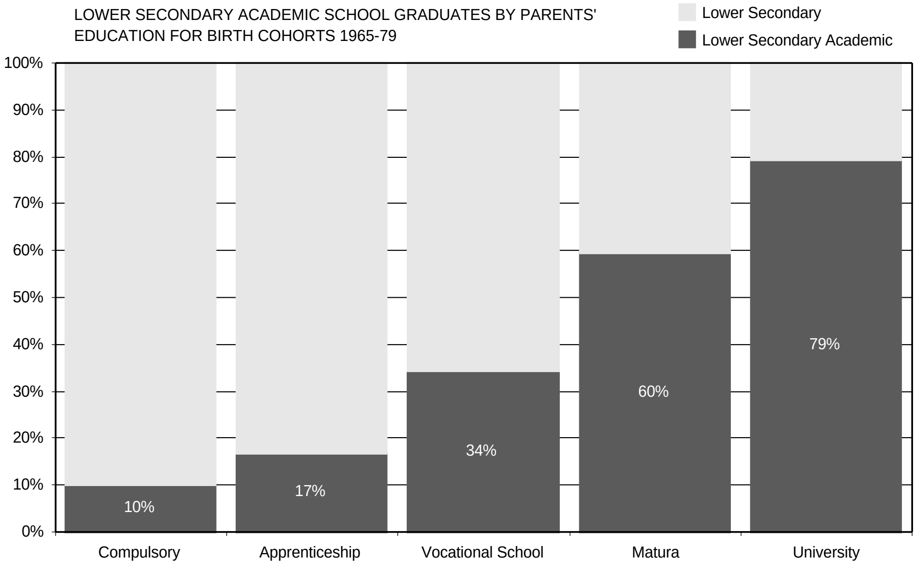
Figure 4: Lower secondary academic school graduates by gender and municipality type over five-year-birth cohorts from 1935 to 1979



Source: Micro Census June 1996 special program on education; own calculations

Besides rural urban differences, it is the parents' educational attainment, defined as the highest educational attainment of both parents, that shows the greatest influence on the school choice. While only 10% of the children of parents with compulsory education graduate from lower secondary academic schools, this rate reaches almost 80% for the offspring of university graduates.

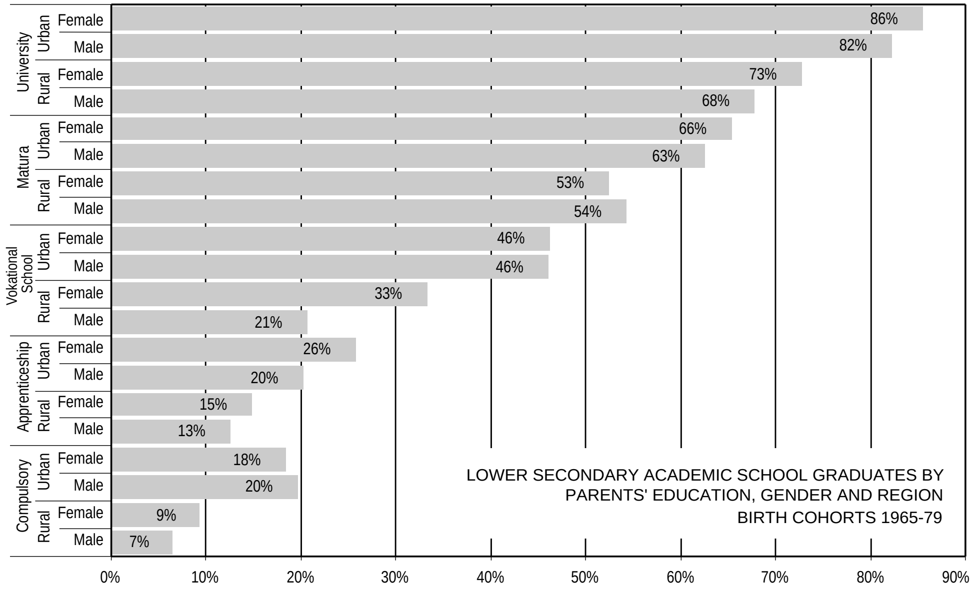
Figure 5: First school choice by parents' educational attainment for the birth cohort 1965-79.



Source: Micro Census June 1996 special program on education; own calculations

By further disaggregation of the rates by sex and municipality type, the rates can almost be ranked by parents' education, municipality type and sex with the highest rate (86% for urban daughters of university graduates) lying more than 12 times higher than the lowest rate (7% for rural sons of parents with compulsory education).

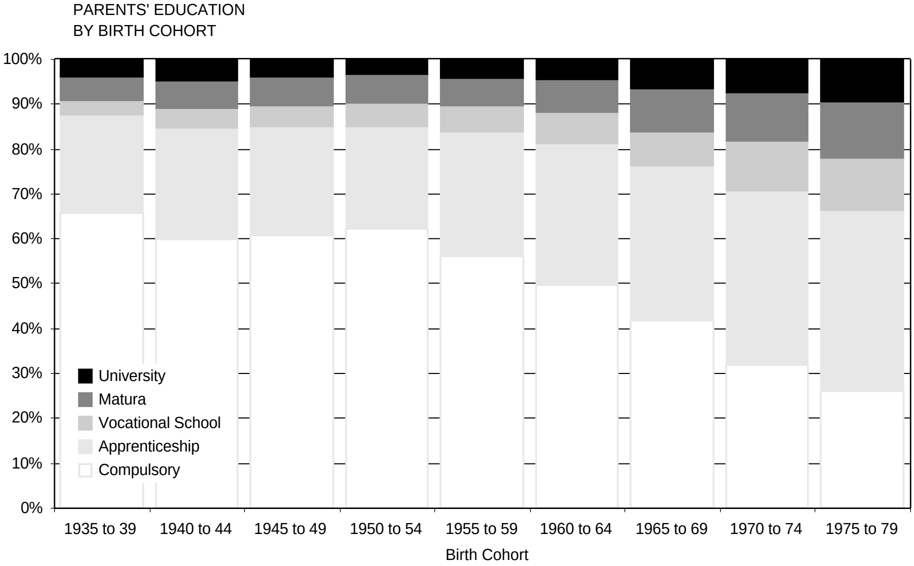
Figure 6: First school choice by parents' educational attainment, gender and municipality type for the birth cohort 1965-79

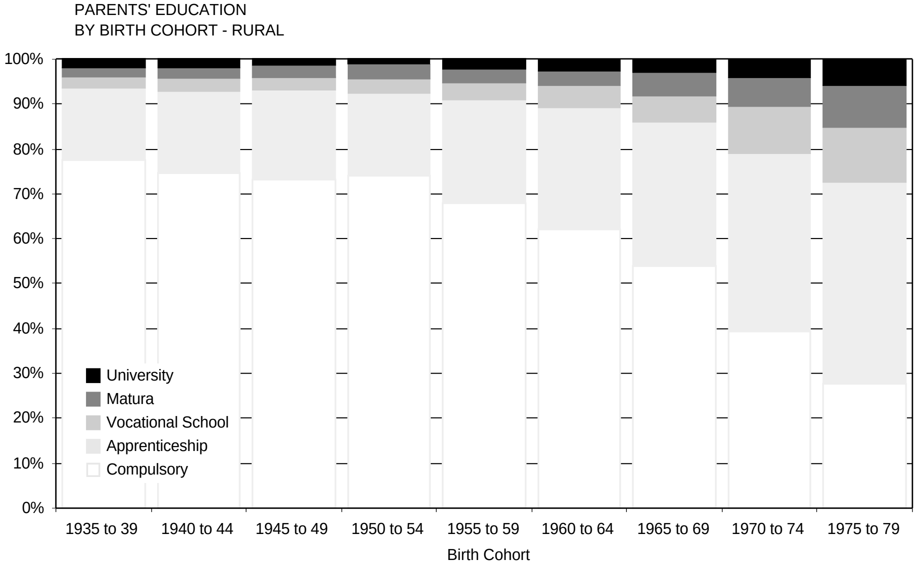


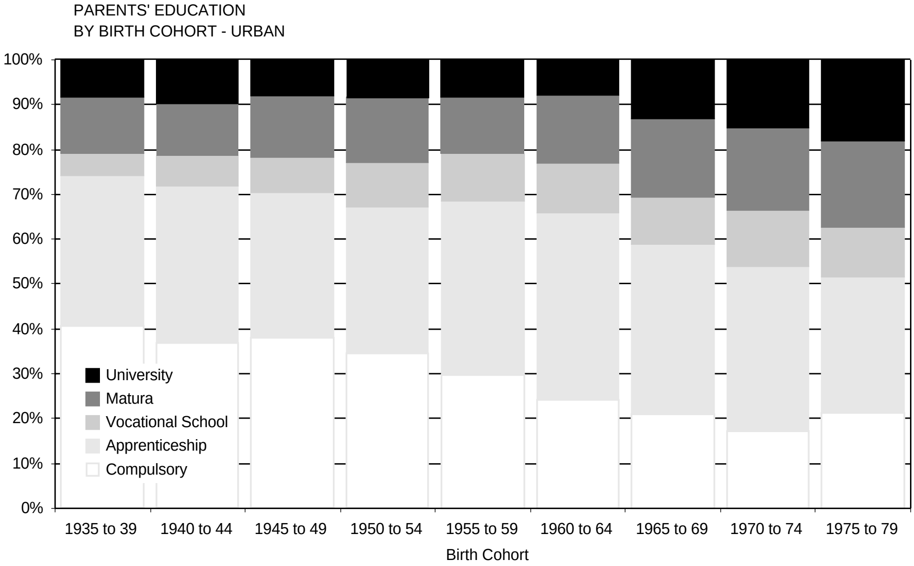
Source: Micro Census June 1996 special program on education; own calculations

Given this dominant effect of parents' education on the first school choice, it can be expected that most of the increase of the overall rate of children graduating from lower secondary academic school can be attributed to the changing educational composition of the parents' generation. As can be seen in the following figure, the percentage of children with academically educated parents more than doubled over the last decades while the percentage of children with parents with compulsory education more than halved. While rural-urban differentials exist for all educational groups of parents — the figure above indicates that this difference averages at around 10% points or half of the total rural-urban differential — the second half of this differential can roughly be attributed to the different educational composition of the urban and rural population.

Figure 7: Parents' educational attainment over five-year-birth cohorts (total and for rural and urban areas)



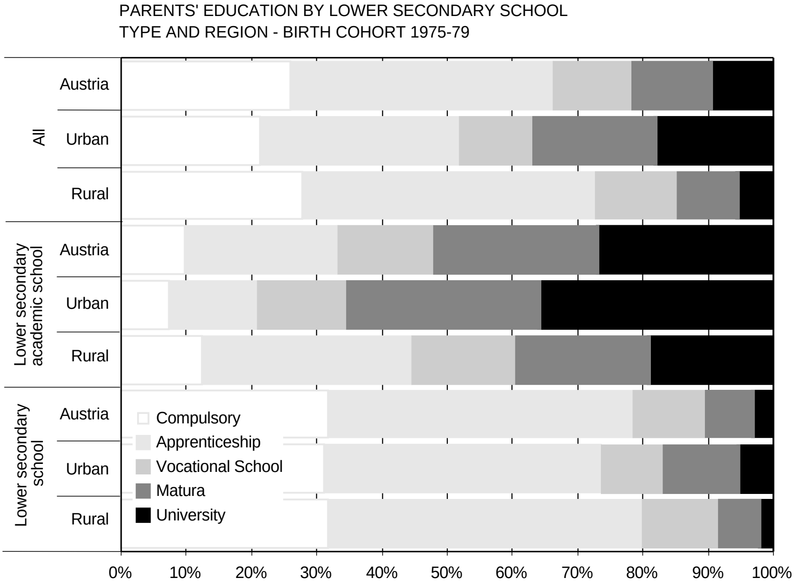




Source: Micro Census June 1996 special program on education; own calculations

Together with the rural-urban differentials observed, the strong educational transmission process from parents to children leads to a very different composition of graduates of the two school types regarding parents' education. While 80% of graduates of rural lower secondary schools have parents with compulsory or apprenticeship education, this rate is four times lower (20%) for urban graduates of lower secondary academic schools. In contrast, less than 3% of the children in the first group have parents with an university background, while this rate is around 37% in the second group.

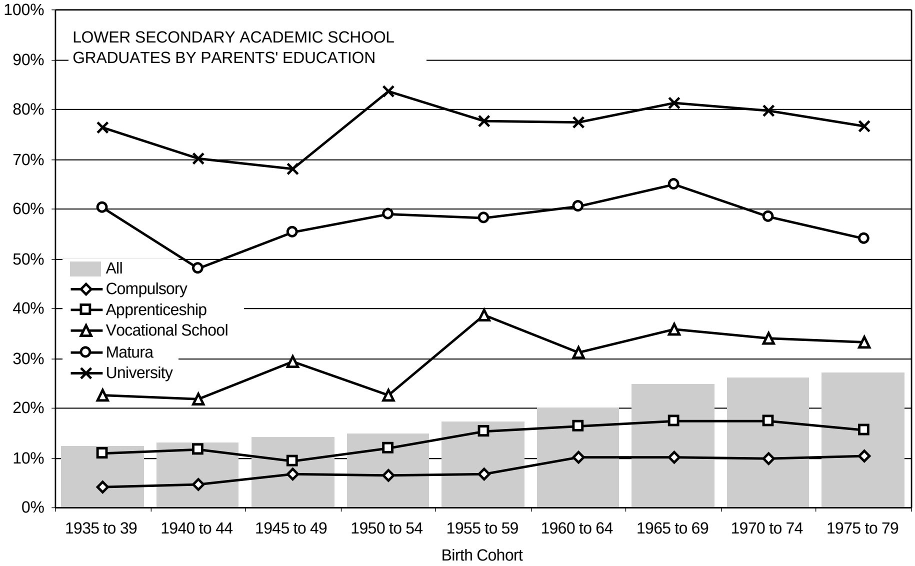
Figure 8: Educational composition of parents by school type and municipality type for the birth cohort 1975-79



Source: Micro Census June 1996 special program on education; own calculations

For given educational backgrounds of parents, school decisions have followed very stable patterns over time, with no significant changes in percentage of children graduating from lower secondary academic school from the 1960s onwards. For the last two decades, percentages stayed at around 10%-17%-34%-60%-80%, depending on parents' education.

Figure 9: Lower secondary academic school graduates by parents' education over five-year-cohorts from 1935 to 1979



Source: Micro Census June 1996 special program on education; own calculations

Further disaggregation by gender and municipality type shows that changes over time can almost entirely be attributed to the catch-up effect of female students, especially in rural areas. In contrast, rates for urban males remained almost unchanged for the last 50 years. The individual contribution of the variables gender, municipality and parents' education can be best explored by regression analysis. For this purpose, a logistic regression was estimated separately for all five-year birth cohorts.

Table 5: Logistic regression coefficients, standard error and odds ratios for graduating from lower secondary academic school for five-year-birth cohorts from 1935 to 1979

	1935 to 39	1940 to 44	1945 to 49	1950 to 54	1955 to 59	1960 to 64	1965 to 69	1970 to 74	1975 to 79
Urban	1.533*** (0.247) 4.634	1.171*** (0.161) 3.225	1.465*** (0.157) 4.328	1.002*** (0.148) 2.723	0.908*** (0.123) 2.478	0.783*** (0.114) 2.187	0.667*** (0.113) 1.948	0.686*** (0.116) 1.986	0.669*** (0.118) 1.952
Male	0.457* (0.236) 1.579	0.797*** (0.154) 2.218	0.602*** (0.151) 1.825	0.374*** (0.141) 1.453	0.219* (0.118) 1.245	0.159 (0.107) 1.172	-0.215** (0.108) 0.807	-0.223** (0.109) 0.800	-0.191* (0.108) 0.826
University	3.574*** (0.404) 35.642	3.560*** (0.261) 35.161	2.997*** (0.279) 20.018	3.667*** (0.339) 39.125	3.150*** (0.231) 23.341	3.037*** (0.243) 20.849	3.106*** (0.221) 22.330	3.330*** (0.230) 27.932	3.096*** (0.213) 22.116
Matura	2.907*** (0.351) 18.306	2.551*** (0.228) 12.823	2.364*** (0.223) 10.638	2.342*** (0.204) 10.397	2.357*** (0.195) 10.561	2.183*** (0.185) 8.872	2.533*** (0.169) 12.597	2.306*** (0.181) 10.031	2.186*** (0.189) 8.898
Vocational	1.260*** (0.474) 3.524	1.566*** (0.285) 4.789	1.324*** (0.256) 3.760	0.902*** (0.257) 2.466	1.528*** (0.197) 4.611	1.244*** (0.180) 3.471	1.292*** (0.182) 3.638	1.479*** (0.176) 4.387	1.434*** (0.188) 4.197
Apprentice	0.625*** (0.302) 1.868	0.659*** (0.198) 1.932	0.004*** (0.200) 1.004	0.285*** (0.182) 1.330	0.605*** (0.148) 1.832	0.329*** (0.131) 1.390	0.463*** (0.136) 1.588	0.499*** (0.154) 1.648	0.499*** (0.171) 1.647
Constant	-4.060** (0.263)	-3.972*** (0.179)	-3.564 (0.163)	-3.093 (0.137)	-2.926*** (0.122)	-2.545** (0.105)	-2.319*** (0.112)	-2.234*** (0.135)	-2.315*** (0.157)
Chi-Square DF=6	235.342	481.944	447.393	402.518	492.710	448.950	573.311	538.130	485.107
Nagelkerke R Square	0.373	0.353	0.335	0.288	0.273	0.227	0.291	0.301	0.278

*Models estimated from June 1996 Micro Census data; significance levels are indicated by *** over 99%, ** over 95% and * over 90%*

The Chi-square statistics of the model are highly significant for each cohort (p-value=0.000), which shows that the relationship between the dependent variable and the model is probably real and not due to sampling fluctuations. The Nagelkerkes R^2 is one of the various pseudo R-square, developed for binary response models, as an equivalent of the usual coefficient of determination. Although the R^2 of the logistic regression is calculated in a different way than the R^2 in the ordinary linear regression, it can to a great extent be interpreted in the same way, for the several cohorts the Nagelkerkes R-squares vary around 0.25 to 0.35, which are moderate to good values for a logistic regression.

The regression coefficients of the logistic regression, listed in the table, explain the influence of the several factors on compulsory education for each cohort separately. Most of the regression coefficients are highly significant (over 99%), except gender (male) in the “turning years” of birth cohorts 1955-64, when female students catch-up and overtake male students. For the five categories of parents education dummy variables were built, whereby the last category, of course, is linear dependent to the rest of the categories. Therefore, the regression coefficients show not only the influence on the educational choice but also the distance to the category "compulsory education".

A logistic regression model does not directly estimate the probability p of an event but a logit transformation of this probability with

$$y = \text{logit}(p) = \ln(p/(1\text{-}p)) = b_0+b_1x1+b_2x2+..+b_kx_k+e$$, or solved for p

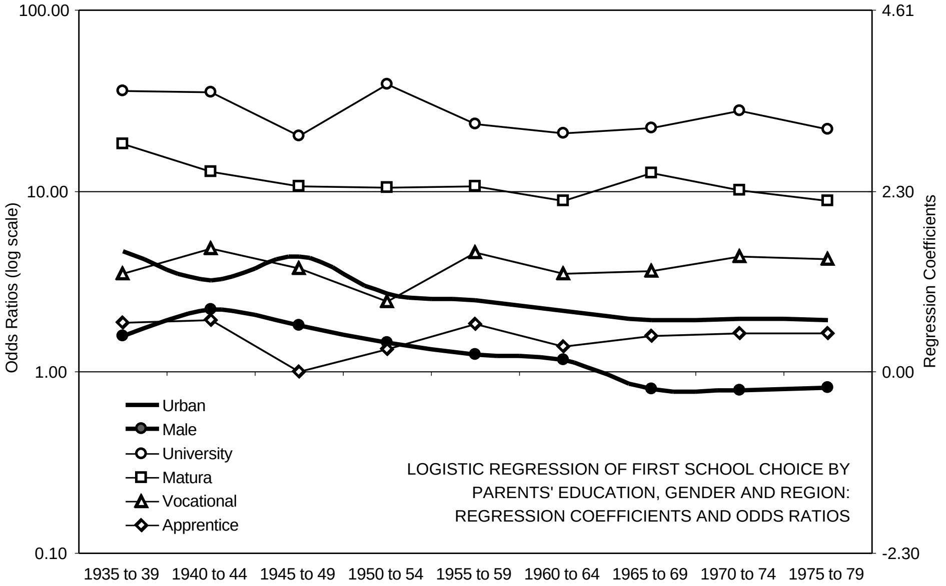
$$p = \frac{e^y}{1+e^y} = \frac{e^{\text{logit}(p)}}{1+e^{\text{logit}(p)}}$$

For an interpretation of the regression coefficients, one might look at the odds ratio

$$\psi = \frac{p_1/(1-p_1)}{p_0/(1-p_0)} = e^{b_1}$$

which explains the partial effect, from changing a binary explanatory variable from one to zero, holding all other variables fixed. This means that by calculating the exponential of the regression coefficients, one obtains the odds ratio, or the ratio of the odds, that an event happens if the variable is 1 to the odds that the same event happens if the variable is 0. As displayed in the following figure, the regression coefficients regarding the influence of parents' education (and therefore the odds ratios) stayed relatively stable for the last half century, whereas the "advantage" of being male regarding the probability of graduating from lower secondary academic school disappeared and turned negative over time. Additionally, the "advantage" of living in urban municipalities decreased over time. The influence of both, gender and municipality type, leveled off for the three most recent cohorts.

Figure 10: Regression coefficients of the logistic regression model estimated separately for all five year birth cohorts from 1935 to 1979



3.2 Comparison of findings with other studies on education in Austria

Our approach to investigate education in Austria differs from available studies in various ways: they usually use period measures, i.e. current enrollment rates by school type, rather than individual history data in their socio-demographic family context. Several analyses concerning education in Austria have been carried out in the last years. These include Biffl (2000) and Landler (1997), both analyzing school transition and enrollment rates. Due to the different approaches, the results of these studies are not directly comparable to our findings, as we focus on transition rates from one educational level to the next completed one. Compared to period measures on school enrollment, in our study we do not include school dropouts or students who change to another school, as we focus on successful school graduations. Notwithstanding these differences, we will aim at comparing the findings and try to find a reasonable correspondence of results.

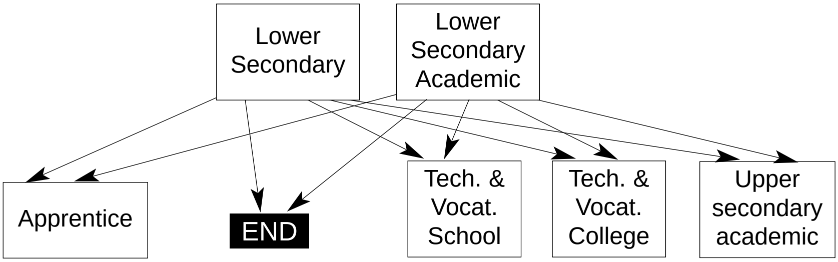
According to Biffl (2002, p. 379) the transition rate from elementary school to secondary academic school in the school year 1988/89 was 30%, taking into account the net transitions between lower secondary academic schools and lower secondary schools, which amounts to approximately 1% of those enrolled in secondary academic schools. Landler (1997, p. 22) calculated that throughout the early 90s about one quarter of the pupils attended a secondary academic school after successfully completing elementary school, while the rest continued in secondary schools. Based on our data and approach, for the birth cohort 1975-79 around 27% of the pupils graduated from a lower secondary academic school. Thus, the magnitude of this number is quite close to that of comparable studies.

Bauer (1996) asserts in her evaluation of census data that the educational career of children is crucially influenced by their parents' socio-economic status. She determined the social affiliation by the job position of the head of the family. She does not only distinguish between self-employed, employed/public servants, workers and non-employed, but differentiates further by qualification, which make her findings widely comparable to ours. According to Bauer, of those who have been in a secondary academic school, roughly one third have parents with compulsory education only. Taking into account small differences in definitions, this is equivalent to our results. Bauer also compares the composition of parents' education and profession within different school types for the year 1981 with those of 1991 and finds a high persistence of discrepancies for this period.

4 The second educational choice

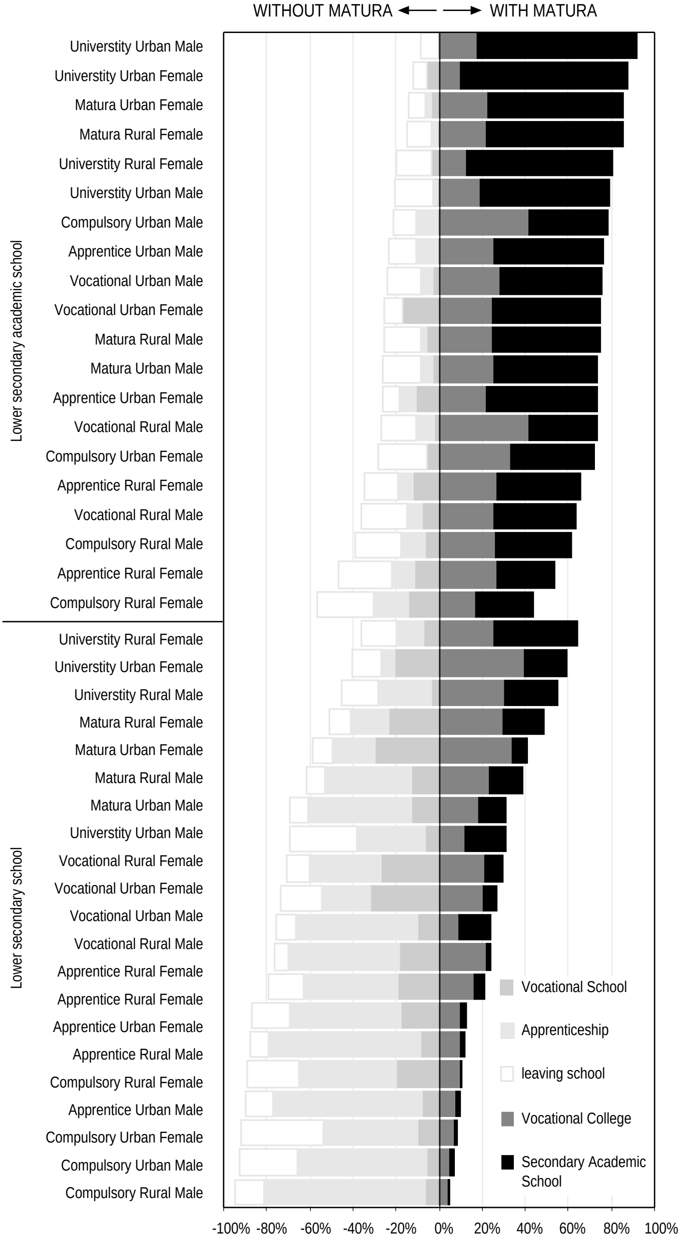
The second educational choice is usually made at the age of 14 at the transition point from lower to upper secondary education. While the first choice is basically a choice between two types of schools, namely between the lower secondary school and the lower secondary academic school, educational career paths meet again at this point in order to branch to a wide set of school types and apprenticeships. The higher secondary level offers several possibilities for further education. The apprenticeship, taking three to four years, combines specific job-related training according to the chosen occupation in firms and vocational schooling. Other possibilities are secondary vocational and technical schools, which generally last three years and lead to a certificate. Students attending secondary vocational and technical colleges finish with a final exam after five years of successful schooling, the *Matura*, which is essential for accessing university and other post-secondary colleges or academies. Secondary vocational colleges are primarily commercial academies, while secondary technical colleges allow specialization in certain technical industries. A further alternative is the upper secondary academic school, which provides its attendants mainly with general knowledge. It takes four years and successful graduation also requires passing the *Matura*. The following analysis uses a simplified model of the school system of this level, which reduces the choice to five options, as displayed in the following figure:

Figure 11: The second educational decision



Again, the individual school choice is highly influenced by gender, municipality type and the educational attainment of parents as well as by the previous educational choice.

Figure 12: Second educational decision by previous school attendance, parents' education, municipality type and gender; birth cohorts 1970 to 79



Source: Micro Census June 1996 special program on education; own calculations

4.1 Descriptive and regression analysis

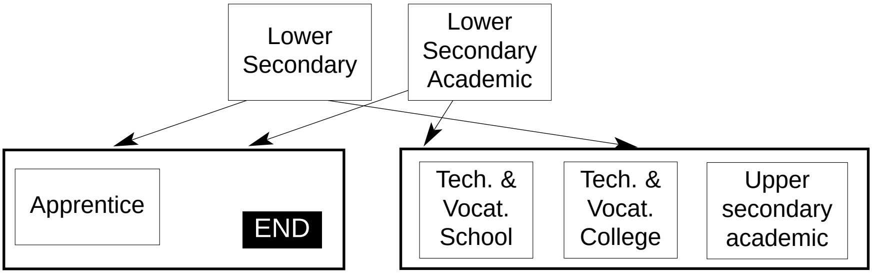
Using parents' education, rural/urban setting, gender and the previous school choice as grouping variables, students at this decision point can be assigned to 40 possible groups. The following figure displays the distribution of educational choices within these groups ranked by the previous school attendance and the probability to obtain a *Matura* diploma. In this graph we group the educational attainments by those without and with a *Matura* diploma (left side resp. right side bars).

In order to structure the school decisions, the following analysis separates the decision between five options to a series of up to three binary decisions. The first decision studied is between further fulltime schooling vs. an apprenticeship training or leaving school after finishing compulsory education by attending one year of any school available at the age of 14. For those staying in fulltime schooling, a decision has to be taken between school types leading to a *Matura* diploma and vocational and technical schools. For those obtaining the *Matura* diploma, the last school choice has to be made between technical colleges and the upper level of the secondary academic school.

Fulltime school vs. apprenticeship training or leaving school

Due to the educational expansion observed in the last decades, especially the number of people leaving the education system after compulsory schooling has decreased considerably leveling off at currently 17% in recent birth cohorts. At the same time, the importance of apprenticeships has increased to the same extent, peaking at a proportion of 40% in recent birth cohorts. In this analysis, apprenticeship training and leaving school will be treated as one group, versus the group of students who decide to remain fulltime in the school system.

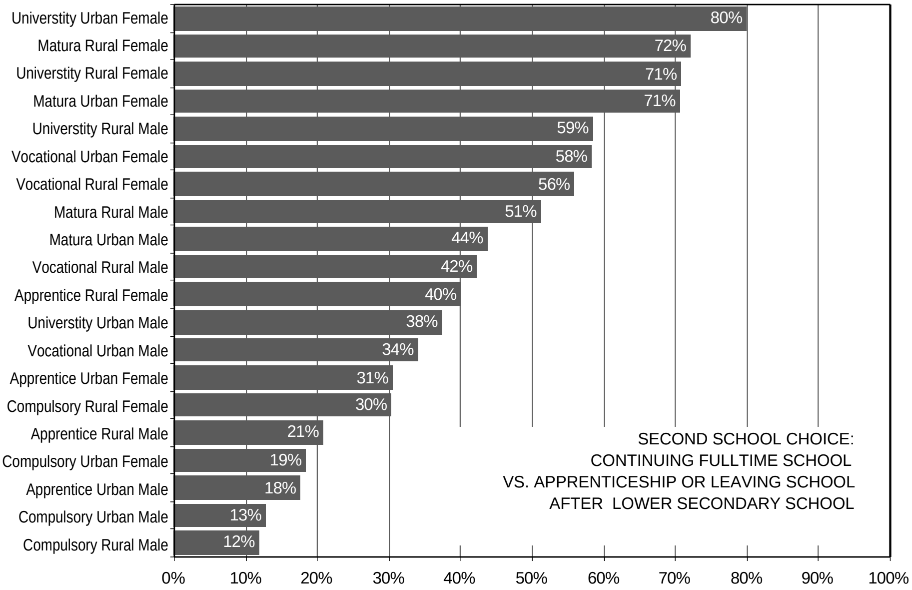
Figure 13: The second educational decision: leaving vs. continuing fulltime schooling



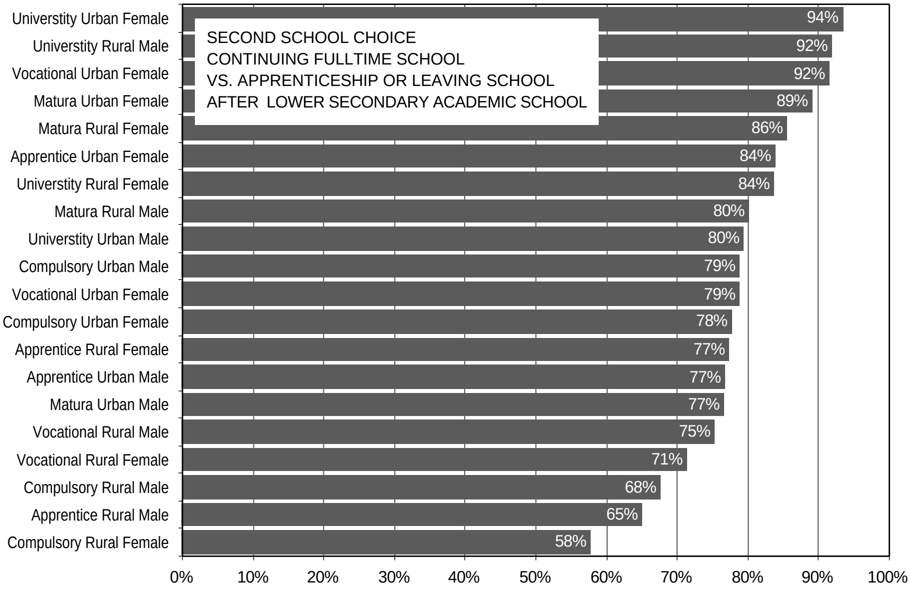
The decision to stay in school is highly influenced by the parents' educational backgrounds, as can be seen in the following figures. For students coming from a lower secondary school, probabilities of continuing fulltime schooling vary from 12% to 80%, with the highest probabilities found for students with parents who made the same educational choice in their lives. The range of probabilities between socio-demographic groups is much lower for students coming from a lower secondary academic school.

Figure 14: Second educational decision by parents' education, municipality type and gender; probability of graduating from secondary schools after (1) lower secondary school and (2) lower secondary academic school for birth cohorts 1970 to 79

(1)



(2)



Source: Micro Census June 1996 special program on education; own calculations

In order to determine the contribution of the different factors and the associated changes over time, a logistic regression model was estimated for both groups of students (regarding previous school) and for four birth cohorts, with the estimation results given in the table below. With Odds-Ratios up to 8, the influence of parents' education is considerable and highly significant for all cohorts, with a clear ranking of the educational dummies.

Figure 15: Second educational decision by parents' education, municipality type and gender; Logistic regression of probability to continue fulltime schooling after a (1) lower secondary school and a (2) lower secondary academic school for birth cohorts 1940 to 79

	Lower Secondary School (1)				Lower Secondary Academic School (2)			
	1940 to 49	**1950 to 59**	**1960 to 69**	**1970 to 79**	**1940 to 49**	**1950 to 59**	**1960 to 69**	**1970 to 79**
Urban	0.520*** (0.097) 1.682	0.234*** (0.089) 1.263	0.094 (0.084) 1.098	0.094 (0.084) 1.098	-0.164 (0.227) 0.848	0.162 (0.182) 1.176	-0.041 (0.147) 0.960	0.351** (0.155) 1.420
Male	-0.505*** (0.093) 0.603	-0.720*** (0.078) 0.487	-0.875*** (0.073) 0.417	-0.875*** (0.073) 0.417	-0.103 (0.210) 0.902	-0.255 (0.176) 0.775	-0.115 (0.142) 0.892	-0.343** (0.146) 0.710
University	1.678*** (0.283) 5.357	1.690*** (0.302) 5.419	2.124*** (0.274) 8.367	2.124*** (0.274) 8.367	1.304*** (0.326) 3.682	0.408 (0.279) 1.503	0.971*** (0.247) 2.639	1.106*** (0.259) 3.023
Matura	1.630*** (0.189) 5.105	1.653*** (0.177) 5.220	1.385*** (0.168) 3.993	1.385*** (0.168) 3.993	0.798*** (0.287) 2.222	0.366 (0.260) 1.442	0.534** (0.209) 1.706	0.854*** (0.248) 2.349
Vocational	1.510*** (0.175) 4.528	1.421*** (0.148) 4.142	1.657*** (0.134) 5.246	1.657*** (0.134) 5.246	0.383 (0.364) 1.466	0.522 (0.336) 1.686	0.514** (0.252) 1.672	0.561** (0.254) 1.753
Apprentice	0.550*** (0.106) 1.733	0.404*** (0.089) 1.498	0.458*** (0.078) 1.581	0.458*** (0.078) 1.581	0.542* (0.291) 1.720	-0.068 (0.234) 0.935	0.366* (0.193) 1.441	0.409* (0.233) 1.505
	-2.001*** (0.078)	-1.306*** (0.061)	-1.077*** (0.059)	-1.077*** (0.059)	0.790*** (0.259)	1.058*** (0.194)	0.772*** (0.156)	0.730*** (0.202)
Constant	0.135	0.271	0.341	0.341	2.204	2.880	2.164	2.075
Chi-Square DF=6	263.554	301.996	389.875	389.875	20.256	11.146	18.884	37.424
Nagelkerkes R^2	0.111	0.103	0.119	0.119	0.054	0.022	0.025	0.049

*Models estimated from June 1996 Micro Census data; significance levels are indicated by *** over 99%, ** over 95% and * over 90%*

A comparison of regression coefficients reveals a very stable influence of parents' educational attainments on the choice of their offspring to continue fulltime schooling.

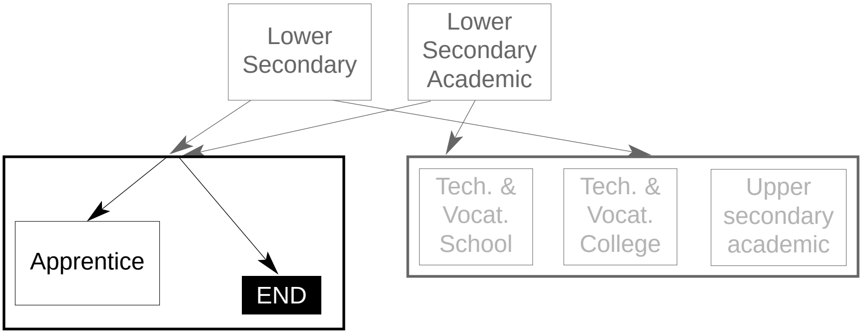
Regarding children coming from a lower secondary school, the influence of parents is much higher. For these children, it can be seen that an urban environment influences the decision to stay in fulltime schooling. This influence turned negative for recent cohorts, which might reflect the stronger selection process already taking place with the first school decision. Leaving fulltime schooling, especially in order to start an apprenticeship, is more likely for male students; the influence of the gender variable increased over time but leveled off for recent cohorts.

For children coming from a lower secondary academic school, probabilities of continuing fulltime schooling are generally higher and vary less by the educational background of parents. Also, gender and rural-urban differentials are lower. They do not follow a clear trend over time and are statistically less or not significant for some cohorts.

Apprenticeship vs. school leaving

For those who decide to leave the school system, the second decision is between an apprenticeship training, that is, continue education in a dual system of schooling and training on the job, or leave the formal school system.

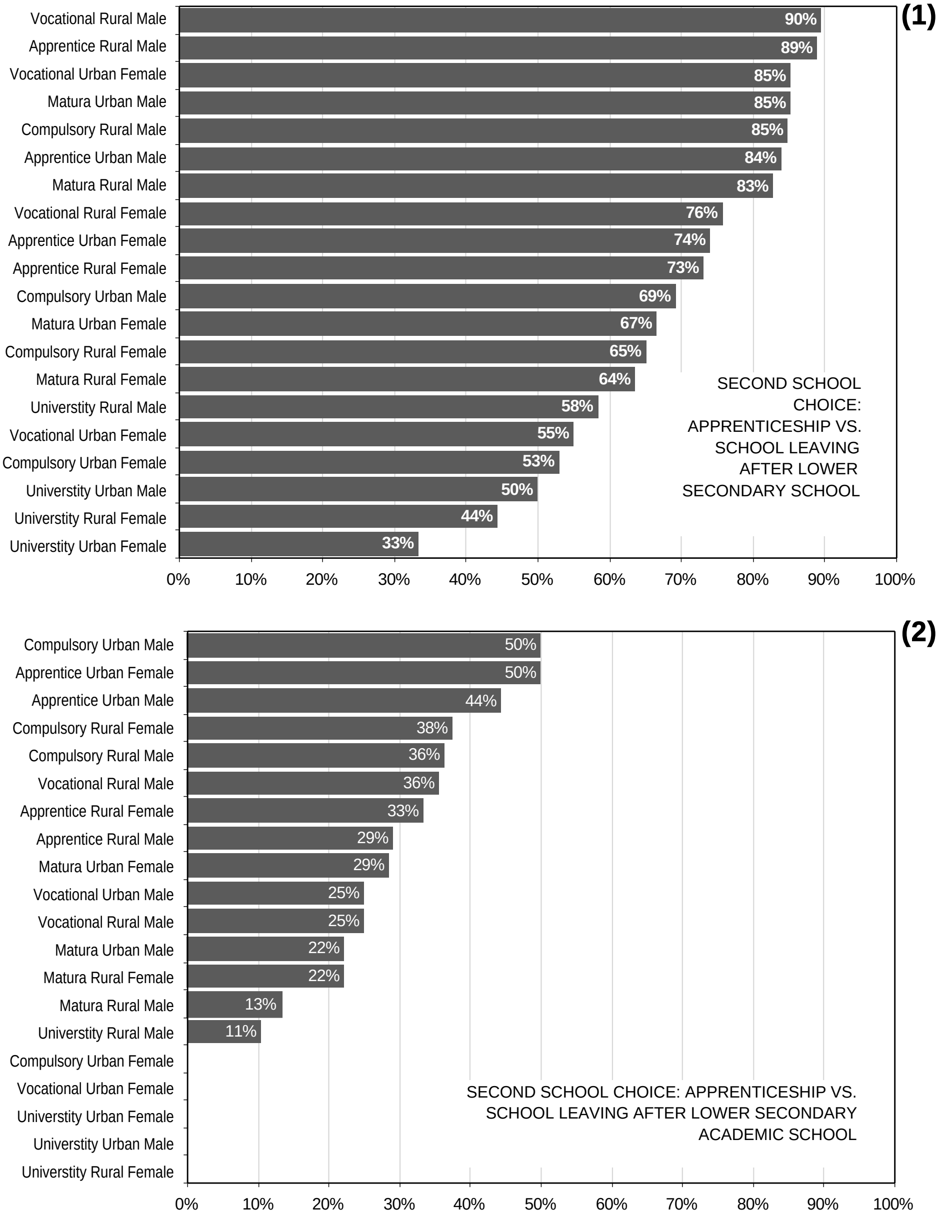
Figure 16: The second educational decision: Apprenticeship versus leaving school of students leaving fulltime schooling



Again, this decision is highly influenced by the socio-demographic background. For students coming a from lower secondary school, the probabilities of completing an apprenticeship training range from 33% for urban daughters of university graduates to 90% of rural males with vocational education of parents. In general the highest rates can be observed for males. An university background of parents lowers the probability of doing an apprenticeship training considerably, while the influence of other educational attainments of parents is rather low.

For children which previously attended lower secondary academic schools and which decided to leave fulltime schooling, the probability of leaving the formal school system completely is generally much higher, especially if the come from higher educated families.

Figure 17: Second educational decision by parents' education, municipality type and gender: Probability of an apprenticeship for students leaving fulltime education after a (1) lower secondary school and a (2) lower secondary academic school for birth cohorts 1970 to 79



Source: Micro Census June 1996 special program on education; own calculations

In order to determine the contribution of the different factors and the associated changes over time, a logistic regression model of the decision for an apprenticeship was estimated for both groups of students (regarding previous school) that decided to leave fulltime schooling. The estimation results for four birth cohorts are given in the table below.

Table 6: Second educational decision by parents' education, municipality type and gender; Logistic regression of the probability of an apprenticeship for students leaving fulltime education after a (1) lower secondary school and a (2) lower secondary academic school

	Lower Secondary School (1)				Lower Secondary Academic School (2)			
	1940 to 49	**1950 to 59**	**1960 to 69**	**1970 to 79**	**1940 to 49**	**1950 to 59**	**1960 to 69**	**1970 to 79**
Urban	0.863*** (0.096) 2.370	0.293*** (0.101) 1.340	-0.011 (0.104) 0.989	-0.420*** (0.122) 0.657	-0.197 (0.413) 0.822	-0.572 (0.404) 0.564	-0.413 (0.298) 0.662	0.227 (0.342) 1.255
Male	1.324*** (0.078) 3.758	1.282*** (0.077) 3.605	1.187*** (0.082) 3.278	1.006*** (0.103) 2.735	0.461 (0.393) 1.585	0.903** (0.418) 2.467	0.374 (0.294) 1.454	0.079 (0.309) 1.083
University	-0.307 (0.386) 0.735	-0.695 (0.452) 0.499	-0.842* (0.440) 0.431	-1.106*** (0.362) 0.331	-0.282 (0.661) 0.754	-1.553* (0.814) 0.212	-1.330** (0.657) 0.265	-2.416*** (0.812) 0.089
Matura	0.517** (0.261) 1.678	0.146 (0.275) 1.157	0.818*** (0.297) 2.265	0.191 (0.263) 1.210	-0.016 (0.532) 0.984	-0.604 (0.542) 0.547	-1.272** (0.500) 0.280	-0.839* (0.500) 0.432
Vocational	0.674*** (0.230) 1.962	0.311 (0.216) 1.365	0.626*** (0.235) 1.869	0.450** (0.197) 1.568	0.207 (0.648) 1.230	-1.319 (0.832) 0.267	-0.858 (0.552) 0.424	-0.413 (0.468) 0.661
Apprentice	1.080*** (0.098) 2.943	0.531*** (0.096) 1.701	0.672*** (0.093) 1.957	0.490*** (0.112) 1.632	0.528 (0.508) 1.695	-0.987** (0.483) 0.373	0.614* (0.339) 1.847	-0.035 (0.410) 0.966
	-0.859*** (0.063)	-0.140** (0.059)	0.184*** (0.062)	0.611*** (0.093)	-0.931** (0.469)	-0.919** (0.399)	-0.796*** (0.291)	-0.696** (0.343)
Constant	0.424	0.870	1.202	1.842	0.394	0.399	0.451	0.499
Chi-Square DF=6	552.517	337.025	295.968	142.078	3.547	16.894	31.692	17.621
Nagelkerkes R^2	0.206	0.131	0.120	0.090	0.037	0.140	0.160	0.101

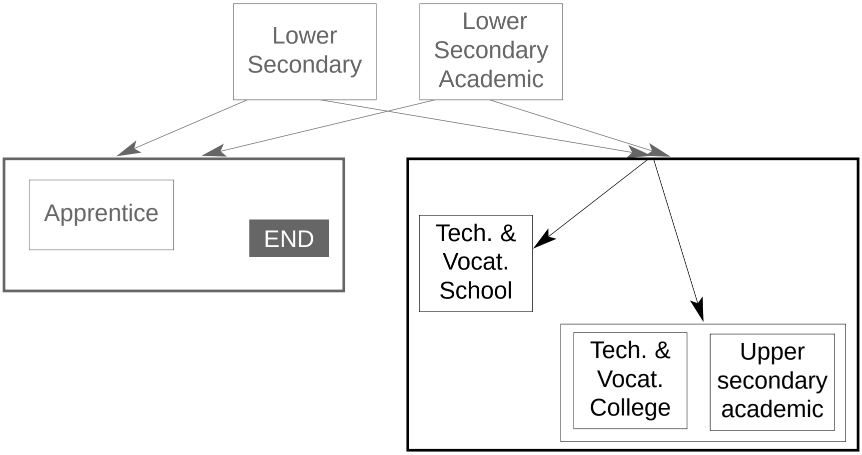
*Models estimated from June 1996 Micro Census data; significance levels are indicated by *** over 99%, ** over 95% and * over 90%*

For students coming from a lower secondary school and finishing fulltime schooling, a general increase of the probability of doing an apprenticeship training can be observed. This is expressed in the increase of the constant term in the regression models. The opposite trend can be seen for urban students, while the influence of parents' education becomes less pronounced, except for the highest educational group. For students coming from a lower secondary academic school, the overall change is less pronounced, gender and rural urban differences disappeared over time and the parents' educational background is more distinctive: the higher the parents' education, the lower the probability of an apprenticeship.

Matura vs. vocational and technical schools

Students who decide to continue fulltime schooling have to opt between (usually shorter) technical and vocational schools and higher schools leading to a *Matura* diploma.

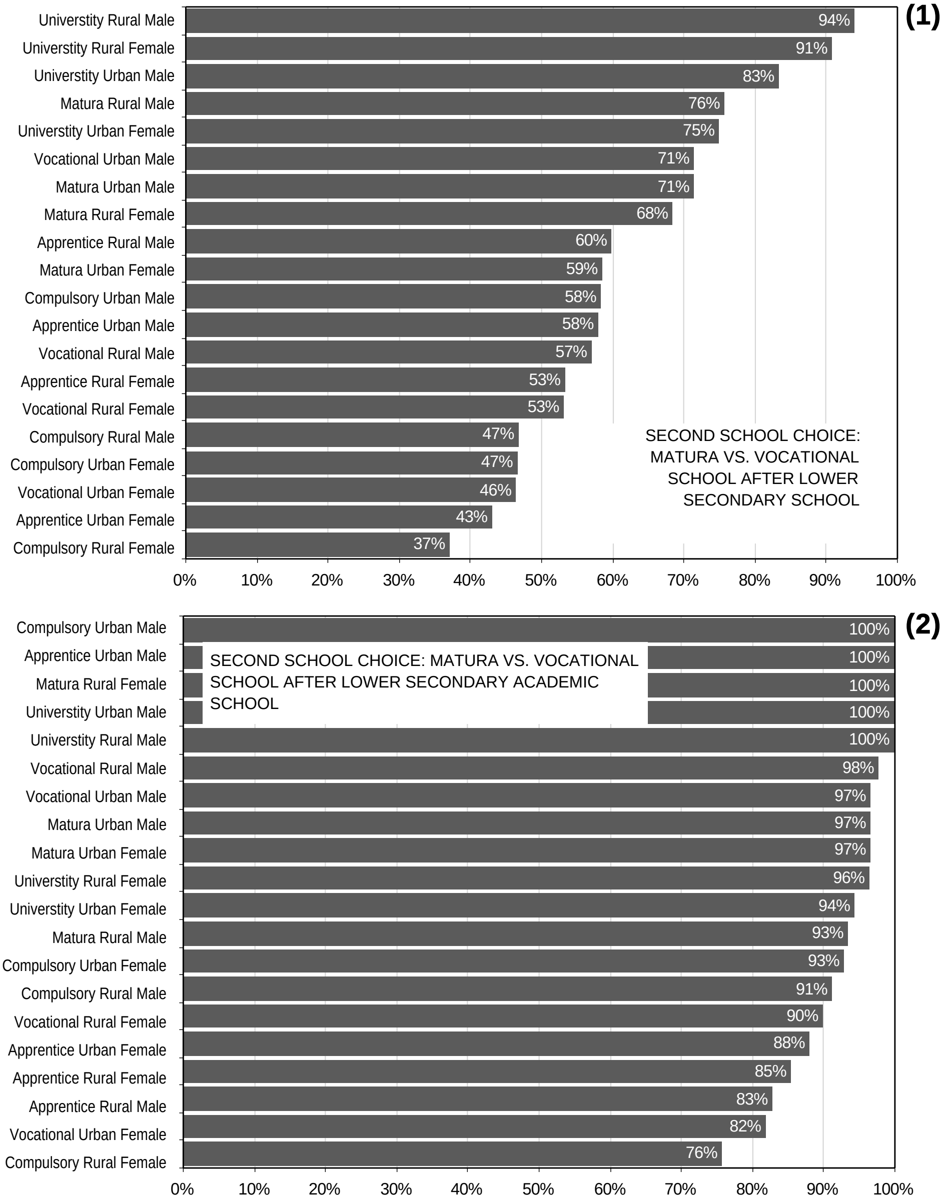
Figure 18: The second educational decision: Technical and vocational schools versus schools leading to a *Matura*



For students coming from a lower secondary school and continuing fulltime schooling, the probability of graduating with a *Matura* diploma ranges from 37% to 94%, depending on the socio-demographic background. The probability is lowest for female students with parents of lower educational groups, while for students with parents with university background the probability is highest, lying over 75%. In a ranking of the different groups by the probability of a *Matura*, in none of the lower half of the groups (one of the) parents have a *Matura* diploma.

Again, for those coming from a lower secondary academic school the influence of the socio-demographic background is lower regarding this decision, with probabilities generally lying over 75% and reaching virtually 100% for some groups, especially for males.

Figure 19: Second educational decision by parents' education, municipality type and gender: Probability of a *Matura* diploma for students staying in fulltime schooling after a (1) lower secondary school and a (2) lower secondary academic school for birth cohorts 1970 to 79



Source: Micro Census June 1996 special program on education; own calculations

In order to determine the contribution of the different factors and the associated changes over time, a logistic regression model of the decision for a higher school leading to a *Matura* diploma was estimated for both groups of students (regarding previous school) who decided to stay in fulltime schooling. The estimation results for four birth cohorts are given in the table below.

Table 7: Second educational decision by parents' education, municipality type and gender: Logistic regression of obtaining a *Matura* diploma for students staying in fulltime schooling after a (1) lower secondary school and a (2) lower secondary academic school

	Lower Secondary School (1)				Lower Secondary Academic School (2)			
	1940 to 49	**1950 to 59**	**1960 to 69**	**1970 to 79**	**1940 to 49**	**1950 to 59**	**1960 to 69**	**1970 to 79**
Urban	0.736*** (0.204) 2.087	0.141 (0.161) 1.152	0.204 (0.138) 1.227	-0.147 (0.163) 0.864	0.585* (0.322) 1.794	0.144 (0.276) 1.155	0.077 (0.241) 1.080	0.346 (0.282) 1.413
Male	1.046*** (0.199) 2.845	0.732*** (0.146) 2.080	0.695*** (0.126) 2.004	0.365*** (0.131) 1.441	0.810*** (0.314) 2.249	1.131*** (0.285) 3.100	0.335 (0.231) 1.398	0.667** (0.281) 1.949
University	1.234*** (0.458) 3.436	1.660*** (0.437) 5.261	0.980*** (0.343) 2.663	2.328*** (0.427) 10.257	0.357 (0.489) 1.428	1.675*** (0.512) 5.339	2.859*** (0.742) 17.446	1.702*** (0.530) 5.484
Matura	0.906*** (0.324) 2.474	1.172*** (0.258) 3.229	0.748*** (0.252) 2.113	1.149*** (0.228) 3.156	0.505 (0.505) 1.657	1.470*** (0.455) 4.350	0.958*** (0.343) 2.606	1.333*** (0.488) 3.792
Vocational	0.598* (0.320) 1.818	0.583** (0.234) 1.792	0.346* (0.194) 1.413	0.518*** (0.198) 1.679	-0.253 (0.566) 0.776	0.453 (0.426) 1.573	0.722* (0.392) 2.058	0.460 (0.437) 1.584
Apprentice	0.118 (0.242) 1.125	0.369** (0.172) 1.447	0.071 (0.142) 1.073	0.524*** (0.165) 1.689	-0.907** (0.433) 0.404	0.359 (0.334) 1.432	0.335 (0.282) 1.398	0.036 (0.386) 1.036
	-2.187*** (0.207)	-1.348*** (0.127)	-0.934*** (0.109)	-0.450*** (0.142)	1.245*** (0.396)	0.823*** (0.249)	1.263*** (0.227)	1.543*** (0.347)
Constant	0.112	0.260	0.393	0.638	3.472	2.277	3.537	4.680
Chi-Square DF=6	59.737	63.974	60.041	65.643	21.088	40.857	39.766	36.621
Nagelkerkes R^2	0.136	0.090	0.660	0.080	0.920	0.132	0.095	0.097

*Models estimated from June 1996 Micro Census data; significance levels are indicated by *** over 99%, ** over 95% and * over 90%*

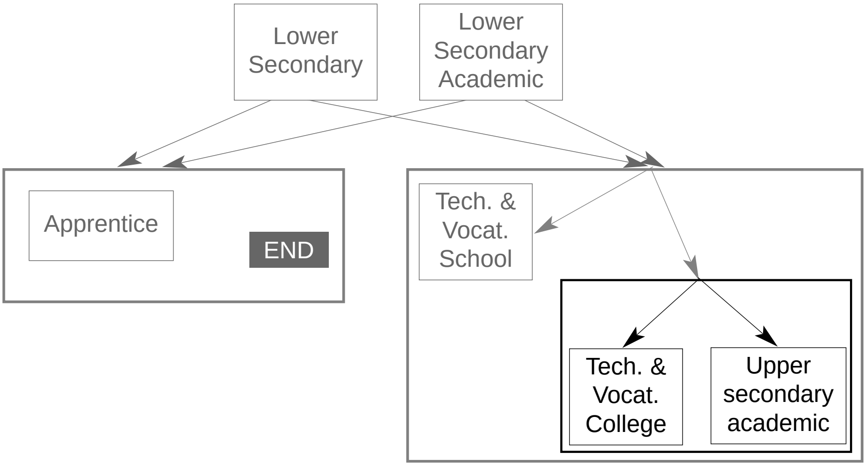
For students coming from a lower secondary school and continuing fulltime schooling, a general increase of the probability of obtaining a *Matura* diploma can be observed. This is expressed in the increase of the constant term in the regression models. Urban-rural differentials are low and become statistically insignificant. The probability is higher for males, with gender differentials decreasing over time. Differences by parents' education are pronounced, highly significant and relatively stable over time.

For students coming from a lower secondary academic school, the overall change is less pronounced, rural urban differences are not significant, as are lower educational groups compared to compulsory education, whereas having parents who obtained a *Matura* diploma themselves increases the probability considerably. Probabilities are higher for males, with gender differences also diminishing and becoming statistically less significant.

The choice between *Matura* types

For students who decide to obtain a *Matura* diploma, two main options exist, namely (1) the upper secondary academic school providing general education and usually covering four years and (2) upper secondary technical and vocational schools usually taking five years. The second school type provides general and vocational education ("double qualification") and leads both to an occupation and to the entrance permission to university. Its curriculum is divided into three parts, namely general education, vocational theory and vocational practice.

Figure 20: The second educational decision: upper secondary academic versus upper secondary technical and vocational schools

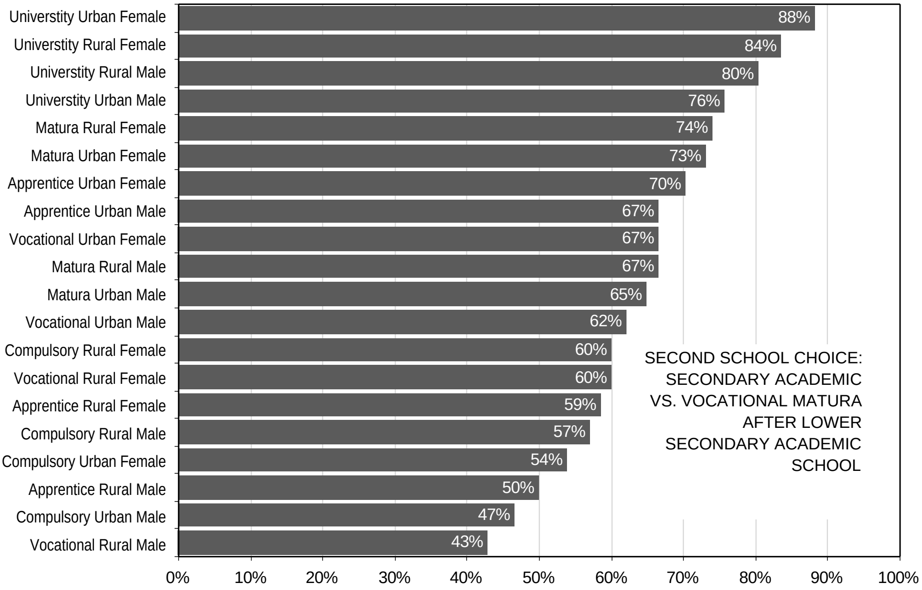


Even though both school types entitle students to proceed to university, the choice between them is highly influenced by the intention to finish schooling with the upper secondary level or continue by attaining university programs. In dependence on the socio-demographic background and the school previously attended, the probabilities to chose the shorter upper secondary academic track ranges considerably, from 7% to 88%.

For students coming from a lower secondary school, probabilities to opt for the general educational academic path range from 7% to 60%, with parents' education being the main influencing factor. While the offspring of parents with vocational, apprenticeship or compulsory education usually — in more than 70% of the cases — opt for vocational and technical schools, the highest probabilities for academic schools can be found for offspring of university graduates. The same patterns can be found for students coming from lower secondary academic schools, whereas probabilities to continue the secondary academic school are generally higher and vary less among students.

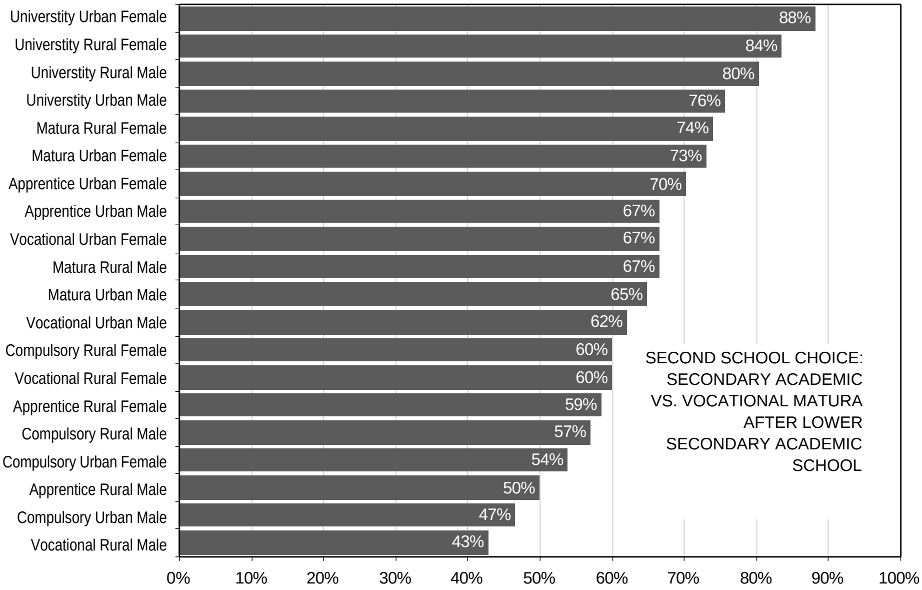
Figure 21: econd educational decision by parents' education, municipality type and gender: Probability of an academic *Matura* diploma for students obtaining a *Matura* diploma after a (1) lower secondary school and a (2) lower secondary academic school for birth cohorts 1970 to 79

(1)



SECOND SCHOOL CHOICE:
SECONDARY ACADEMIC
VS. VOCATIONAL MATURA
AFTER LOWER
SECONDARY ACADEMIC
SCHOOL

(2)



Source: Micro Census June 1996 special program on education; own calculations

Table 8: Second educational decision by parents' education, municipality type and gender: Logistic regression of obtaining a *Matura* diploma from upper secondary academic school for students obtaining a *Matura* diploma after a (1) lower secondary school and a (2) lower secondary academic school

	Lower Secondary School (1)				Lower Secondary Academic School (2)			
	1940 to 49	**1950 to 59**	**1960 to 69**	**1970 to 79**	**1940 to 49**	**1950 to 59**	**1960 to 69**	**1970 to 79**
Urban	1.436** (0.559) 4.206	-0.139 (0.270) 0.870	0.079 (0.247) 1.082	0.091 (0.237) 1.095	0.241 (0.262) 1.272	-0.511** (0.238) 0.600	0.204 (0.174) 1.226	0.190 (0.153) 1.209
Male	-0.760 (0.463) 0.468	0.044 (0.240) 1.045	-0.257 (0.231) 0.774	-0.060 (0.197) 0.942	0.090 (0.244) 1.094	-0.639*** (0.228) 0.528	-0.142 (0.167) 0.868	-0.400*** (0.150) 0.670
University	1.769** (0.752) 5.864	1.254** (0.573) 3.505	1.265*** (0.453) 3.544	1.758*** (0.406) 5.803	1.215*** (0.385) 3.370	1.241*** (0.393) 3.460	1.380*** (0.297) 3.974	1.268*** (0.290) 3.554
Matura	-0.144 (0.694) 0.866	-0.024 (0.386) 0.976	-0.193 (0.446) 0.824	1.151*** (0.360) 3.162	-0.078 (0.323) 0.925	0.595* (0.325) 1.813	0.721*** (0.255) 2.057	0.606** (0.277) 1.832
Vocational	-0.695 (0.866) 0.499	-0.153 (0.375) 0.858	0.168 (0.352) 1.183	0.504 (0.371) 1.655	0.016 (0.444) 1.017	0.102 (0.377) 1.108	0.450 (0.296) 1.568	0.052 (0.290) 1.054
Apprentice	0.122 (0.563) 1.130	-0.584* (0.309) 0.558	0.078 (0.276) 1.081	0.484 (0.329) 1.622	0.368 (0.376) 1.445	-0.228 (0.304) 0.796	0.072 (0.234) 1.074	0.168 (0.280) 1.182
	-2.239*** (0.625)	-0.435** (0.211)	-1.263*** (0.212)	-1.759*** (0.300)	0.433 (0.321)	1.621*** (0.276)	0.354* (0.198)	0.342 (0.253)
Constant	0.107	0.647	0.283	0.172	1.541	5.058	1.425	1.408
Chi-Square DF=6	20.724	12.366	10.036	28.074	18.909	29.709	40.601	50.985
Nagelkerkes R^2	0.204	0.051	0.033	0.068	0.071	0.068	0.077	0.080

*Models estimated from June 1996 Micro Census data; significance levels are indicated by *** over 99%, ** over 95% and * over 90%*

In order to determine the contribution of the different factors and the associated changes over time, a logistic regression model of the decision to obtain a *Matura* diploma attending higher secondary academic school was estimated for both groups of students (regarding previous school) who decided to obtain a Matura diploma. The estimation results for four birth cohorts are given in the table below.

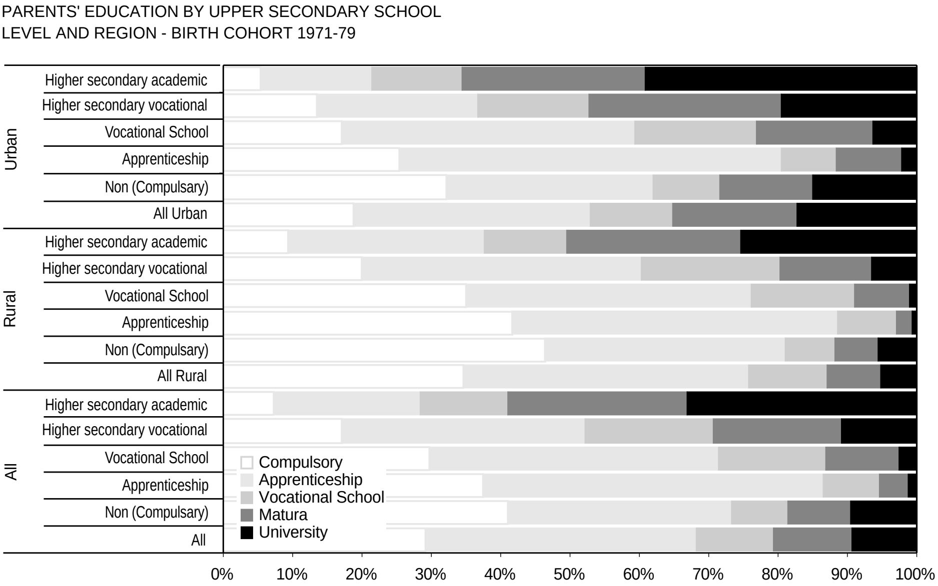
For students coming from a lower secondary school and obtaining a *Matura* diploma, a general decrease of the probability to obtain the diploma in an academic school can be observed for the last cohorts, expressed in the decrease of the constant term in the regression models. Urban-rural as well as gender differentials are low and statistically insignificant. In contrast, the differences by parents' education are pronounced and highly significant for the two highest educational groups, staying relatively stable over time for university graduates.

For students coming from a lower secondary academic school, again a change towards vocational and technical *Matura* diplomas can be observed for the most recent cohorts. While rural urban differences are not significant, males are generally more likely to attend technical and vocational schools. The differences by parents' education are pronounced and significant for the two highest educational groups. The influence of parents' education stayed very stable over the last three five-year-cohorts.

Educational composition of parents

The different probabilities of school choices regarding parents' education are also reflected in a very different educational composition of parents in different school types. In rural areas, almost half of the students leaving the educational system after finishing compulsory school have parents who also attended compulsory school only. In urban secondary academic schools, only 5% of the students have parents with this educational background, while almost 40% have parents with university education. The educational background of parents is generally higher in urban areas. A high homogeneity of parents' education can be found for the apprenticeship group: 80% (urban) to 90% (rural) have parents with apprenticeship training or compulsory education.

Figure 22: Educational Composition of parents by upper secondary school attainment



Source: Micro Census June 1996 special program on education; own calculations

4.2 Comparison of findings with other studies on education in Austria

The second educational choice is acknowledged to be of tremendous importance, since it already determines the final educational attainment and the access to higher education to a great extent. The second educational choice acts like a filter. The chance of higher education largely depends on the choice made on the second educational level (Bauer, 1996; Landler, 1997; Lechner & Reiter, 1998; Wroblewski & Unger, 2003).

When we compare our findings regarding upper secondary education with other studies we have to consider that compulsory education consists of nine years, while elementary school and lower secondary school take eight years only. This fact makes comparisons of rates quite difficult. Many students who do not intend to continue their education often use the first year of upper secondary schools and colleges as substitute for the regular 9th grade of compulsory education, namely the prevocational school. In this case we consider these individuals as school leavers after compulsory education. As a consequence, our results show lower numbers in upper secondary school attendance compared to period measures on school enrollment.

Biffl (2002) calculates the transition rates from compulsory education to the subsequent education level. A rough comparison of our findings with the results of Biffl is provided in the following table. While the rates cannot be compared directly due to different definitions and observation periods (we compare graduation rates of the birth cohorts 19965-79 with period school transition rates of the school year 1988/89), some interesting observations and interpretations can be derived.

Table 9: Transition rates from secondary schools and secondary academic schools to further education (in%)

Transition from ... to ...		Biffl	ÖIF
		School year 1988/89 **Transition rates**	Cohort 1965-79 **Graduation rates**
Secondary school	no further education	*21.7*	14.9
	Apprenticeship	49.3	53.9
	Vocational or technical school	20.3	14.2
	Vocational or technical college	8.0	12.7
	Secondary academic school	0.7	4.2
	Total	**100**	**100**
Secondary academic school	no further education	*3.2*	11.7
	Apprenticeship	9.7	5.3
	Vocational or technical school	9.7	8.8
	Vocational or technical college	38.7	23.6
	Secondary academic school	38.7	50.6
	Total	**100**	**100**

Source: Biffl (2002), micro census 1996, own calculations

The most dominant educational track for those who attended a lower secondary school is an apprenticeship training. In contrast to the fulltime school system, the supply of apprenticeship trainings is market driven and can involve waiting periods, which students spend either outside the school system (accounted for "no further education" in Biffl's calculation) or in fulltime schools, most typically of the vocational and technical type. This fact might explain the differences in transition rates of the first three educational tracks. We also find a considerable difference regarding students obtaining a *Matura*. This indicates that many students who initially enrolled in other schools or temporarily left the school system finally attend schools leading to a *Matura*.

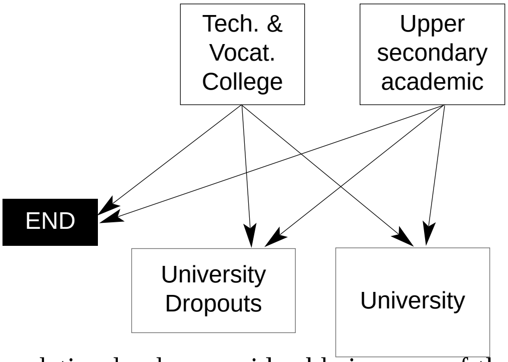
For students who attended a lower secondary academic school, apprenticeship-trainings are of minor importance and the comparison of data indicate that almost half of the students starting an apprenticeship training do not finish it or also obtain a higher secondary degree. The differences of rates regarding vocational and technical colleges can be explained by the very high dropout rates in this school form. The comparison of rates indicates that most dropouts obtain an academic *Matura* instead, while a considerable proportion also increases the group of “no further education”.

Landler (1997, p.35ff) examined the attendance of the two school types that lead to a *Matura* diploma, namely secondary academic school and secondary vocational college. He observed a steady shift from secondary academic schools towards vocational and technical colleges over the last decades. In the school year 1994, around 55% of all males and 50% of all females who obtained a *Matura* diploma attended vocational or technical colleges. Our data show similar results: for the graduation cohort 1990-94, 49% of all males and 47% of all females who obtained a *Matura* diploma attended vocational or technical colleges.

5 University Education

The third educational transition regards the decision of students having passed the *Matura* diploma to continue education by enrolling — and graduating — from university. Due to the high dropout rates in Austria, ranging at around 50%[6] and the high variance of study durations that usually lie considerably higher than the regular time foreseen by study plans, the following analysis also includes study durations. In contrast to the previous school careers, dropout rates and study durations have to be explicitly taken into account also due their high dependence on socio-demographic factors like gender and social background.

Figure 23: The third educational decision: University enrollment



On the population level, a considerable increase of the proportion of university graduates in successive birth cohorts can be observed that more than doubled in the second half of the last century. Female enrollment rates that have only been one third of the male rates for the 1930-39 birth cohort have already drawn level with the male rates. Another change over time are the long and increasing durations until graduation, that, besides the high dropout rates can be seen as a second typical — and problematic — feature of the Austrian university system[7]. Regarding enrollment durations, some gender differences can be observed: female students both study faster — or drop out faster. Accounting for parents' education, the analysis reveals that the strong intergenerational transmission

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[6] Dropout rates are underreported in the micro census compared to administrative university inscription and graduation data. This analysis based on micro census data assumes that un-reported university inscriptions have no impact on the other behaviors studied, i.e. they are interpreted as having a negligible effect on other life course careers e.g. due to shorter durations or low time commitments.

[7] This study does not distinguish between university degrees (Master, Doctorate) and therefore master programs followed by a doctoral study are treated as one educational spell.

mechanism within families already in place at prior educational choices is reinforced at the decision regarding university enrollment and graduation. Put differently, also the enrollment and graduation rates of people already meeting the admission requirements for university vary considerable regarding the parents' education.

5.1 Graduation rates

In the following analysis the graduation rate is defined as the percentage of students who finished the higher secondary academic school or a vocational or technical college — both leading to a *Matura* diploma — and who continue their education by enrolling and graduating from a university program. As shown in the table below, the graduation rates are highly dependent on the previous school, municipality type and gender and follow different patterns over time.

Table 10: University graduation rates by *Matura* type, gender and municipality type

			1940-44	**1945-49**	**1950-54**	**1955-59**	**1960-64**
Rural	Female	Vocational or Technical *Matura*	11.8% (n=17)	4.3% (n=23)	10.8% (n=37)	0.0% (n=66)	1.0% (n=98)
		Academic *Matura*	46.2% (n=13)	22.7% (n=22)	15.9% (n=63)	18.9% (n=74)	20.7% (n=82)
	Male	Vocational or Technical *Matura*	12.1% (n=33)	16.7% (n=36)	12.5% (n=40)	9.3% (n=54)	17.3% (n=75)
		Academic *Matura*	72.2% (n=36)	60.0% (n=25)	45.3% (n=64)	40.0% (n=75)	40.5% (n=79)
Urban	Female	Vocational or Technical *Matura*	0.0% (n=35)	6.7% (n=45)	11.1% (n=27)	8.5% (n=47)	8.6% (n=58)
		Academic *Matura*	28.6% (n=63)	29.0% (n=62)	26.2% (n=65)	40.4% (n=94)	41.3% (n=104)
	Male	Vocational or Technical *Matura*	25.6% (n=43)	5.4% (n=37)	22.2% (n=45)	18.3% (n=60)	17.1% (n=70)
		Academic *Matura*	46.8% (n=79)	66.2% (n=68)	47.9% (n=73)	44.2% (n=77)	47.7% (n=88)

Source: Micro census 2/1996 special program on education; own calculations

Due to the small sample size not permitting a meaningful further disaggregation of data, a logistic regression model was calculated in order to study the influence the parents' educational attainment and the general time trend regarding the graduation rates of eight groups built by gender, municipality type and previous schooling.

Table 11: Logistic regression for not graduating from university

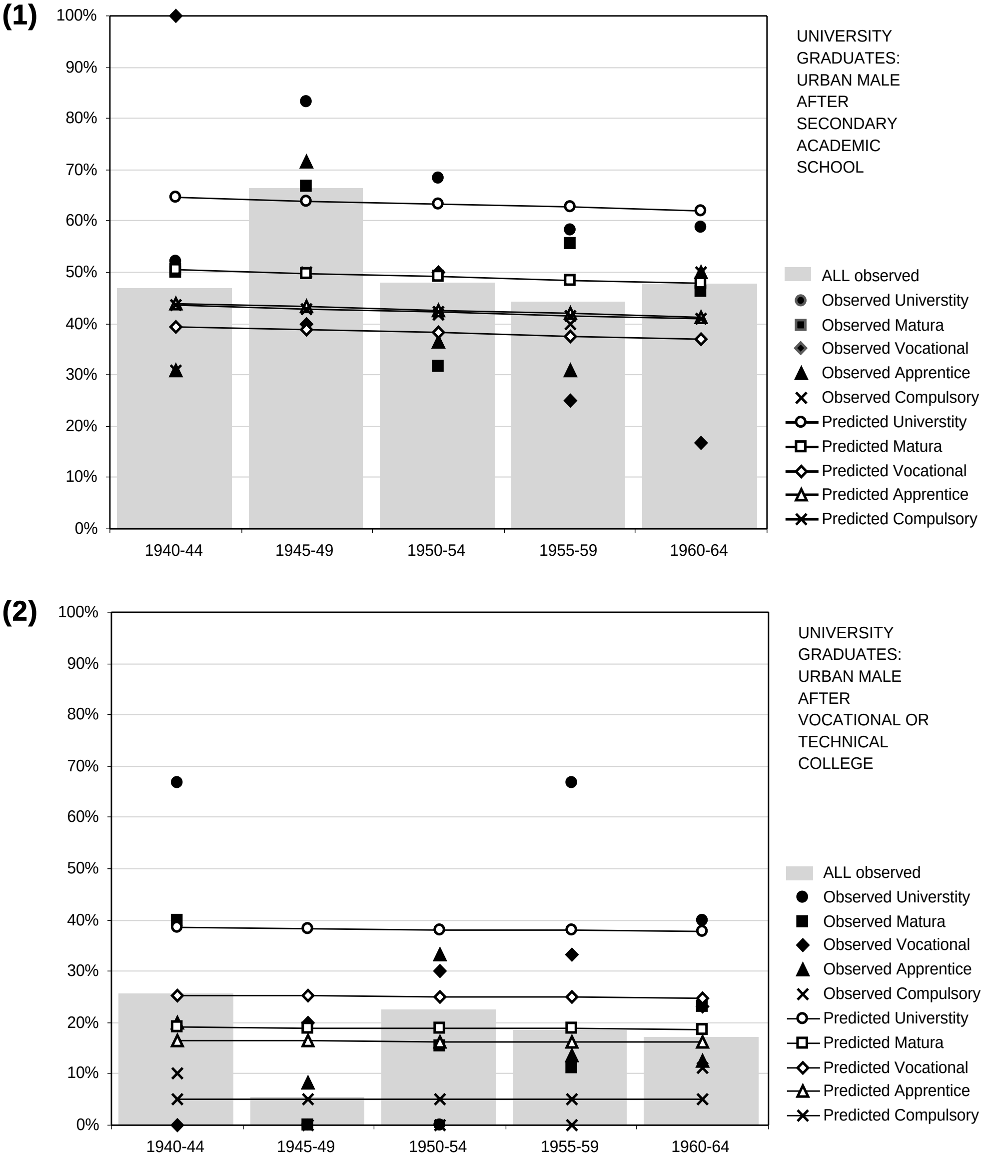
	Urban Male Secondary Academic School	**Urban Male Vocational or Technical College**	**Urban Female Secondary Academic School**	**Urban Female Vocational or Technical College**	**Rural Male Secondary Academic School**	**Rural Male Vocational or Technical College**	**Rural Female Secondary Academic School**	**Rural Female Vocational or Technical College**
Intercept	0.125 (0.582)	2.895** (1.141)	3.848*** (0.793)	5.475*** (1.913)	-2.058*** (0.791)	1.819* (1.063)	1.546 (1.154)	-0.758 (2.156)
Cohort	0.027 (0.076)	0.007 (0.126)	-0.308*** (0.090)	-0.228 (0.218)	0.348*** (0.105)	-0.023 (0.139)	0.112 (0.142)	0.625** (0.285)
University	-0.859** (0.335)	-2.460*** (0.854)	-1.937*** (0.447)	-2.389** (1.211)	-1.026** (0.411)	-0.058 (0.832)	-2.345*** (0.527)	-1.298 (1.305)
Matura	-0.276 (0.335)	-1.487* (0.806)	-0.699 (0.456)	-0.628 (1.244)	-0.630 (0.389)	1.343 (1.063)	-2.145*** (0.533)	-1.598 (1.008)
Vocational	0.170 (0.467)	-1.850** (0.815)	-0.771 (0.533)	-2.599** (1.116)	-1.696*** (0.535)	0.477 (0.674)	-0.936 (0.601)	17.894 (0.000)
Apprenticeship	-0.016 (0.365)	-1.308* (0.788)	-0.511 (0.480)	0.154 (1.436)	-0.212 (0.360)	0.103 (0.449)	-0.712 (0.536)	-0.674 (1.026)

*Models estimated from June 1996 Micro Census data; significance levels are indicated by *** over 99%, ** over 95% and * over 90%*

Regression results indicate a clear ranking of probabilities by parents' education. Especially the influence of parents having academic education is highly significant in most groups. Looking at the time trends in different groups, an interesting pattern arises.

No time trend can be found for urban male students. This means that the rising number of students obtaining a *Matura* diploma can be directly translated into higher numbers of university graduates, as graduation rates remained unchanged over time. Graduation rates are highest for students with parents that graduated from university and vary from 40% to 65% (academic *Matura*) or 5%-40% (vocational and technical *Matura*) respectively.

Figure 24: Observed and estimated graduation rates for urban males coming from (1) a secondary academic school and (2) vocational or technical colleges

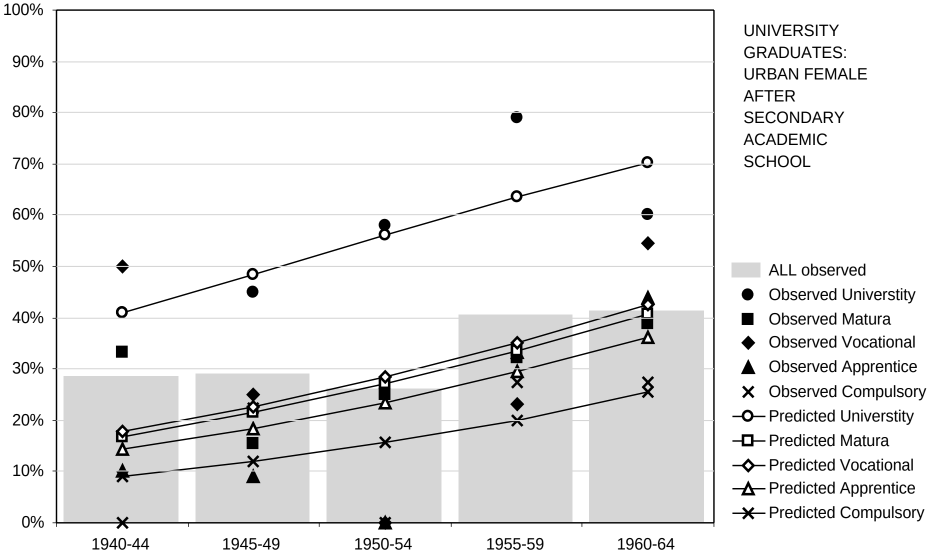


Source: Logistic regression models estimated from June 1996 Micro Census data; own calculations

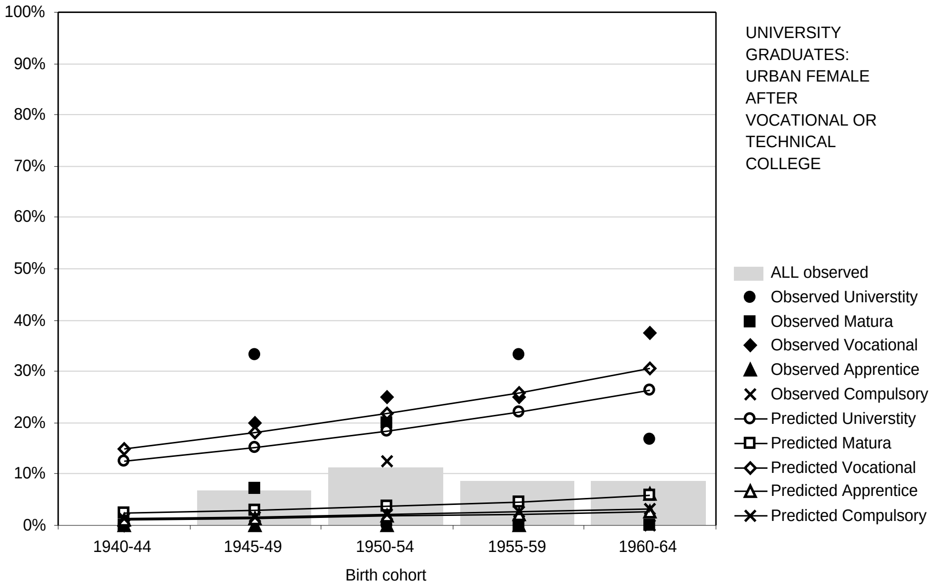
A very different picture emerges for urban females. In this group graduation rates increased considerably over the last decades and the influence of parents' education is even more pronounced, with university graduation rates ranging from 25% to70% for students with an academic *Matura*.

Figure 25: Observed and estimated graduation rates for urban females coming from a (1) secondary academic school and (2) vocational or technical colleges

(1)



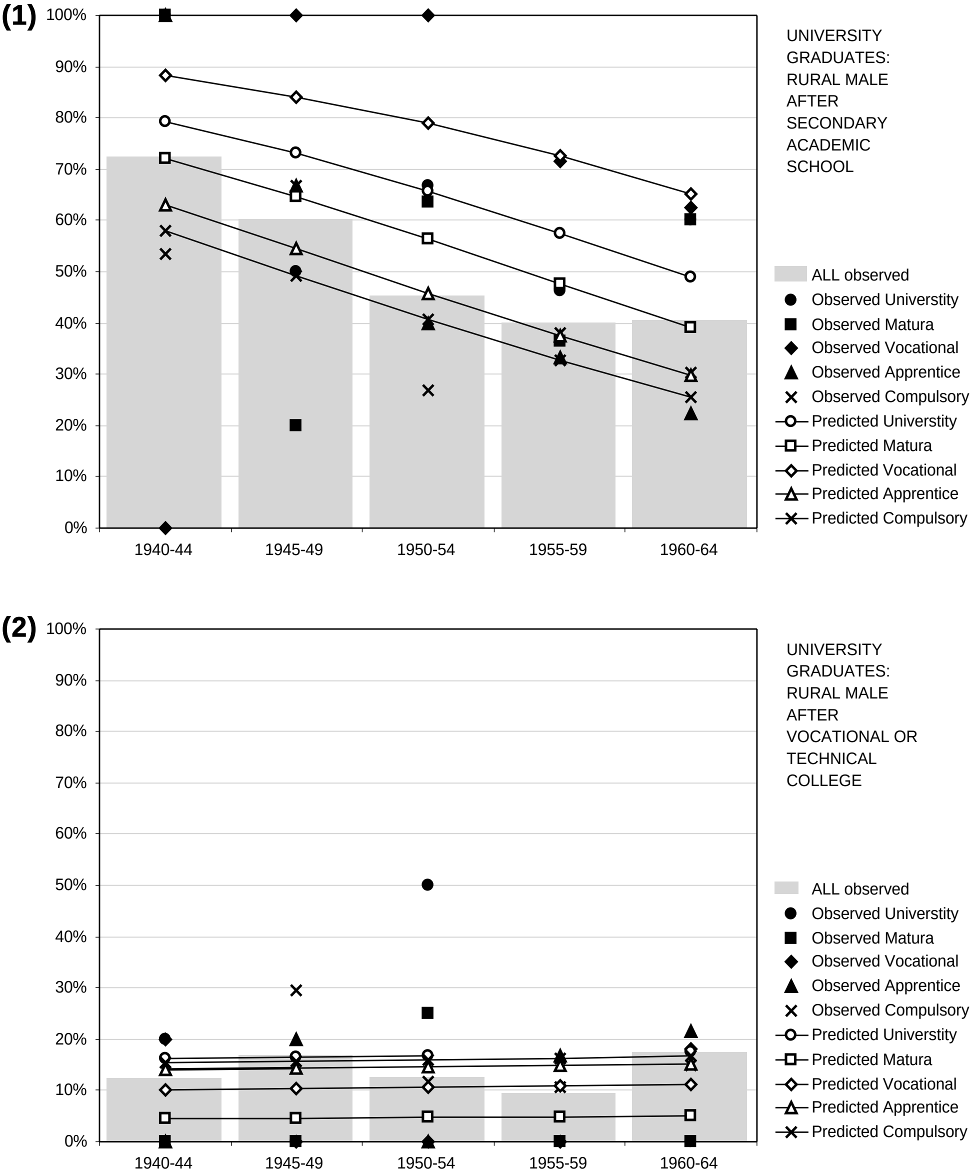
(2)



Source: Logistic regression models estimated from June 1996 Micro Census data; own calculations

For rural males with an academic *Matura*, graduation rates decreased considerably over time. While attending secondary academic school was almost exclusive to rural males in the past and most of them (70%) went on to university, graduation rates dropped and stabilized at “urban levels”. No such change can be observed for students from vocational and technical colleges, for whom graduation rates remained stable at the same level as in urban areas.

Figure 26: Observed and estimated graduation rates for rural males coming from a (1) secondary academic school and (2) vocational or technical colleges

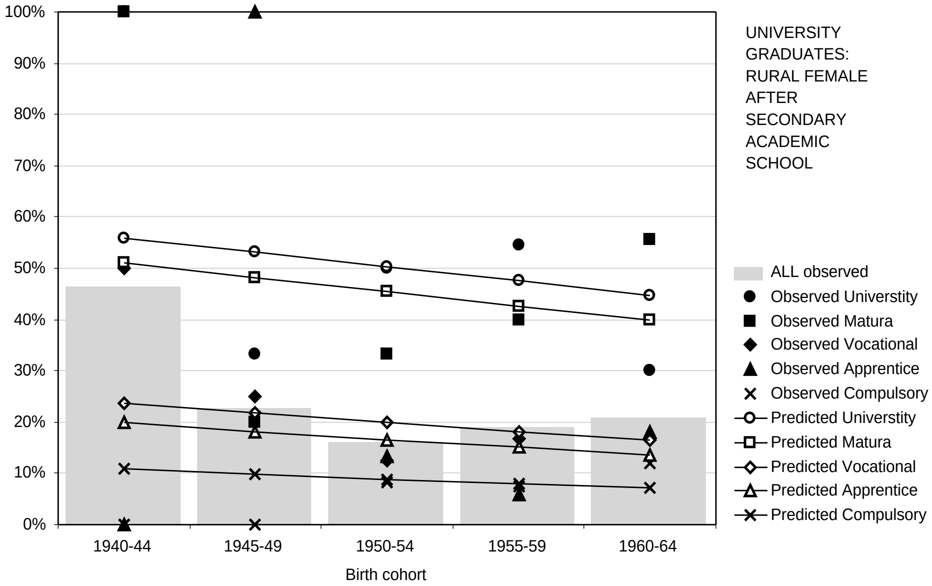


Source: Logistic regression models estimated from June 1996 Micro Census data; own calculations

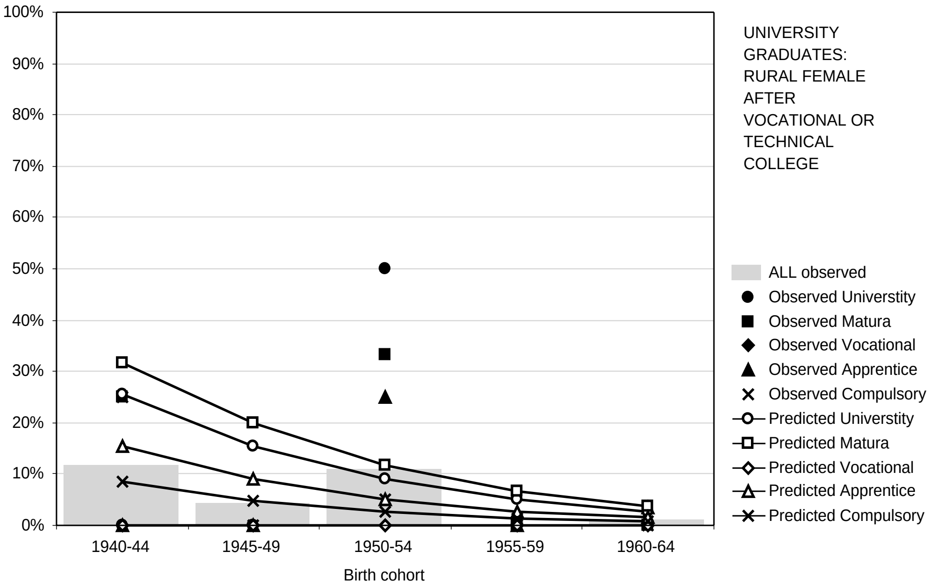
For students with an academic *Matura* diploma, graduation rates are lowest for rural females that only reach half the level of all other groups whose rates converged over time at around 40%. While the time trend is not significant for this group, parents' education has a highly significant and very pronounced impact on graduation rates that range from 8% to 45% with a clear ranking by parents' educational level. Graduation rates are lowest for rural females after vocational and technical colleges.

Figure 27: Observed and estimated graduation rates for rural females coming from a (1) secondary academic school and (2) vocational or technical colleges

(1)



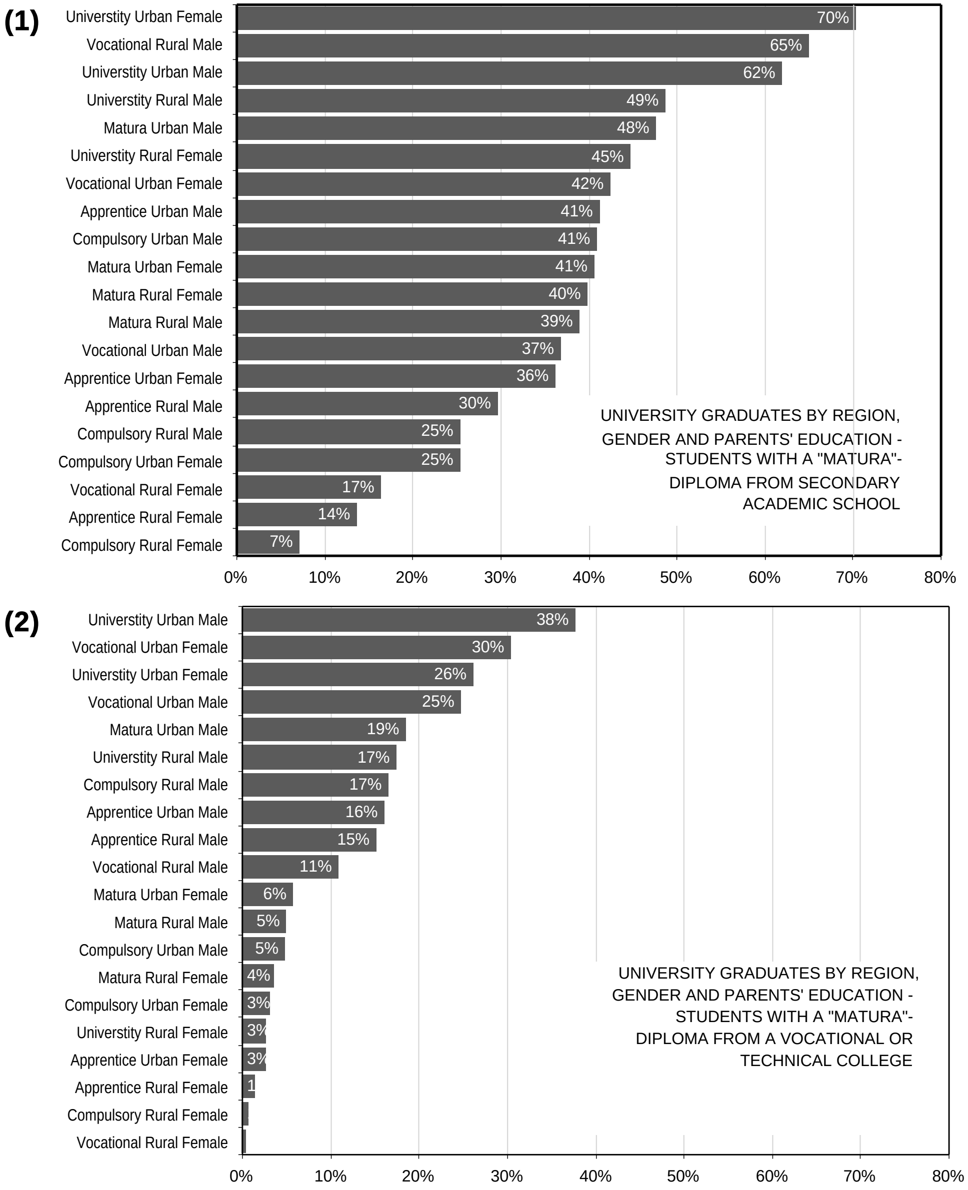
(2)



Source: Logistic regression models estimated from June 1996 Micro Census data; own calculations

The following figure summarizes the (estimated) graduation rates for all groups considered.

Figure 28: Estimated graduation rates after a (1) secondary academic school and (2) vocational or technical colleges



Source: Logistic regression models estimated from June 1996 Micro Census data; own calculations

5.2 University dropouts

Studies done by Landler (1997) reveal very high university dropout rates of around 50%. In the micro census, dropout rates are underreported compared to administrative university inscription and graduation data. The present analysis based on micro census data assumes that unreported university inscriptions have no impact on the other behaviors studied, i.e. they are interpreted as having a negligible effect on other life course careers e.g. due to shorter durations or low time commitments. Although university dropouts do not reach an additional educational level beyond the *Matura* diploma, their explicit consideration in the microsimulation model developed below is necessary in order to avoid distortions regarding the school leaving age that has a key impact on the timing of births.

Regarding dropout rates measured as percentage of students enrolled at university without graduation, no significant time trend could be observed in the micro census data. In the following, a logistic regression model will be used to estimate dropout probabilities using municipality type, gender and parents' education as covariates.

Table 12: Logistic regression for finishing university once enrolled

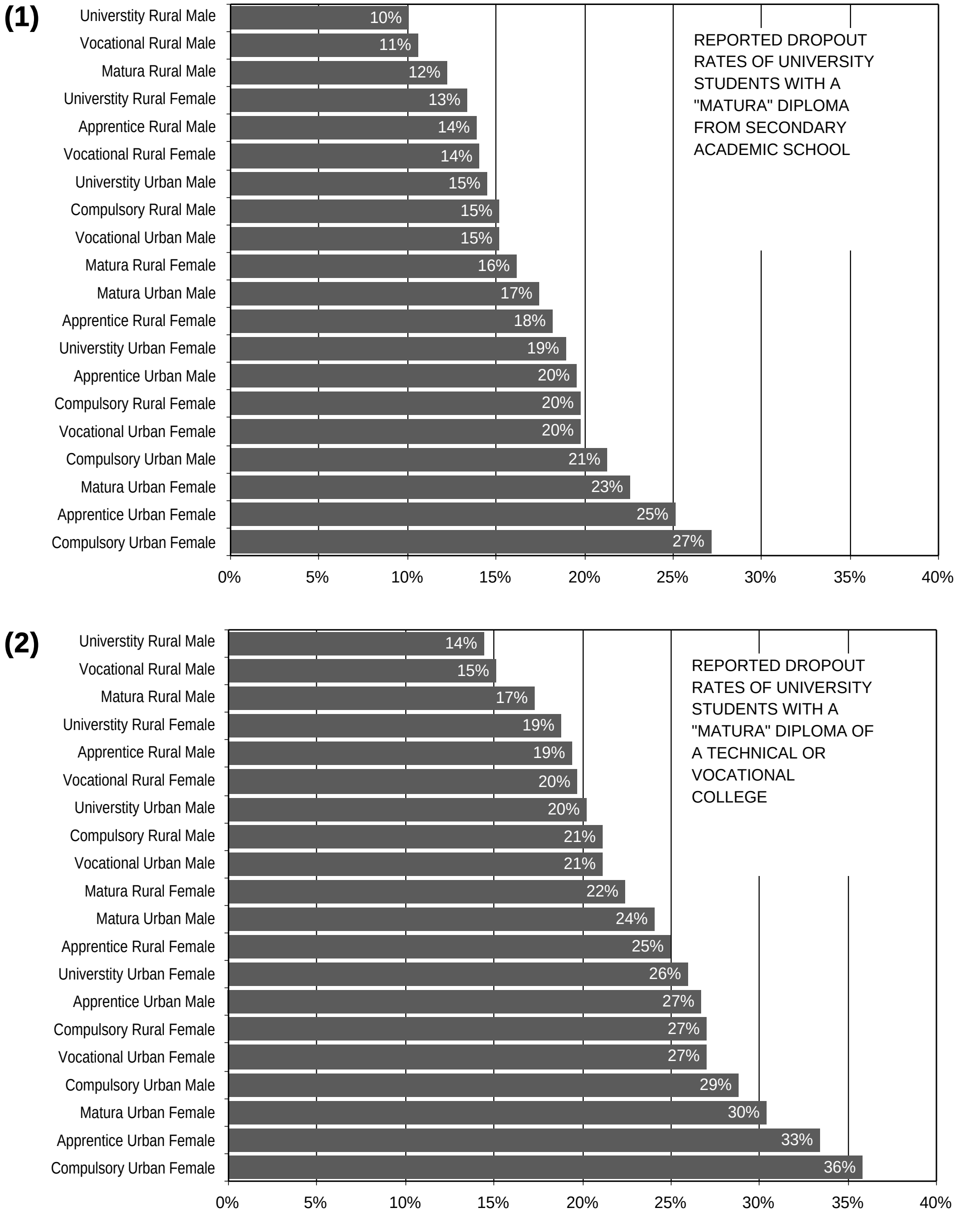
	B	Std. Error	Wald	Sig.	Exp(B)
Intercept	1.3051	0.2692	23.5101	0.0000	
Female	-0.3206	0.2067	2.4059	0.1209	0.7257
Rural	0.4120	0.2233	3.4037	0.0651	1.5098
Academic *Matura*	-0.4036	0.2495	2.6166	0.1057	0.6679
Parents University	0.4666	0.3130	2.2219	0.1361	1.5946
Parents *Matura*	0.2475	0.3164	0.6118	0.4341	1.2808
Parents Vocational School	0.4118	0.3882	1.1252	0.2888	1.5096
Parents Apprenticeship	0.1063	0.3178	0.1119	0.7380	1.1122

Models estimated from June 1996 Micro Census data

While the significance of estimation results is rather low, results are intuitive: dropout rates are lower for students having a vocational or technical *Matura* diploma, which can be explained by a stronger selection mechanism, as considerably fewer students of this group enter university. The same might hold true for rural students.

The following figure summarizes the (estimated) dropout rates for all groups considered.

Figure 29: Estimated university dropout rates after a (1) secondary academic school and (2) vocational or technical colleges



Source: Logistic regression model estimated from June 1996 Micro Census data; own calculations

5.3 Study durations

With a mean value of 7.3 years for the graduation cohorts 1990-96, study durations in Austria far exceed the durations according to study plans in most fields of studies. Our analysis of study durations does not distinguish between university degrees (Master, Doctorate) and, therefore, master programs followed by a doctoral study are treated as one educational spell. The study durations reported in the micro census closely correspond to the study durations based on administrative data. Landler (2000) calculated median study durations of 7.5 and 10 years respectively until obtaining a Master or Doctoral degree respectively.

Durations are longer for male students, for students with an academic *Matura* diploma and for students coming from urban areas.

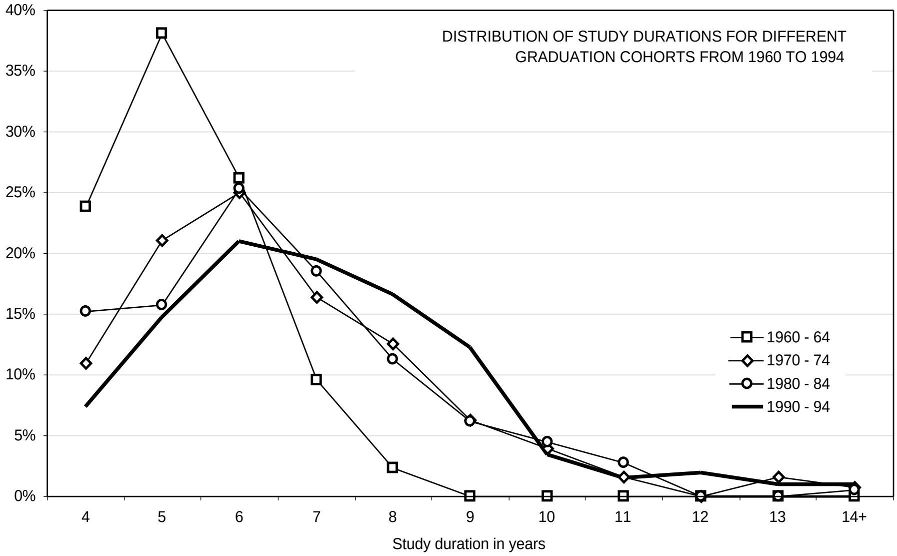
Table 13: Average study duration; graduation cohorts 1990-96

		Female	Male	All
Rural	Technical or Vocational College	5.6	7.0	6.8
	Secondary Academic School	6.8	7.6	7.2
	Total	6.7	7.4	7.1
Urban	Technical or Vocational College	6.2	6.2	6.2
	Secondary Academic School	1.1	8.0	7.6
	Total	7.0	7.7	7.4
Total	Technical or Vocational College	6.0	6.6	6.5
	Secondary Academic School	7.0	7.8	7.5
	Total	6.9	7.6	7.3

Source: Micro census 2/1996 special program on education; own calculations

As can be seen in the following figure, the distribution of study durations changed considerably over time with fewer and fewer students finishing within the regular time.

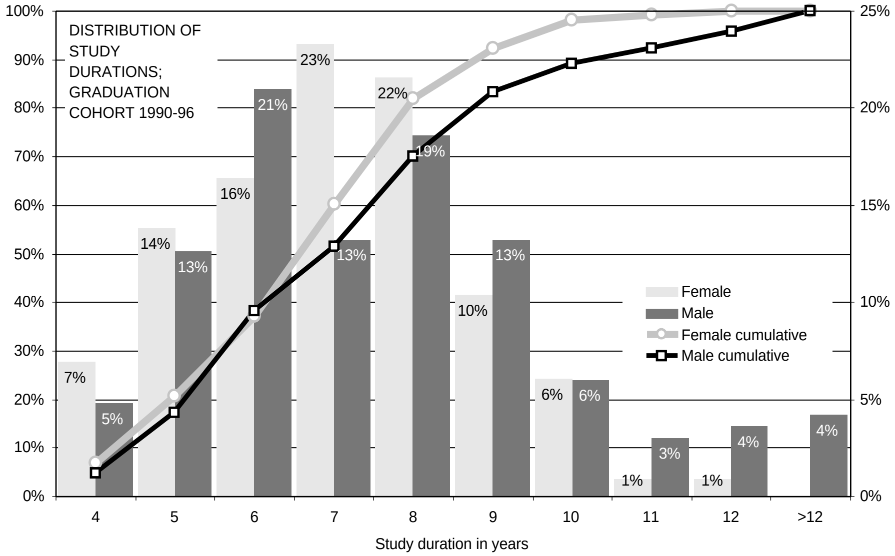
Figure 30: Distribution of study durations by graduation cohorts



Source: Micro census 2/1996 special program on education; own calculations

Gender differentials cannot only be found regarding the mean study duration but also regarding the shape of the duration distribution. While considerably more female students finish within the regular time, 40% of both male and female students finish their studies within a maximum of six years. Of the 60% of the students studying more than six years, male students stay considerably longer at university.

Figure 31: Distribution of study durations by gender, graduation cohort 1990-96

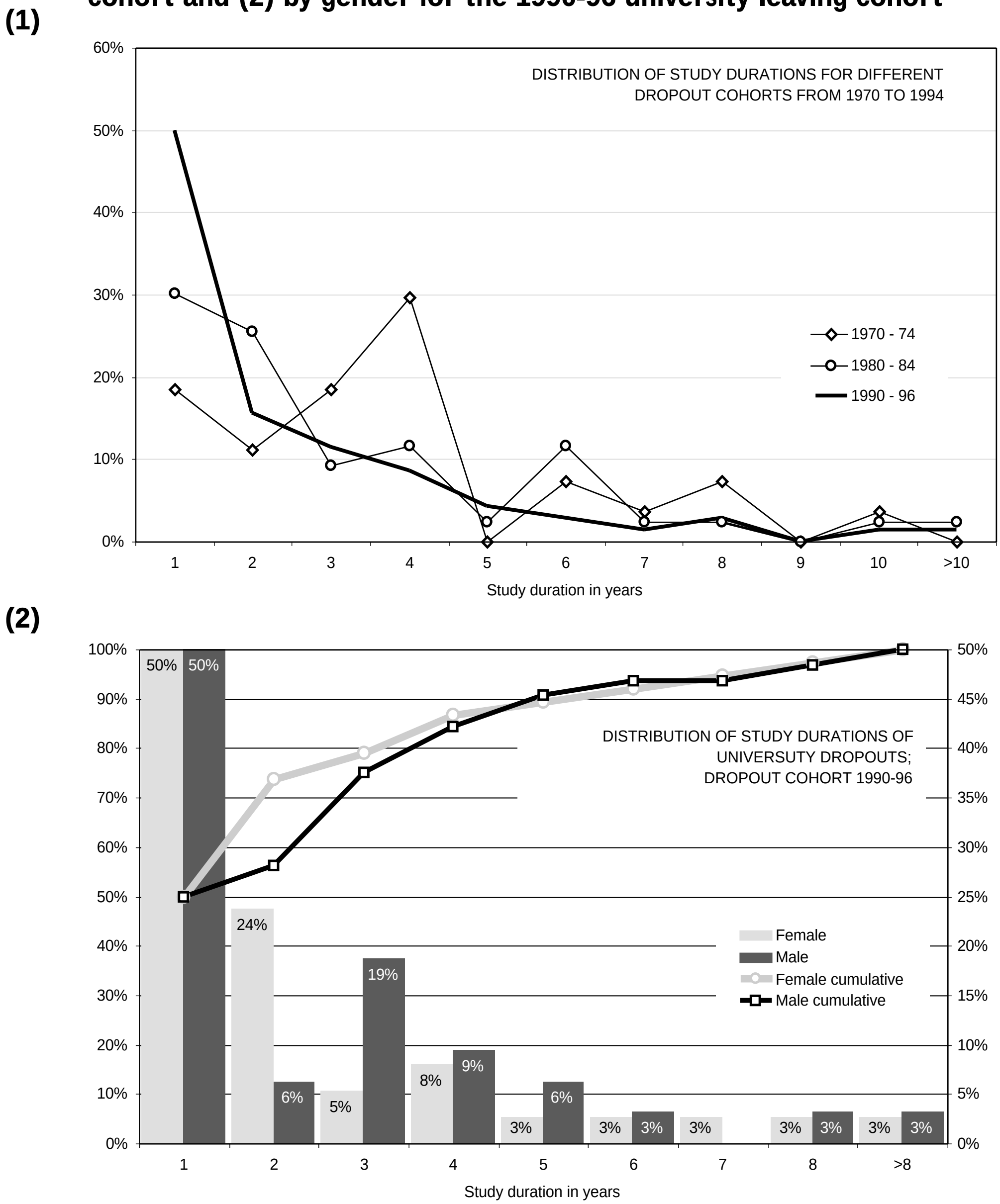


Source: Micro census 2/1996 special program on education; own calculations

5.4 Dropout durations

Enrollment durations of university dropouts decreased over time, with 50% of the students leaving university in 1990-96 in the first year. Female students drop out faster, with 75% (versus 56%) leaving university in the first two years.

Figure 32: Distribution of study durations (1) by university leaving cohort and (2) by gender for the 1990-96 university leaving cohort



Source: Micro census 2/1996 special program on education; own calculations

5.5 Comparison of findings with other studies on education in Austria

Wroblewski & Unger comprehensively analyzed the social background of first-year students and found that students of fathers with at least a *Matura* degree are over represented. While in 2001 45% (1990: 44%) of those enrolled had a father with higher education, this group comprises only 22% (1991: 14,8%) of the resident population (Wroblewski & Unger, 2003, p. 43). The authors remark that the selection process is observable even one step earlier, when regarding the social composition of school graduates with a *Matura* degree. The proportion of individuals coming from lower social levels, such as workers and farmers, is twice as high for graduates from vocational or technical colleges as those of secondary academic schools. Wroblewski & Unger (2003) also investigated differences in the regional background of students between universities and *Fachhochschulen* (universities of applied sciences). They conclude that the regional provenance of students enrolled in *Fachhochschulen* is more or less in accordance with the structure of Austrian inhabitants, while individuals from urban areas are over represented at universities.

Regarding the parents' education and profession, Dell'mour and Landler (2002) calculate success rates for different cohorts and find them with 58% to be highest for those students whose fathers also have an academic degree. The second-best prospect to graduate successfully from university have students whose fathers have a *Matura* degree (49%), followed by those with compulsory education as highest educational attainment. According to Dell'mour and Landler, students having a father who graduated from university or who holds a *Matura* degree have above-average success rates for the cohorts considered[8]. Our data confirm these findings but since in our analysis we do not only take into account the educational attainment of parents but additionally divide into gender and municipality type, we are able to make more precise statements. When regarding graduates of secondary academic schools who have grown up in rural areas and whose parents have a vocational education, we find males having very good prospects of graduating (65%), while not even a fifth of the females with the same characteristics obtains a university degree.

Looking at the gender ratio of graduates, Landler (1997) finds that 40% of the graduates are females. This proportion was constant during the period between 1989 and1993, and has increased only slightly in the years prior to 1989. Our data yield exactly the same proportions of about 60% of the male gradu-

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[8] Cohorts 1980-85. The analysis does not include apprenticeship trainings.

ates and 40% of the females, and, thus, are consistent with the findings of Landler.

Landler (1997, p. 85ff) also examined the transition rates from secondary academic school and vocational college to university. Due to the high dropout rates of around 50% and the fact that the university education was provided free of charge in the years considered (and the student status provided numerous privileges, e.g. free public transport), first year enrollment rates are not a good measure for the "true" numbers of students. As a matter of fact, first year enrollment rates differ significantly from our results. According to Landler, around 90% of the secondary academic school graduates enrolled at university in 1985, 1991 and 1995, compared to only around 60% in our data. For technical and vocational colleges, Landler's results are not comparable to our findings, since he divided them into different colleges types. However, one can find a similar discrepancy of the transition rates in both studies. Depending on the college type, between 33% and 57% of the graduates enrolled at university in 1991, whereas in our data only 29% reported university enrollment for the graduation cohort 1990-1994.

Our analyses do not include Fachhochschulen, since they were only introduced in 1994/95. According to Wroblewski & Unger (2003), *Fachhochschulen* differ considerably from universities as concerns the social structure and regional provenance of their students.

6 The final educational attainment: a summary

In the previous chapters we examined individual school transition rates at the main transition points of the Austrian educational system. In this chapter we will look at individual school careers as a whole and the final outcome of these transitions, that is, the highest educational attainment. Which educational level do individuals achieve considering their socio-economic background? To what extent are individuals able to improve their educational attainment compared to their parents' education?

This chapter is based on the observed and estimated graduation transition rates of the three previous chapters, which will also be used for the following educational projections (see chapter 3-5 for a discussion of rates and chapter 10 for the projections). In our model we distinguish 20 groups of students by gender, municipality type and parents' education.

Table 14: Final educational attainment by gender, municipality type and parents' education

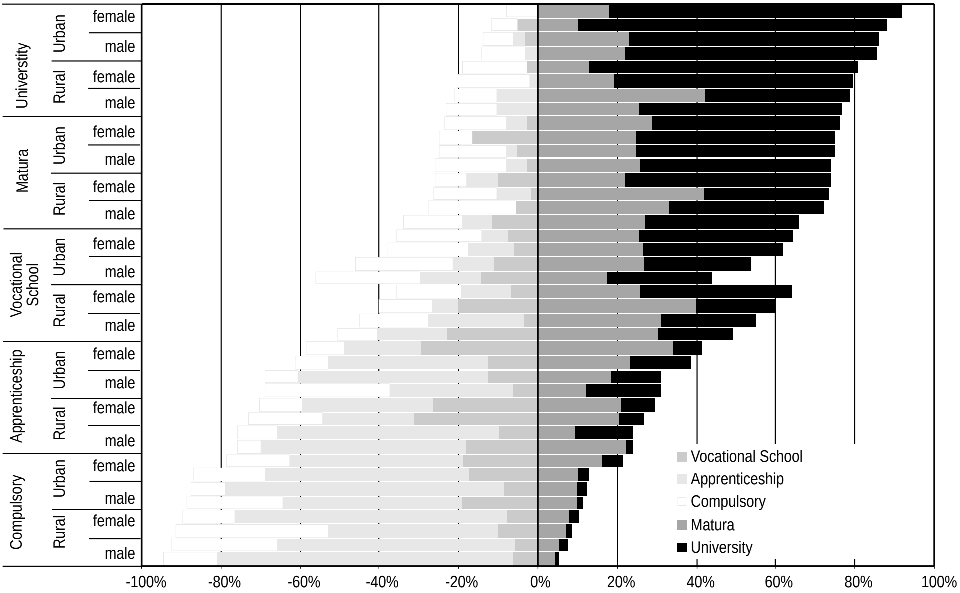
			Highest Completed Education				
Gender	Munici-pality	Education of Parents	Comulsory	Apprentice-ship	Vocational School	Matura	University
female	rural	Compulsory	24.5%	42.5%	18.7%	14.0%	0.3%
		Apprenticeship	15.9%	38.4%	17.6%	26.4%	1.6%
		Vocational School	14.2%	24.6%	19.9%	38.2%	3.1%
		Matura	10.6%	10.1%	10.8%	50.6%	17.9%
		University	16.2%	3.5%	3.9%	49.2%	27.2%
	urban	Compulsory	35.3%	35.2%	9.1%	17.9%	2.5%
		Apprenticeship	15.5%	40.2%	15.5%	22.9%	6.0%
		Vocational School	13.9%	12.3%	24.5%	31.0%	18.2%
		Matura	8.4%	8.7%	12.1%	51.3%	19.4%
		University	7.5%	1.0%	7.3%	31.5%	52.8%
male	rural	Compulsory	13.8%	70.6%	6.3%	7.4%	1.8%
		Apprenticeship	10.7%	62.9%	8.7%	14.2%	3.5%
		Vocational School	8.1%	42.7%	14.7%	26.4%	8.1%
		Matura	13.1%	19.8%	8.6%	44.0%	14.5%
		University	11.0%	7.8%	1.1%	48.0%	32.2%
	urban	Compulsory	23.6%	50.4%	4.3%	17.3%	4.3%
		Apprenticeship	13.1%	57.1%	6.0%	16.9%	6.9%
		Vocational School	12.5%	32.7%	6.5%	32.7%	15.6%
		Matura	14.5%	21.2%	6.3%	37.1%	20.9%
		University	20.6%	7.3%	1.1%	31.3%	39.7%

Source: Micro Census 1996-2; own calculations

The following figure gives a graphical representation of the final educational attainment by gender, municipality type and parents' education. In this graph we additionally group the final educational attainments by those with and without a *Matura* diploma (right and side bars respectively).

When doing so, we found the probability of obtaining a *Matura* degree or graduating from university almost ordered by parent's education. However, within each level of parental education, considerable variation remains, caused by municipality type and gender.

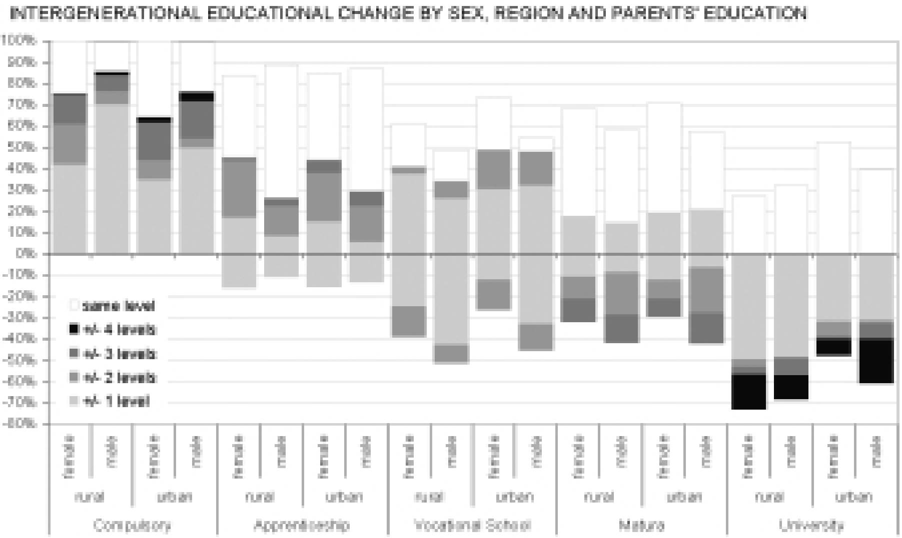
Figure 33: Final educational attainment by gender, municipality type and parents' education



Source: Micro Census 1996-2; own calculations

An alternative way of looking at the data is by asking, how many children obtain a higher, equal or lower education than their parents'. In contrast to the comparison of rates of different educational attainments that indicate considerable socio-economic differentials and, therefore, a strong intergenerational persistence of educational attainments within families, the representation these data rather highlights the existing social dynamics.

Figure 34: Intergenerational educational change



Source: Micro Census 1996-2; own calculations

In the group of students with parents having only compulsory education, about three-quarters obtain a higher education. There are considerable gender differentials with females, who are more likely to attain compulsory education only. The highest intergenerational persistence of educational attainments can be found in the apprenticeship group: almost two-thirds of the rural males of this group follow the same educational track. On the other side of the educational spectrum we find the offspring of university graduates who can only keep their parents' educational level or fall below. Urban females are most likely to graduate from university (53%), but on average around 60% do not reach the same educational level.

A second observation regards the degree of the intergenerational differences of educational attainments. Most changes are one-level-changes, e.g. if parents have compulsory education, most of the offspring who attain a higher educational level move into the apprenticeship group (83% of rural males). On the other side, more than 70% of the offspring of university graduates who do not graduate from university obtain a *Matura* diploma.

As already pointed out, the individual transition rates have stayed almost unchanged for the past two decades. Thus, the social dynamics can be assumed to be time-invariant. What does this mean for the future? Assuming unchanged behavioral relations on the micro level also for the future, the population will reach a stable equilibrium regarding its educational composition. This long-term equilibrium — and the speed at which it is reached — is determined by the social dynamics. How will the resulting educational composition of the population look like? This question will be discussed in chapter 10, in which we will project the transition path under this status quo assumption.

7 The influence of education on partner choice

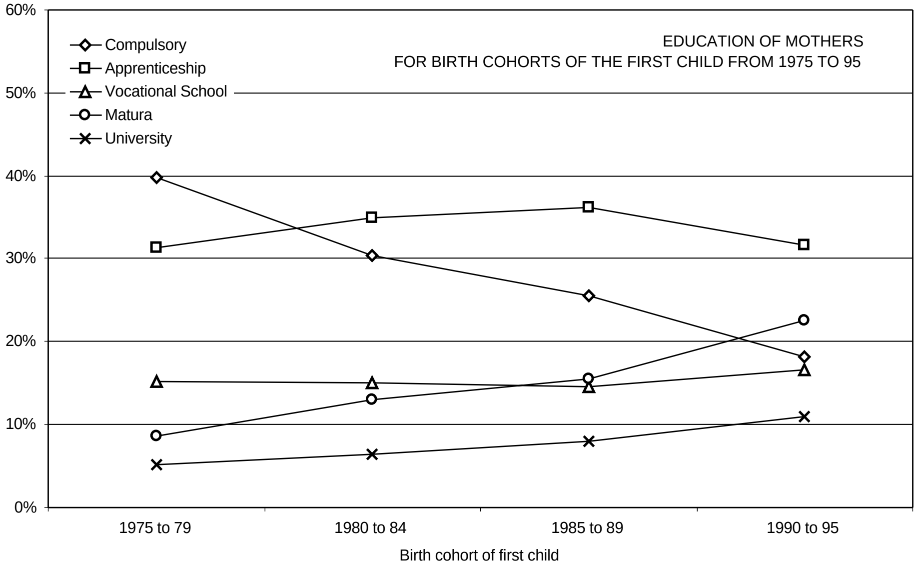
Finding appropriate partner matches is of great importance, as they will highly influence the prediction power of a model that includes intergenerational transmission processes within families. In the application developed here, it is the highest educational attainment of both parents that, besides gender and municipality type, influences the educational decisions modeled. Different microsimulation models use a wide variety of variables in order to model partner matches. Education plays a key role in almost all models that include the modeling of partner matches, as education attainment is usually seen as an indicator of differences between individuals in many dimensions, like talent, income potential, social status and class or individual autonomy, that all influence preferences regarding the partners' characteristics. We might assume that both partners usually come from the same or a close educational group, which, as will be shown below, holds true for Austria. At the same time, matching patterns change over time even without changes in preferences, if the population composition changes, e.g. due to the increasing educational attainment of women. Therefore, we will have to look at changes over time and determine, if there are ongoing dynamics that have an impact on future matching patterns. The second variable studied below is the age difference of couples. As will be seen, the distribution of this variable is highly influenced by the age at partnership formation. Following a closed population model, all matches have to be found within the population sample which enforces more consistency, given a population large enough to find appropriate matches.

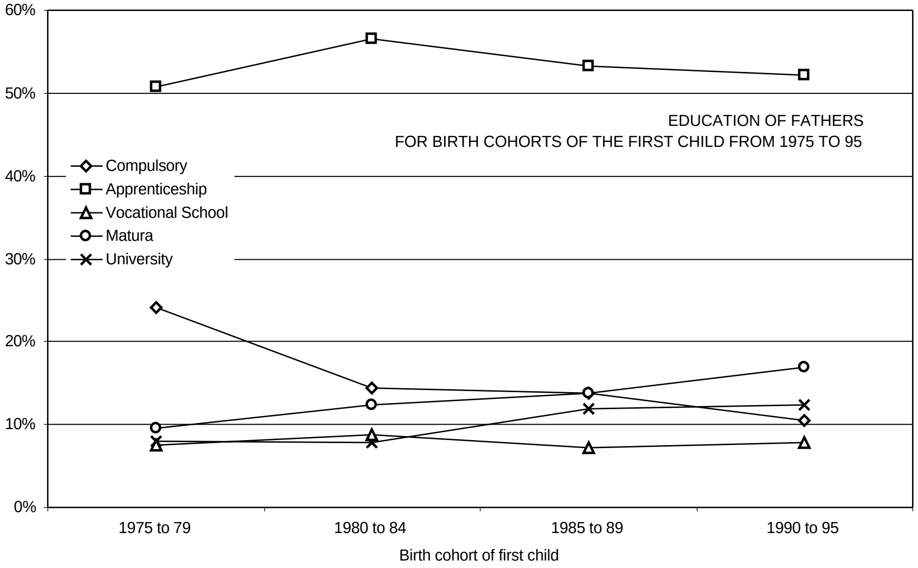
7.1 Partner Matching by Education

In the following analysis we focus on couples with children. Due to data restrictions that do not allow to determine the time of partner formation (information is given only for married couples by the marriage date), the birth date of the youngest child is taken as reference point in the analysis.

Over the last decades an increase of educational attainments can be observed for both male and female partners, but for women it is especially pronounced. From 1975 to 1995 the percentage of mothers with compulsory education only more than halved, while the two highest educational groups (*Matura* and university) more than doubled. For men the same holds true regarding compulsory education, even though they start at a much lower level.

Figure 35: Educational attainment of mothers and fathers for five year birth cohorts of the first child from 1975 to 1995



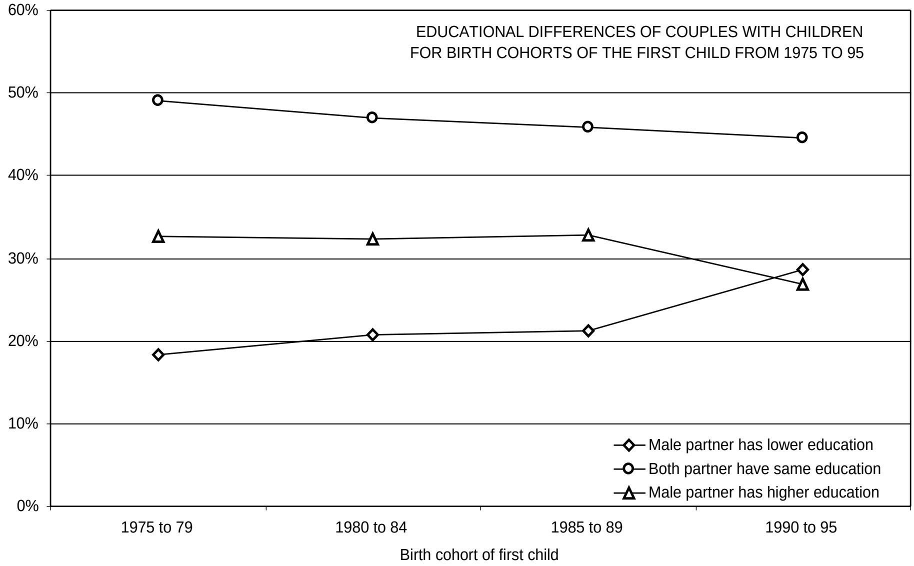


Source: Micro Census June 1996 special program on education; own calculations

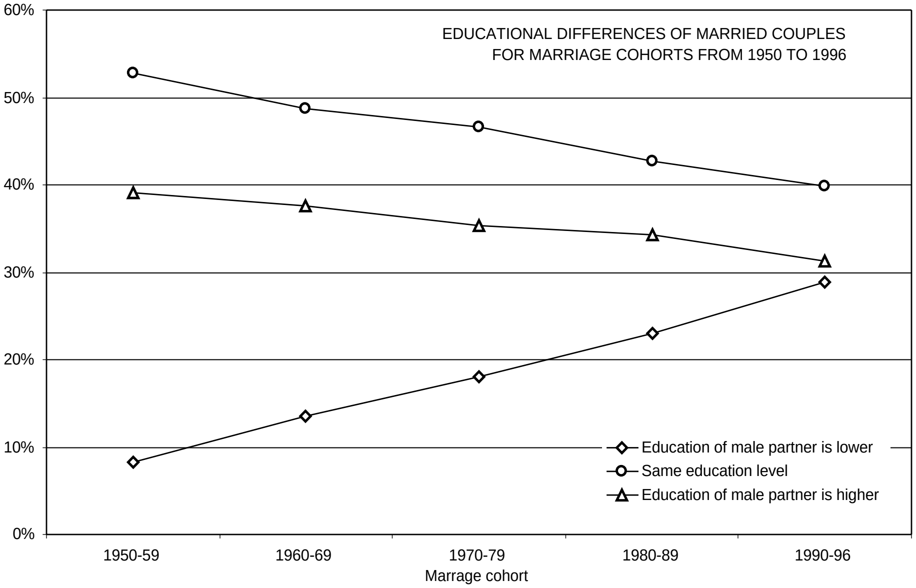
The change in the educational composition of the population implicates changes of the matching patterns of couples over time. This change can be described as a move from an asymmetric educational composition of couples, with many women having a partner with a higher education and only few women having a partner with lower education, to a symmetric situation, in which both groups are of the same size. This change can be observed both in marriages and for couples with children. For married couples, the percentage of women having partners with a higher education decreased from initially 40% to 30% over the last five decades, while the percentage of women having partners with a lower education increased from below 10% to 30%, resulting in a symmetric pattern. The same holds true for couples with children, as displayed in the following figure.

Figure 36: Educational differences of (1) couples with children over birth cohorts of first child and of (2) married couples by marriage cohort.

(1)



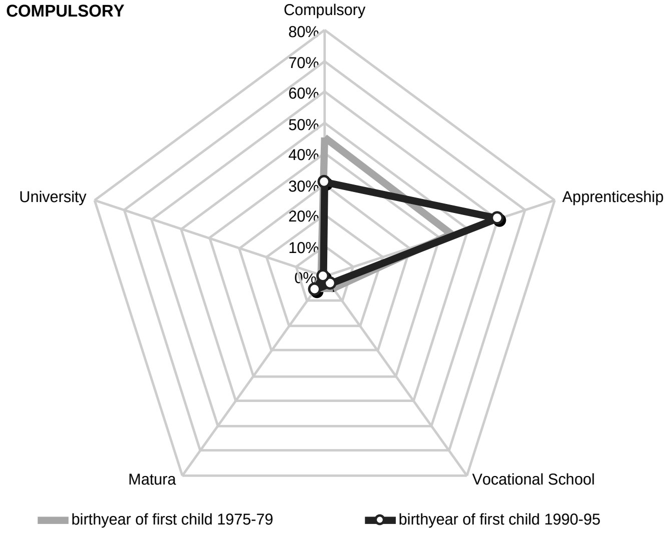
(2)

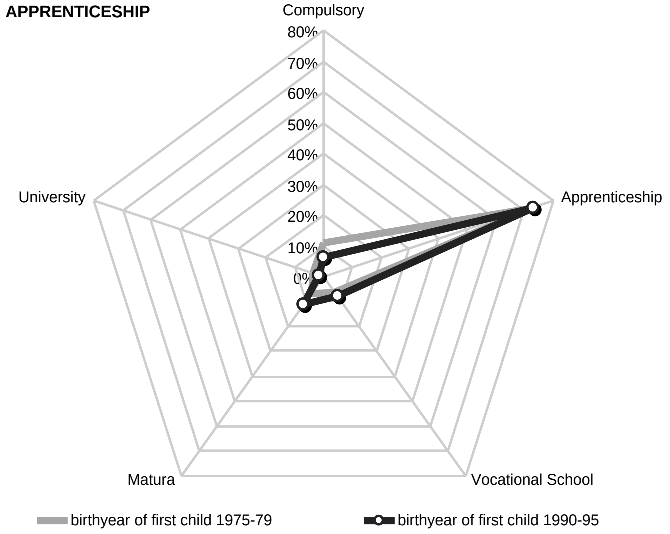


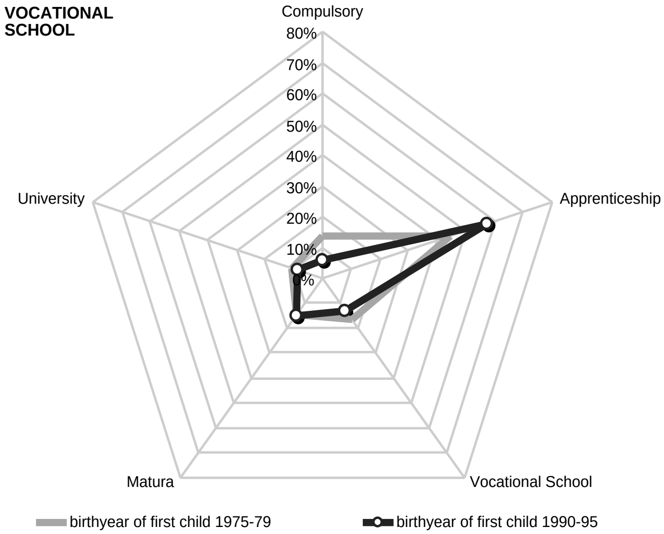
Source: Micro Census June 1996 special program on education; own calculations

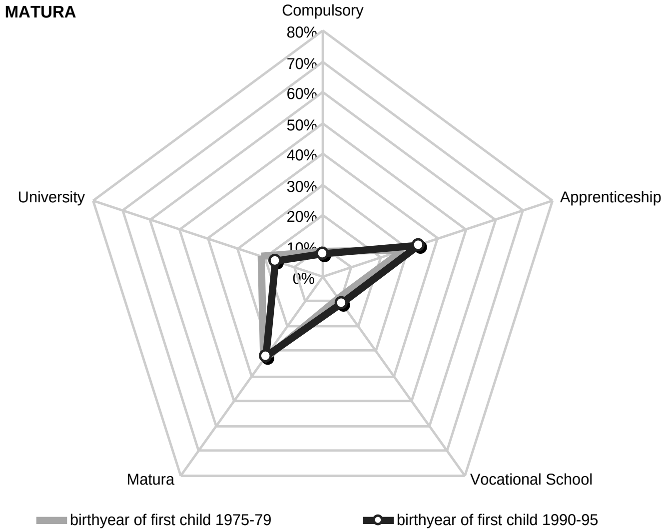
A comparison of matching patterns of couples with children over time reveals that most changes occurred in the lowest and the highest educational groups. Between 1975-79 and 1990-95 (using the birth year of the youngest child as reference) the probability of having a partner from the same educational group decreased from 45% to around 30% for women with compulsory education. The highest probability of having a partner from the same educational group is found the apprenticeship group with 70%. The highest and lowest educational groups are almost mutually exclusive; for women of both groups, about 90% of the partners come from the same or an adjacent group.

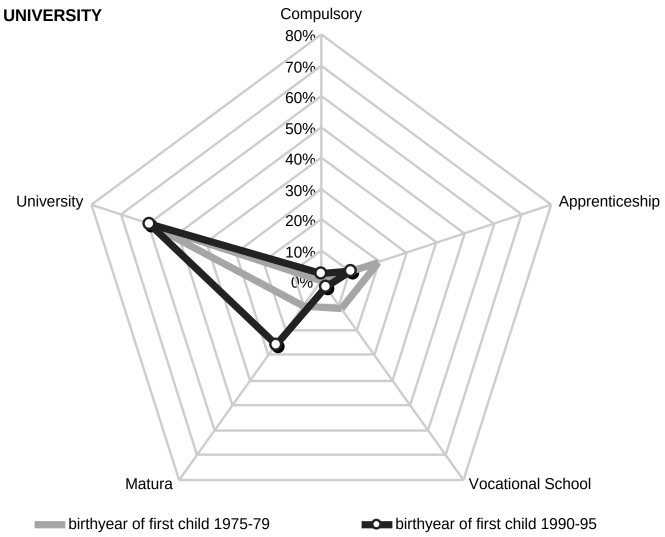
Figure 37: Educational differences of couples with children; birth cohorts of first child 1975-79 and 1990-95






VOCATIONAL SCHOOL
Compulsory
80%
70%
60%
50%
40%
30%
20%
10%
0%
Apprenticeship
Vocational School
Matura
University
birthyear of first child 1975-79
birthyear of first child 1990-95


MATURA
Compulsory
80%
70%
60%
50%
40%
30%
20%
10%
0%
Apprenticeship
Vocational School
Matura
University
birthyear of first child 1975-79
birthyear of first child 1990-95

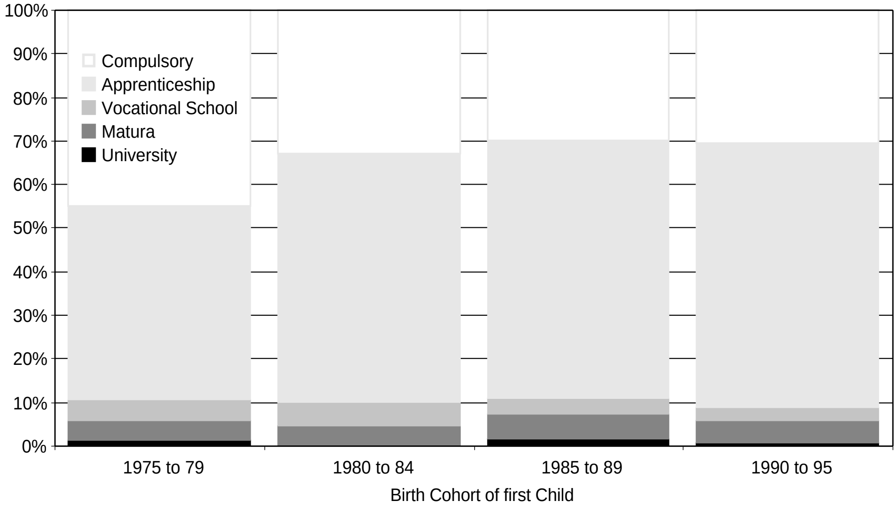


Source: Micro Census June 1996 special program on education; own calculations

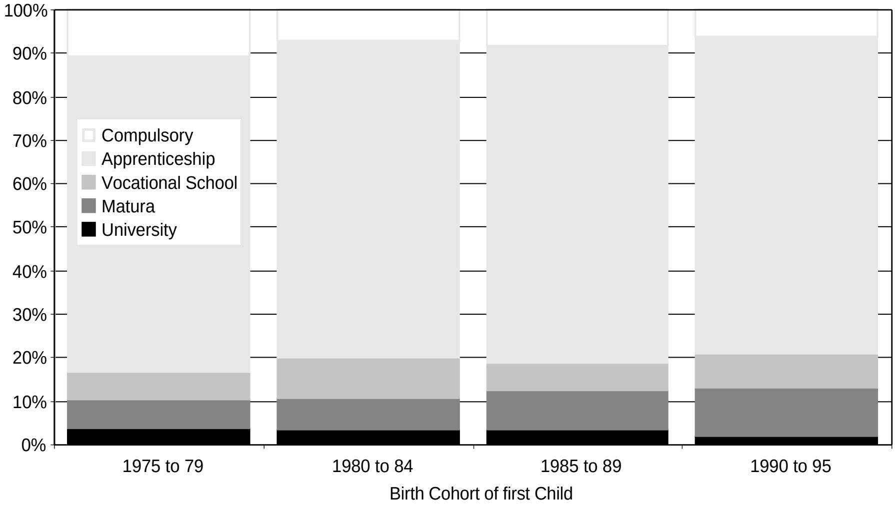
The next figure illustrates the same matching patterns over five-year-birth cohorts (of the youngest child). As a working hypothesis (see the model implementation below) it might be assumed that the most important changes observed in the lowest and highest educational group (and to a lower extent in the apprenticeship group) have already leveled off, while the changes in the remaining two groups do not indicate a clear trend but rather sample fluctuations.

Figure 38: Educational differences of couples with children; five-year-birth cohorts of first child from 1975 to 1995

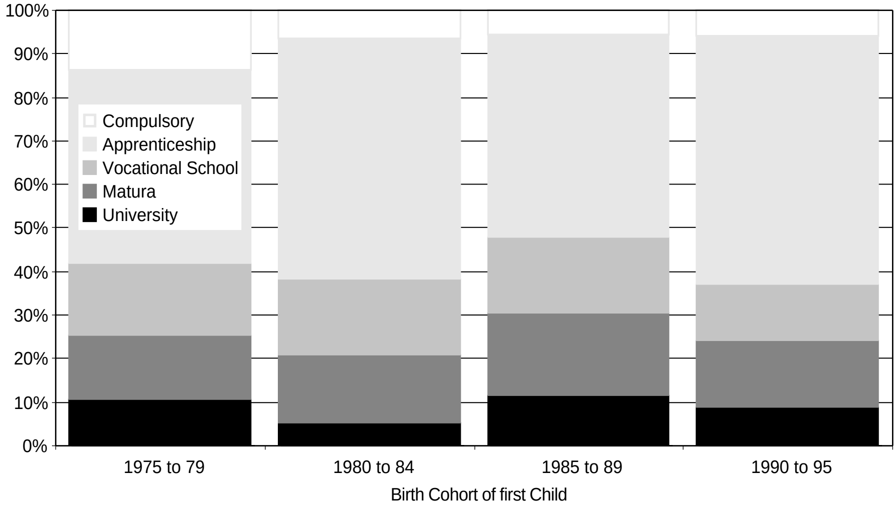
EDUCATIONAL COMPOSITION OF COUPLES WITH CHILDREN:
PARTNERS' EDUCATION OF MOTHERS WITH COMPULSORY EDUCATION



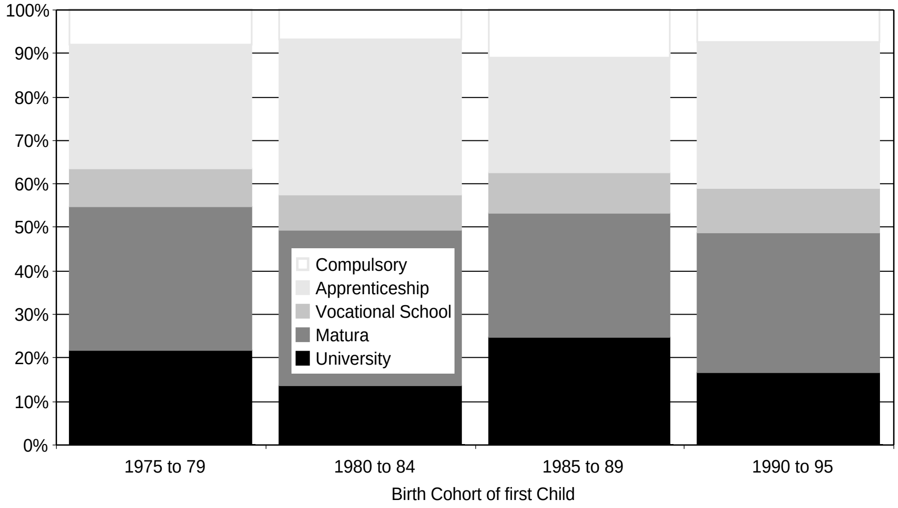
EDUCATIONAL COMPOSITION OF COUPLES WITH CHILDREN:
PARTNERS' EDUCATION OF MOTHERS WITH APPRENTICESHIP

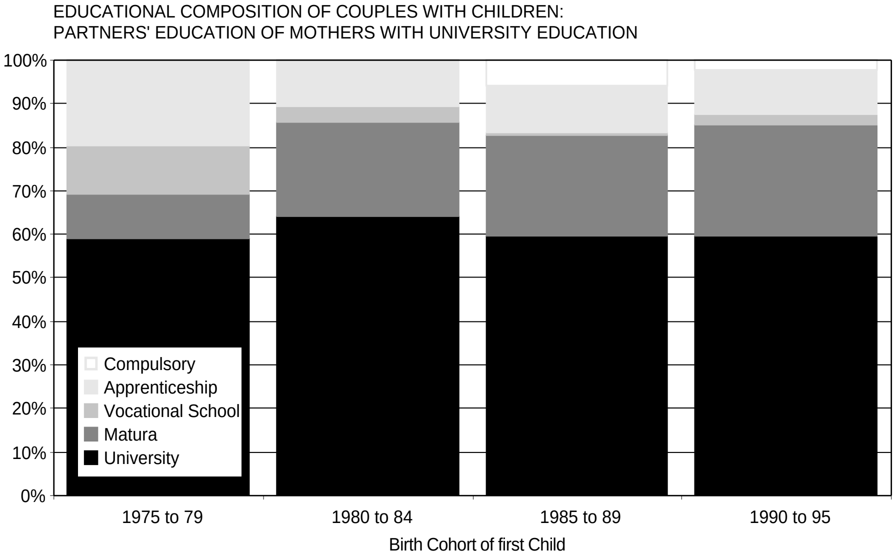


EDUCATIONAL COMPOSITION OF COUPLES WITH CHILDREN:
PARTNERS' EDUCATION OF MOTHERS WITH VOCATIONAL SCHOOL



EDUCATIONAL COMPOSITION OF COUPLES WITH CHILDREN:
PARTNERS' EDUCATION OF MOTHERS WITH MATURA



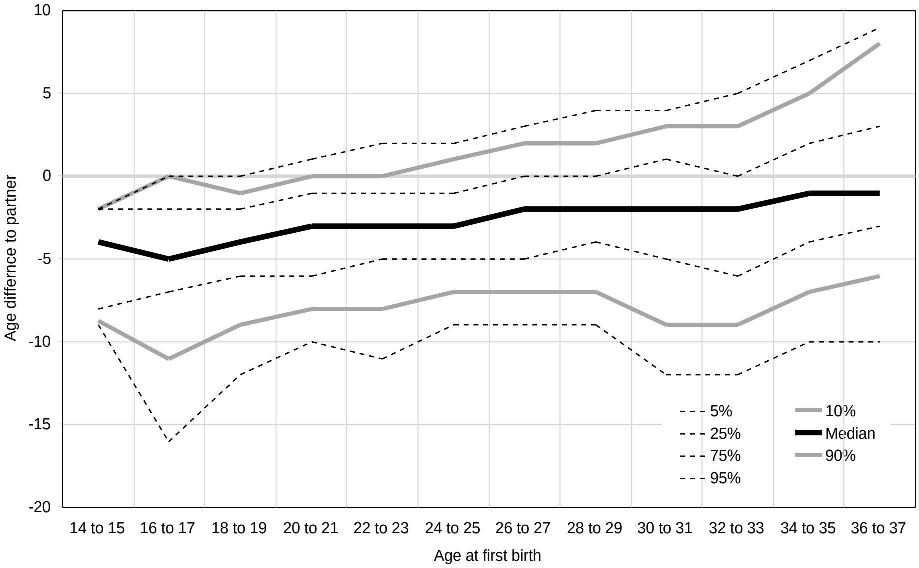


Source: Micro Census June 1996 special program on education; own calculations

7.2 Partner Matching by Age

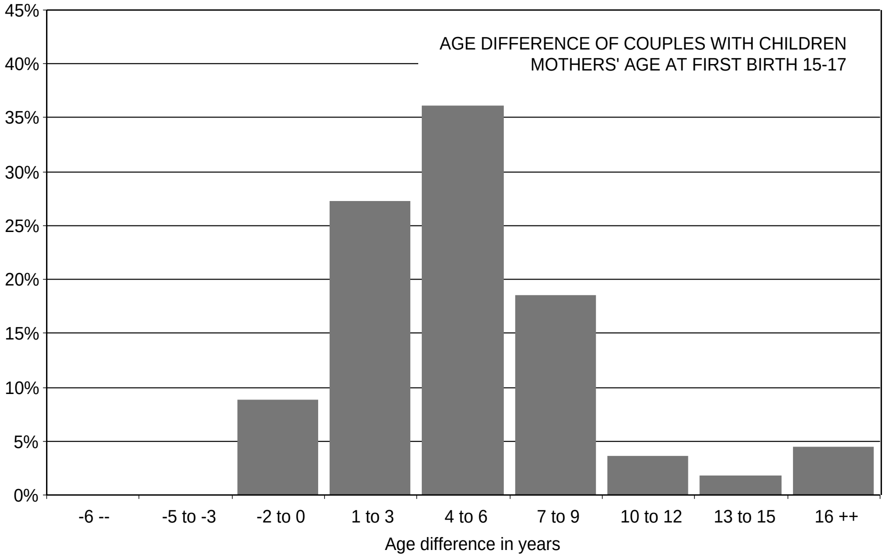
The distribution of the age difference in partnerships alters considerably both in its mean variance and shape, depending on the age at partnership formation. In the following analysis, only couples with children are considered, with the women's age at first birth used as reference point, as the date of the actual partnership formation is unknown. The median age difference has decreased over time, from up to five years for teenage mothers to one year for women being 34 years at first birth. Until the age of 23 at first birth, more than 90% of male partners are older or of the same age. In general, the distribution has become more symmetric over time.

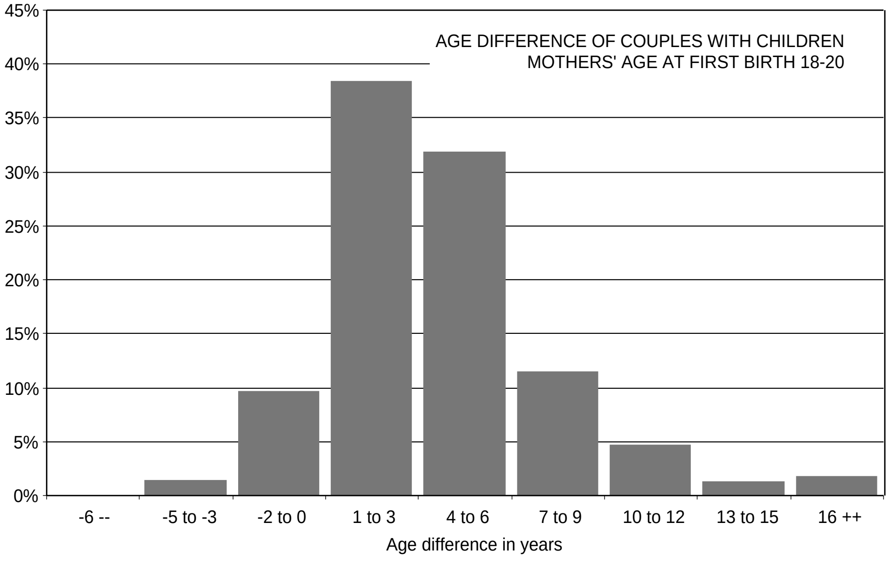
Figure 39: Median and deciles of the age difference of couples with children by women's age at first birth

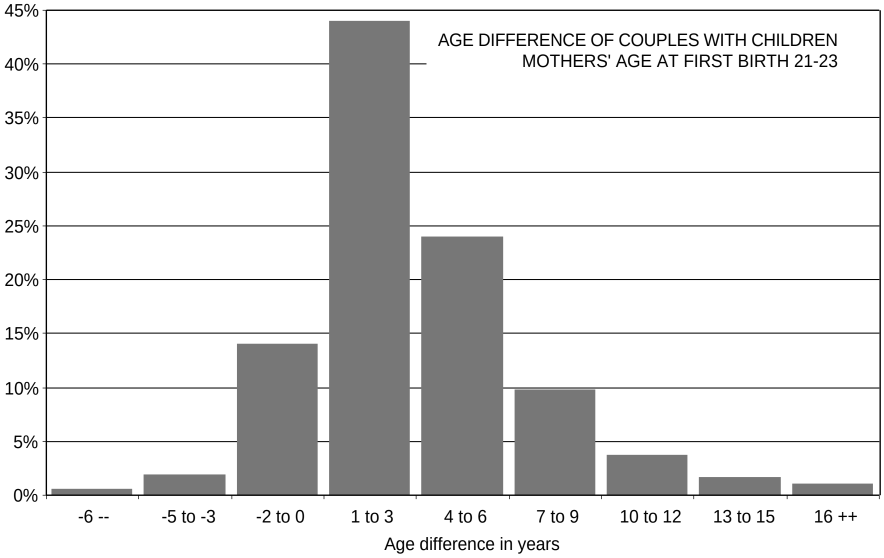


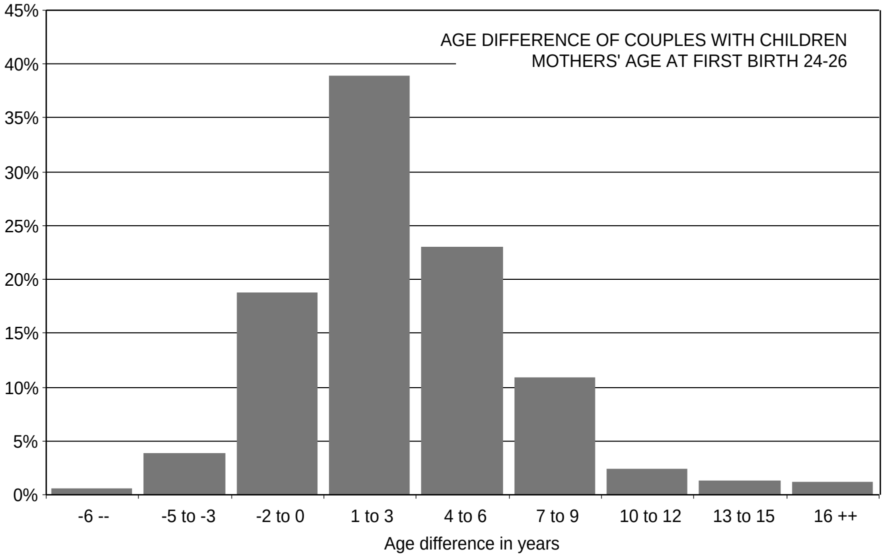
Source: Micro Census June 1996 special program on education; own calculations

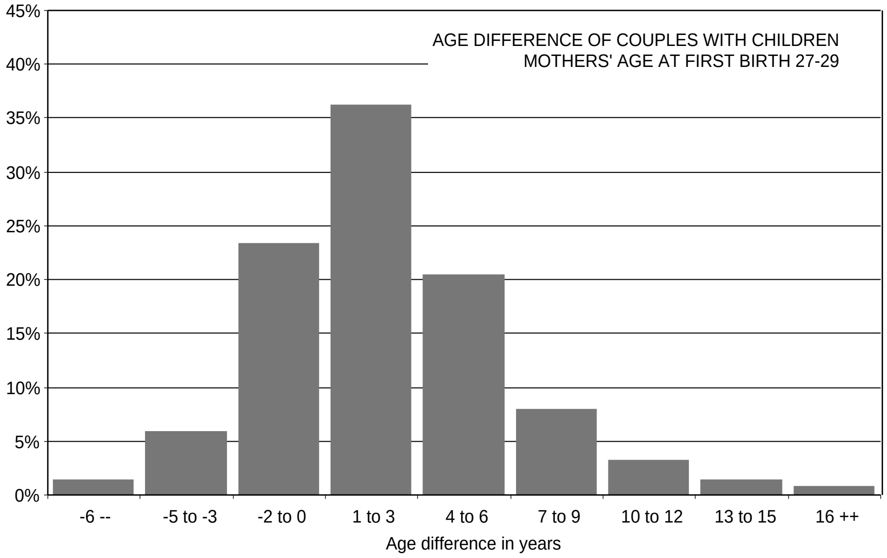
Figure 40: Distribution of age differences of couples with children by women's age at first birth

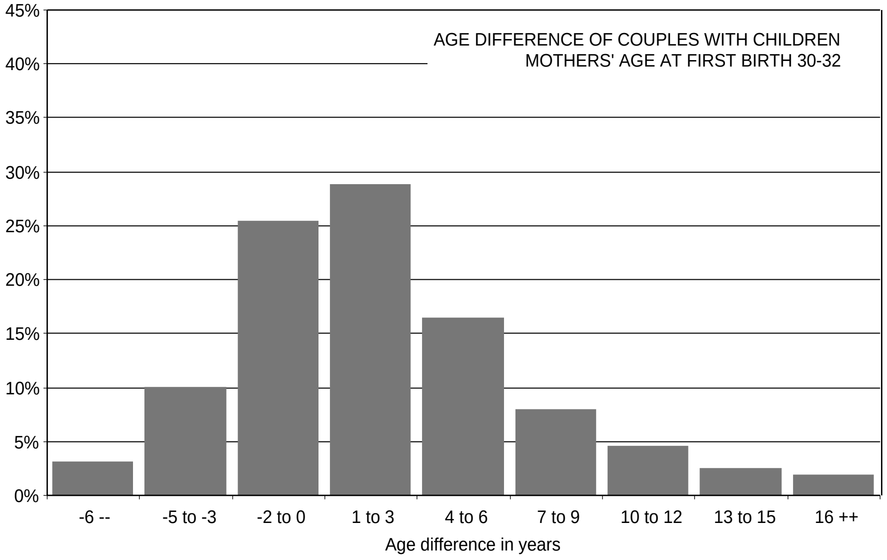


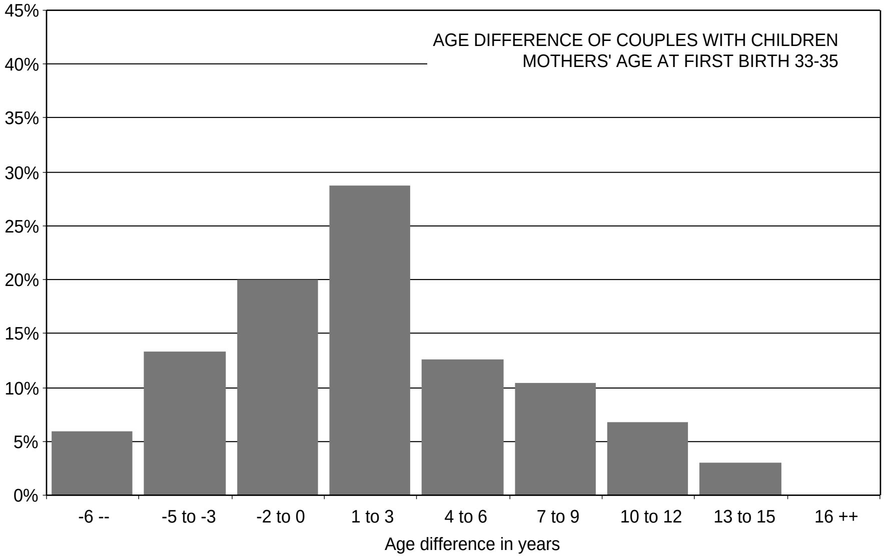


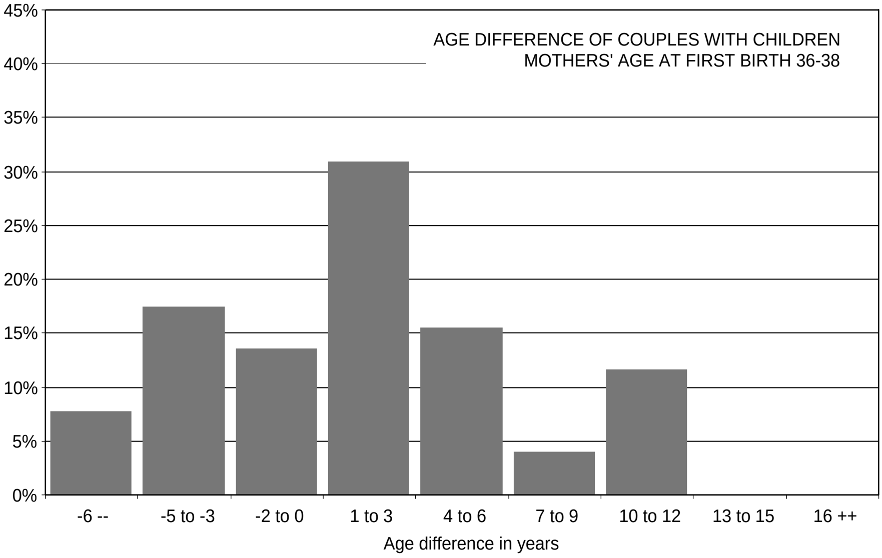

AGE DIFFERENCE OF COUPLES WITH CHILDREN
MOTHERS' AGE AT FIRST BIRTH 21-23
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-6 --
-5 to -3
-2 to 0
1 to 3
4 to 6
7 to 9
10 to 12
13 to 15
16 ++
Age difference in years


AGE DIFFERENCE OF COUPLES WITH CHILDREN
MOTHERS' AGE AT FIRST BIRTH 24-26
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-6 --
-5 to -3
-2 to 0
1 to 3
4 to 6
7 to 9
10 to 12
13 to 15
16 ++
Age difference in years


AGE DIFFERENCE OF COUPLES WITH CHILDREN
MOTHERS' AGE AT FIRST BIRTH 27-29
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-6 --
-5 to -3
-2 to 0
1 to 3
4 to 6
7 to 9
10 to 12
13 to 15
16 ++
Age difference in years


AGE DIFFERENCE OF COUPLES WITH CHILDREN
MOTHERS' AGE AT FIRST BIRTH 30-32
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
-6 --
-5 to -3
-2 to 0
1 to 3
4 to 6
7 to 9
10 to 12
13 to 15
16 ++
Age difference in years





Source: Micro Census June 1996 special program on education; own calculations

8 Fertility differentials by education

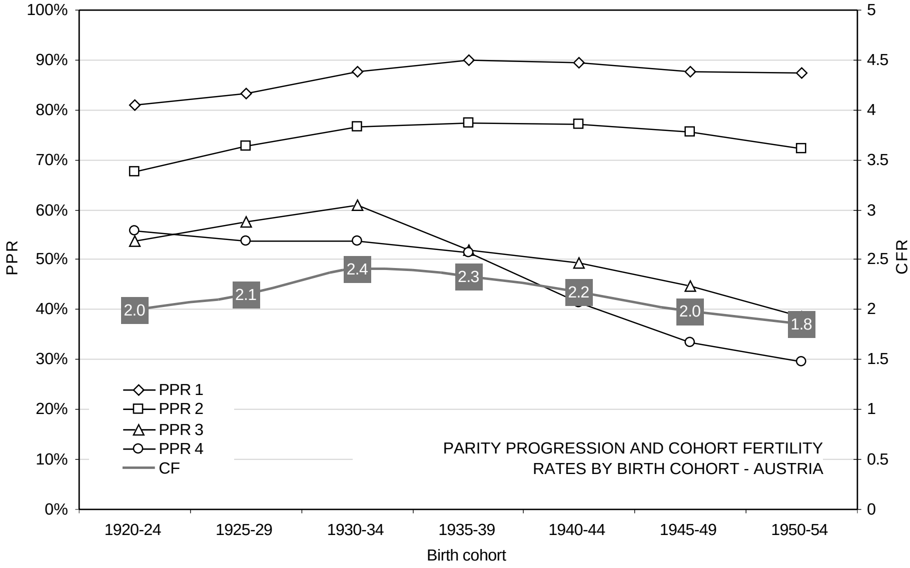
Being interested in the intergenerational education transmission processes within families and the resulting future educational composition of the population, we have to account for fertility differentials between these educational groups. Education is seen as the single most important variable besides age and sex in determining fertility in the context of population forecasts (Lutz et al., 1999) and, as will be seen below, behavioral differences regarding the quantum and timing of birth by educational group are considerable in Austria.

According to the main purpose of the fertility model to be developed, namely to be able to study the effect of fertility differentials between educational groups on the future educational composition of the population, a simple scenario-based approach will be followed here. Different scenarios will be created and used in order to study the impact of the two key differences of fertility behavior between different educational groups, namely differences of quantum — the number of children — and timing of birth, which are modeled in dependence on school leaving age. Besides the educational attainment, there are considerable rural-urban differentials regarding fertility behavior in Austria. Fertility is generally lower in cities and also the fertility changes follow different paths in rural and urban areas over time. To account for these differences, the municipality type will be used as influencing factor besides educational attainment and school leaving age. The parameterization of the model is based on cohort measures. For every woman it is first decided how many children she will have and second, when she will give birth.

8.1 Quantum of Birth

The distribution of the number of children per woman of different cohorts varies considerably over time, following patterns summarized under the terms of the first and second demographic transition (Lesthaeghe & van der Staa, 1986). Regarding the number of births, the first transition is linked to the emergence of the “two-child-norm” with fewer women staying childless and a sharp decrease of higher order parity progression rates. As displayed in the following graph, this pattern can easily be identified for Austria. From the 1945 birth cohorts onwards, a movement back to less uniform fertility behaviors, e.g. higher rates of childlessness, can be observed with parity regression rates decreasing for all birth orders.

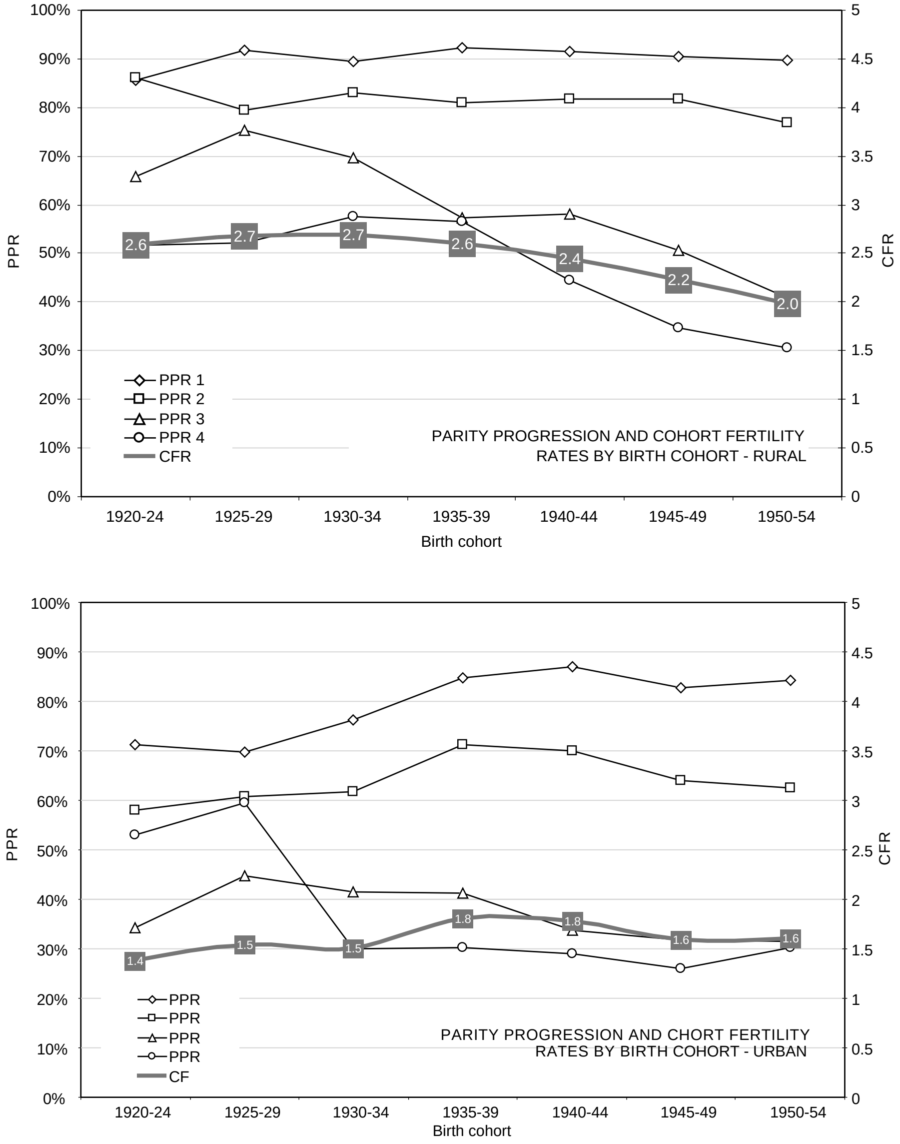
Figure 41: Parity progression and cohort fertility rates by birth cohort



Source: Micro Census June 1996 special program on education; own calculations

Disaggregation by municipality type reveals that the fertility changes over time follow different paths in rural and urban areas. Changes in childlessness and the parity progression rate to a second child are entirely urban phenomena. While 30% of the women of the 1920-24 and 1925-29 birth cohorts remained childless in urban areas, this number decreased over time until it nearly reached the almost time-invariant rural level of 10%, before it increased again for recent cohorts. In contrast, the sharp decline of the parity progression rate to a third child is mostly a rural phenomena. In rural areas, this rate dropped from almost 75% to 30%, finally meeting “urban levels”.

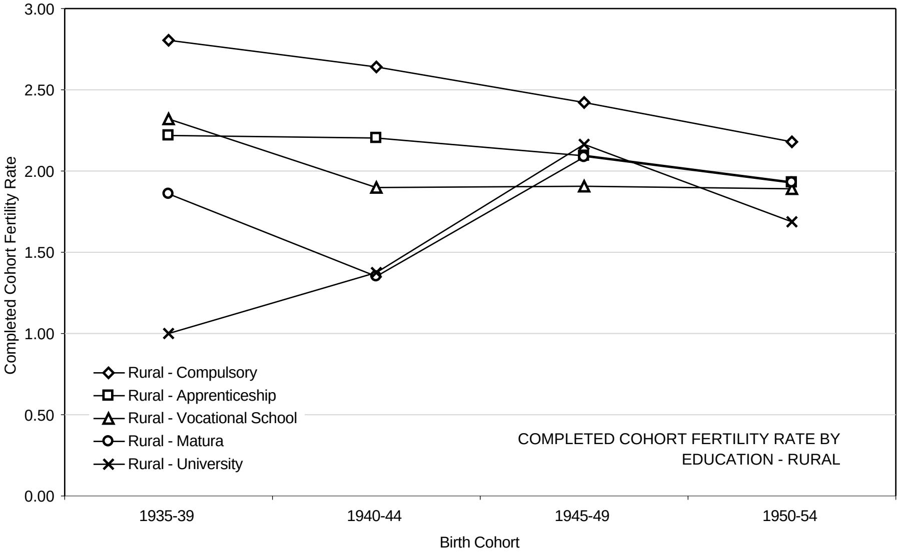
Figure 42: Parity progression and cohort fertility rates by birth cohort and municipality type

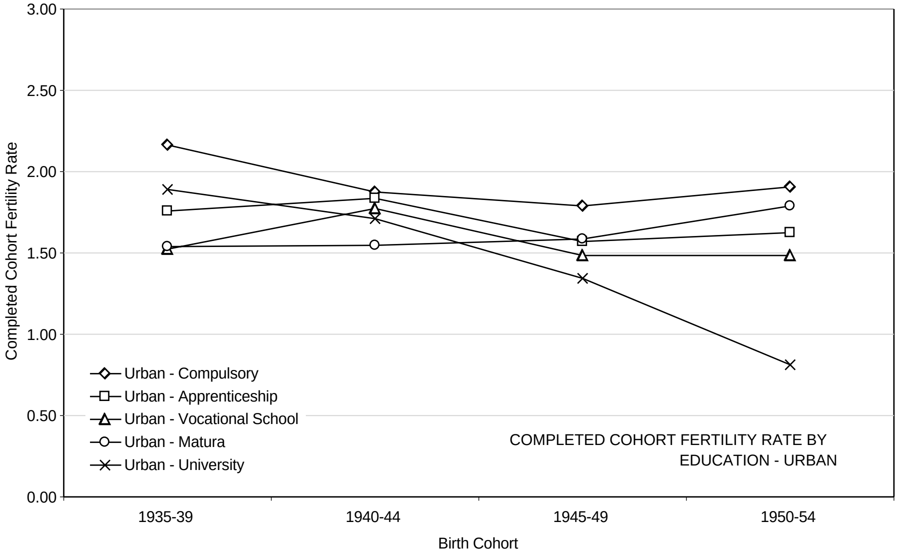


Source: Micro Census June 1996 special program on education; own calculations

Further disaggregation by education level confirm the urban-rural differentials observed. A comparison of cohort fertility rates by education for the birth cohorts 1935-1954 (the last cohort, for which fertility can be assumed to be completed) reveals very different levels of fertility as well as different patterns of change over time. The transition processes seem to happen with a time lag of ten years between urban and rural areas. In rural areas, cohort fertility differs considerably between educational groups ranging from 1 (university graduate) to 2.7 (compulsory) for the 1935-39 cohort with diminishing differentials until the 1945-49 cohort. In urban areas, the process of diminishing fertility differentials is finished ten years earlier and converts into an increase of differentials, especially caused by the fast fertility decrease of university graduates.

Figure 43: Cohort fertility rates by education and municipality type

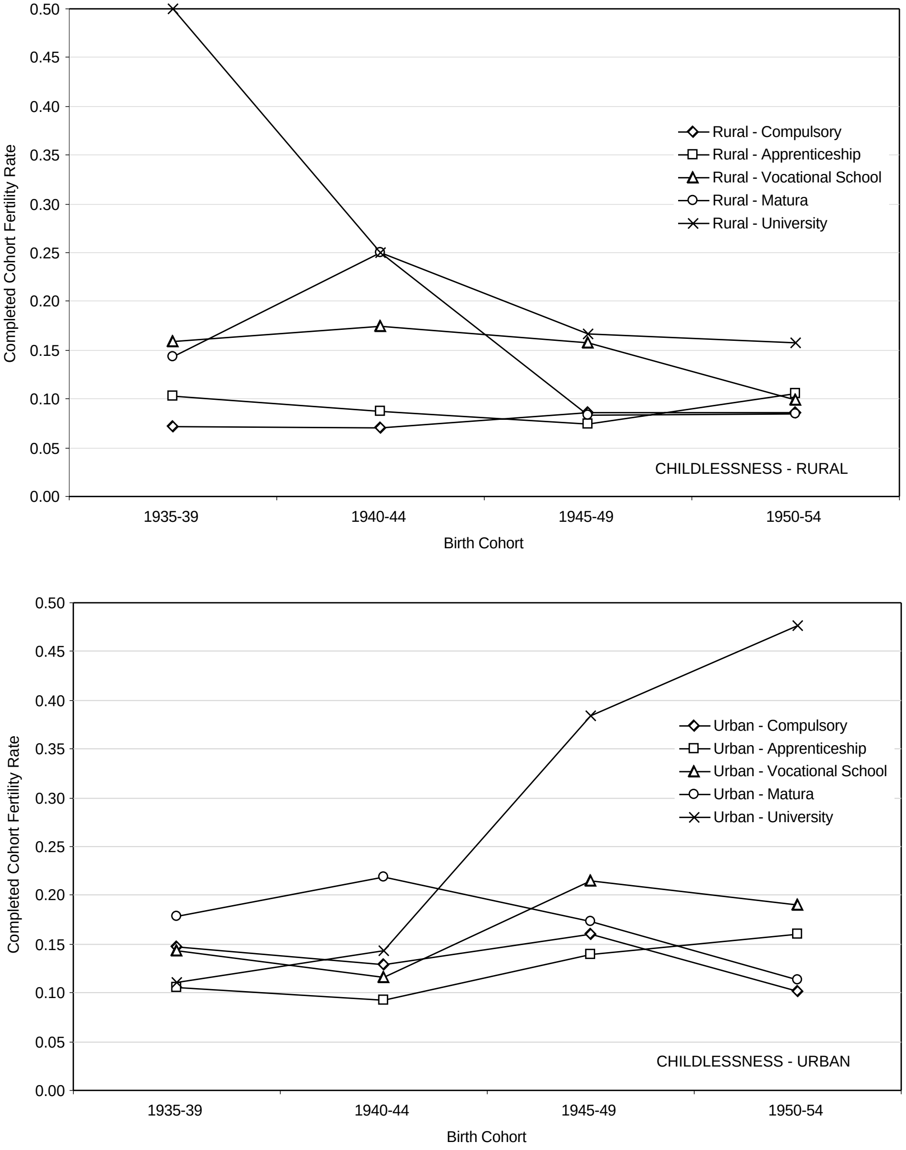




Source: Micro Census June 1996 special program on education; own calculations

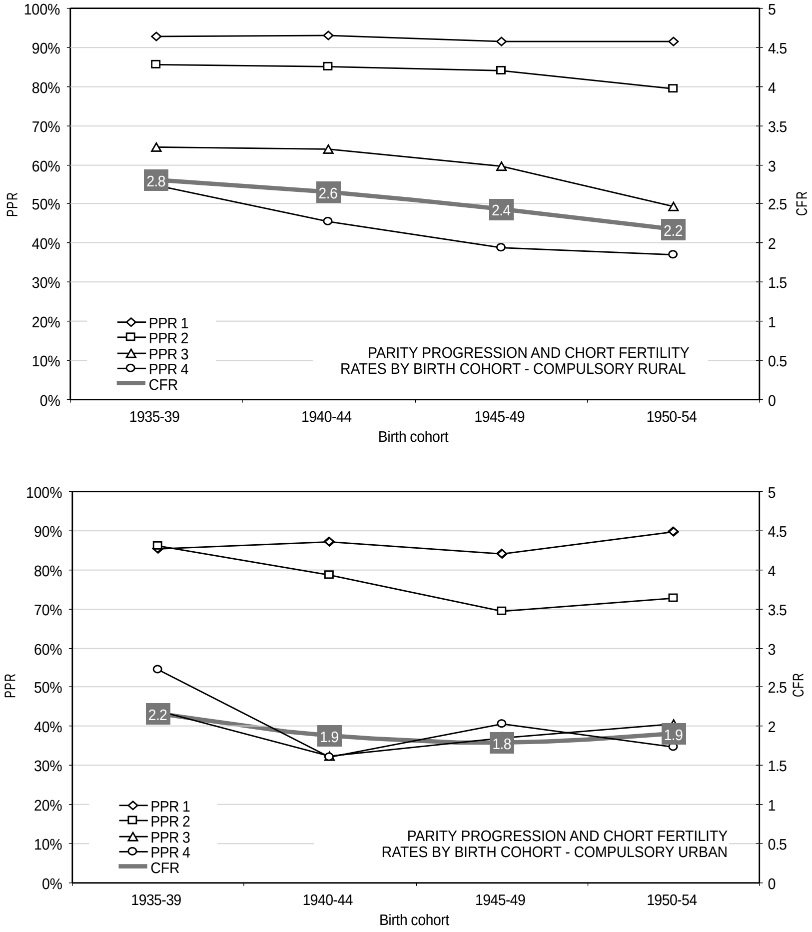
First decreasing and later increasing fertility differentials between educational groups can also be observed regarding childlessness. For earlier birth cohorts, childlessness was highest for (the small group) of rural university graduates, followed by the second highest educational group. Over the time horizon considered differentials in childlessness decreased in rural areas to a range between 16% (university graduates) and around 10% for all other groups. In urban areas, childlessness increased for women of all educational groups, except for the second highest group (*Matura*), while it sharply increased to over 50% for university graduates. This might be the result of a choice between children and higher education.

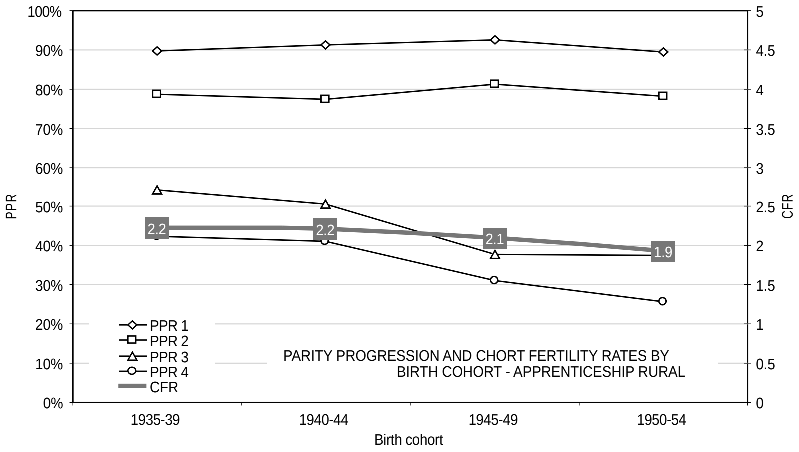
Figure 44: Childlessness by education and municipality type

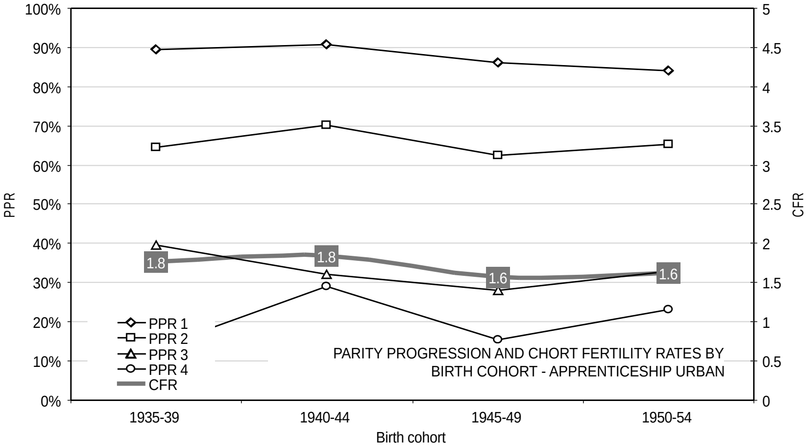


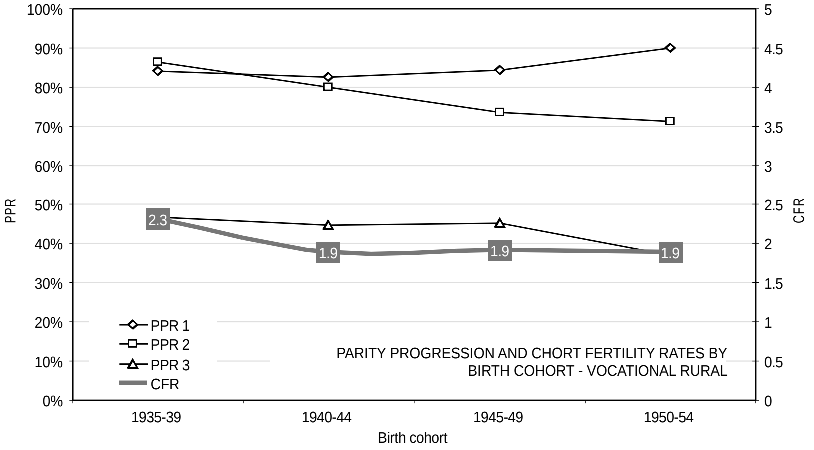
Source: Micro Census June 1996 special program on education; own calculations

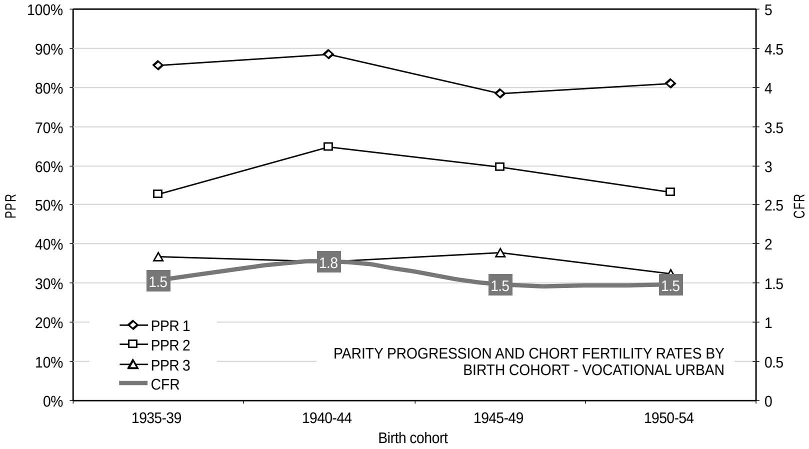
Figure 45: Parity progression and cohort fertility rates by birth cohort for different edu-cational groups and municipality types




100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PPR
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
CFR
2.2
2.2
2.1
1.9
PPR 1
PPR 2
PPR 3
PPR 4
CFR
PARITY PROGRESSION AND CHORT FERTILITY RATES BY
BIRTH COHORT - APPRENTICESHIP RURAL
1935-39
1940-44
1945-49
1950-54
Birth cohort


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PPR
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
CFR
1.8
1.8
1.6
1.6
PPR 1
PPR 2
PPR 3
PPR 4
CFR
PARITY PROGRESSION AND CHORT FERTILITY RATES BY
BIRTH COHORT - APPRENTICESHIP URBAN
1935-39
1940-44
1945-49
1950-54
Birth cohort


100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PPR
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
CFR
2.3
1.9
1.9
1.9
PPR 1
PPR 2
PPR 3
CFR
PARITY PROGRESSION AND CHORT FERTILITY RATES BY
BIRTH COHORT - VOCATIONAL RURAL
1935-39
1940-44
1945-49
1950-54
Birth cohort


100%
90%
80%
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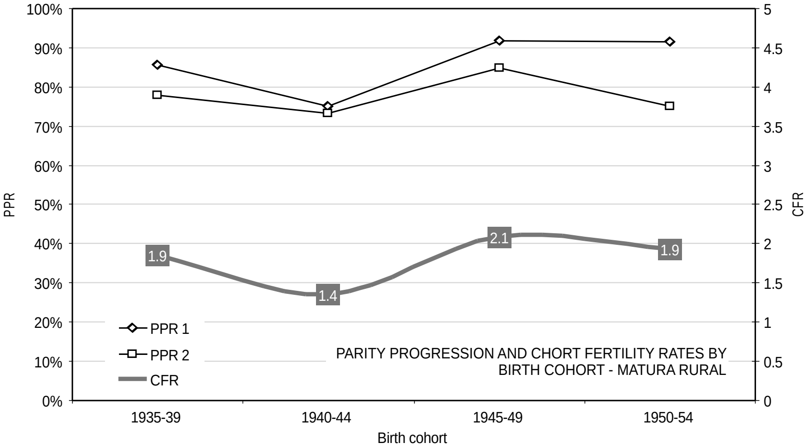
PARITY PROGRESSION AND CHORT FERTILITY RATES BY BIRTH COHORT - VOCATIONAL URBAN
1935-39
1940-44
1945-49
1950-54
Birth cohort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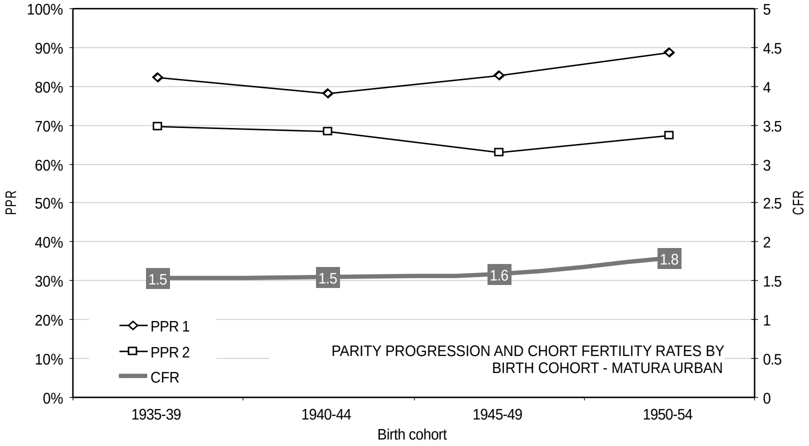
PARITY PROGRESSION AND CHORT FERTILITY RATES BY BIRTH COHORT - MATURA RURAL
1935-39
1940-44
1945-49
1950-54
Birth cohort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PPR 2
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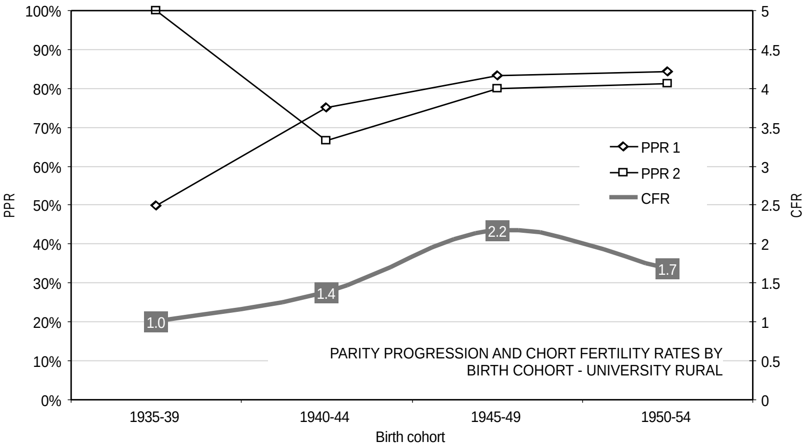
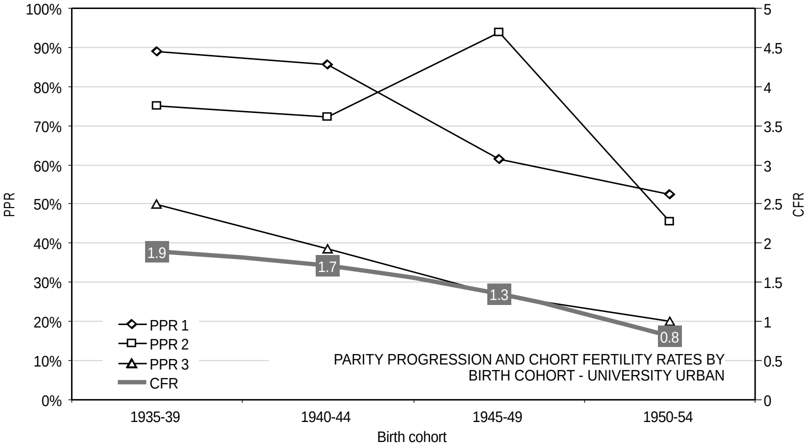
PARITY PROGRESSION AND CHORT FERTILITY RATES BY BIRTH COHORT - MATURA URBAN
1935-39
1940-44
1945-49
1950-54
Birth cohort

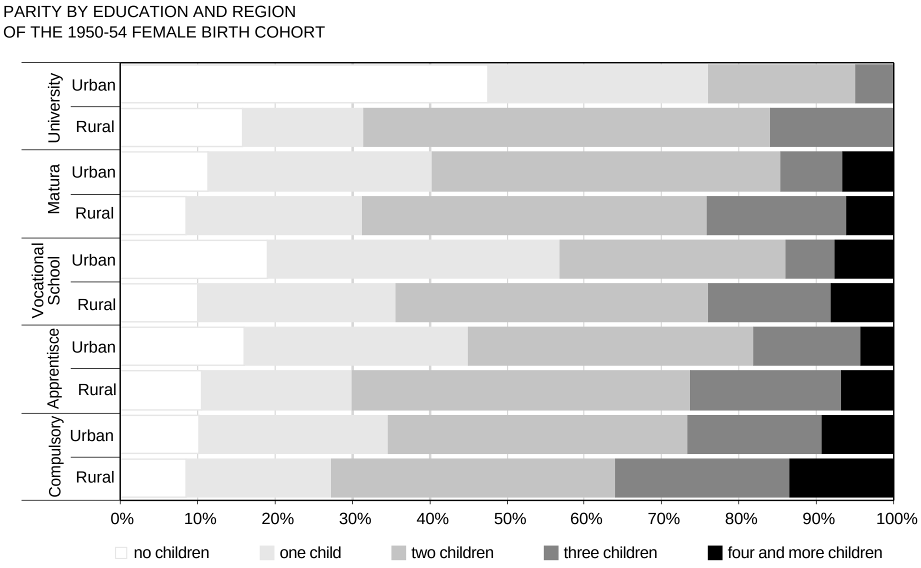




Source: Micro Census June 1996 special program on education; own calculations

The differences of parity progression rates between educational and rural/urban groups result in different parity distributions. The figure below displays these differences for the 1950-54 birth cohort.

Figure 46: Parity by education and municipality type of the 1950-54 birth cohort



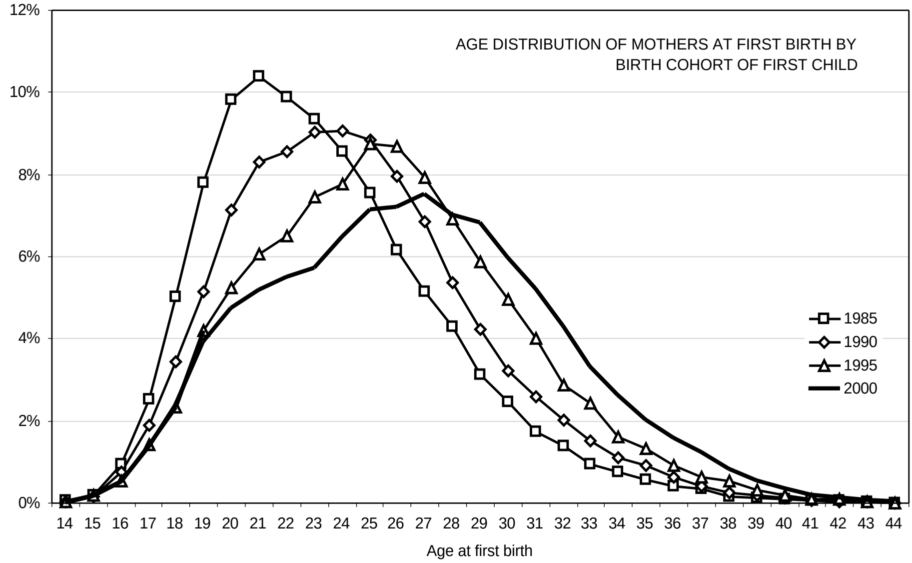
Source: Micro Census June 1996 special program on education; own calculations

8.2 Timing of Birth

Beside the declining fertility rates, another ongoing change regarding fertility behavior is the increasing age of mothers at first birth. The timing of birth is highly dependent on other life course careers like partnership, education and work. In general, timing is one of the most important strategies in the presence of conflicting goals, i.e. births are frequently postponed in order to reach other career goals first. As will be seen below, the increasing age at first birth can be equally attributed to a general rise observable in all educational groups and a rise caused by the changing educational composition of mothers, i.e. the result of higher school leaving ages.

As can be seen in the following figure, the age distribution of mothers at first birth changed considerably over time with an increase in mean age, variance and symmetry.

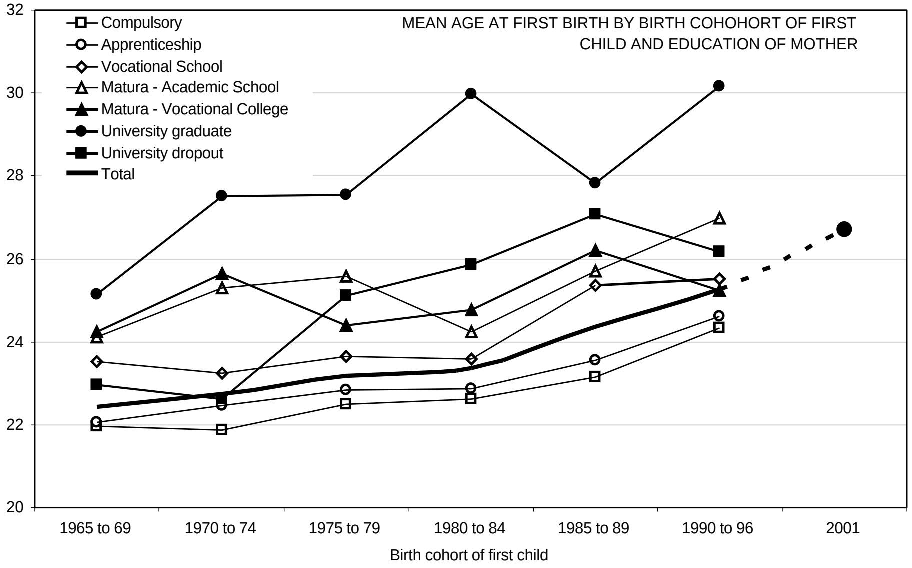
Figure 47: Age distribution at first birth



Source: Administrative data, Statistics Austria

As can be seen in the graph below, the mean age at first birth increased for all educational groups. From the mid-1960s to 1991 the mean age increased by almost five years from 23 to 27.7. The mean age at first birth differs considerably among different educational groups, with an age difference of around six years between mothers with compulsory and university education.

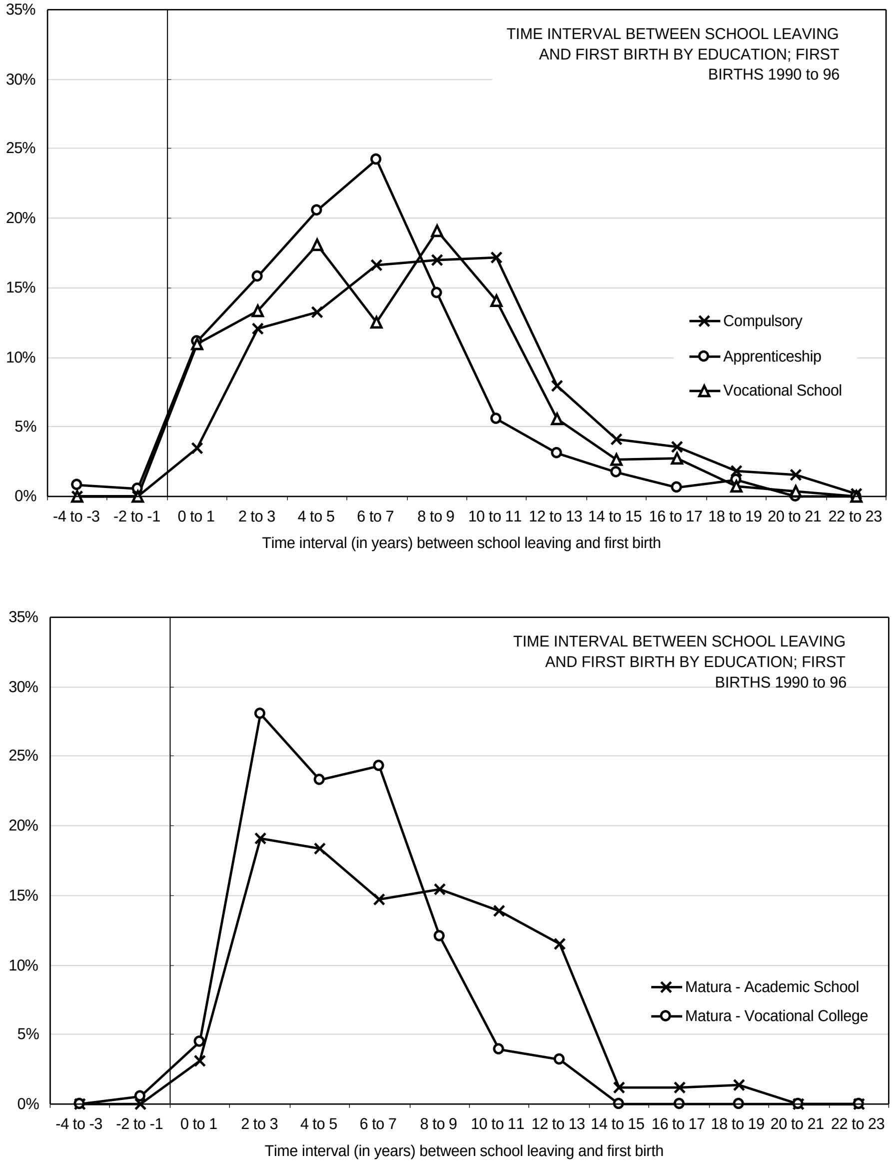
Figure 48: Mean age at first birth by mothers' education

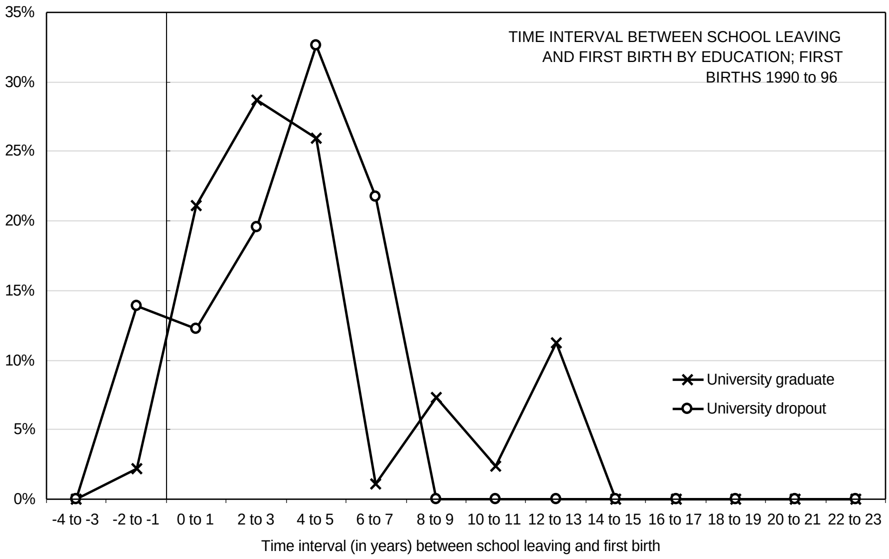


Source: Micro Census June 1996 program on education and births; own calculations; data for 2001 are administrative data from Statistics Austria; earlier aggregated data are reasonably consistent between both data sets

The age at first birth highly depends on the school leaving age and, as can be seen in the following figures, almost all births are given after leaving the educational system.

Figure 49: Distribution of time interval from school leaving to first birth by education; first births 1990-96

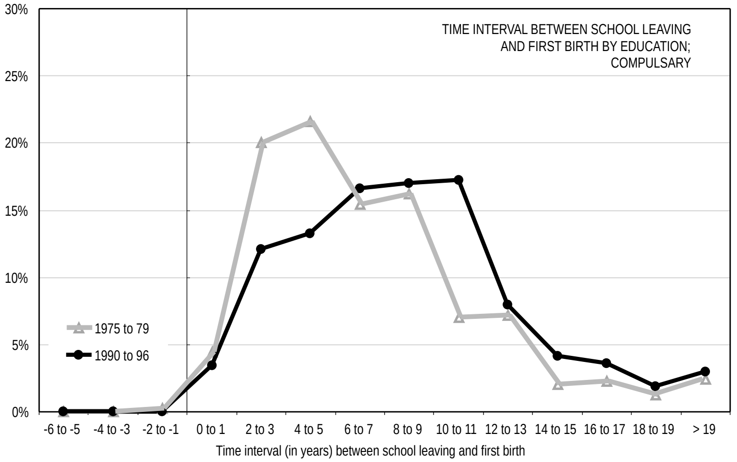


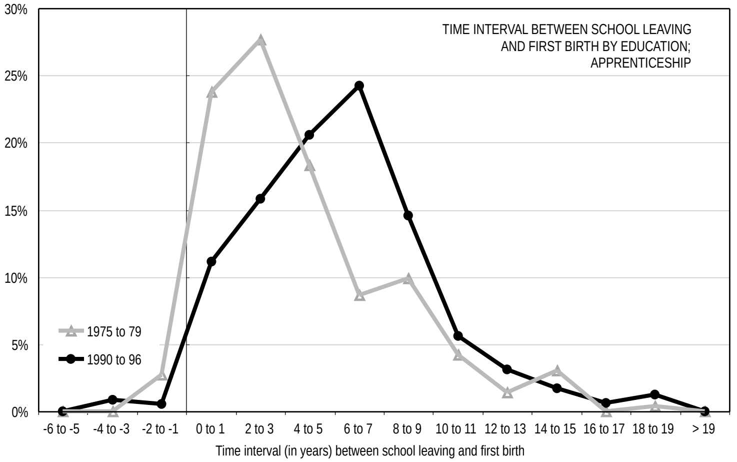


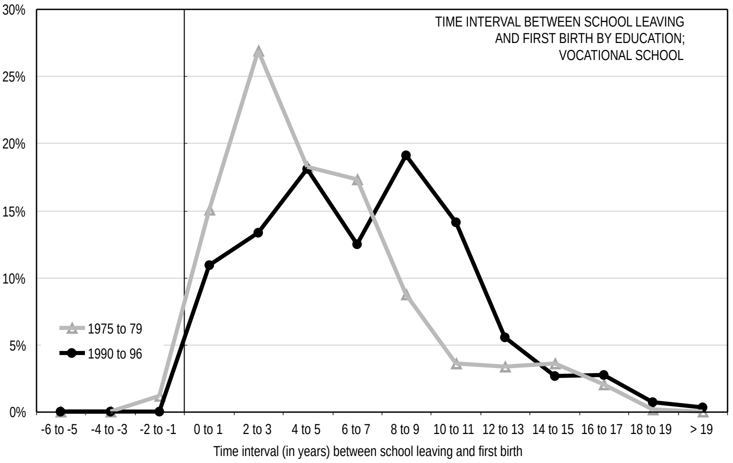
Source: Micro Census June 1996 program on education and births; own calculations

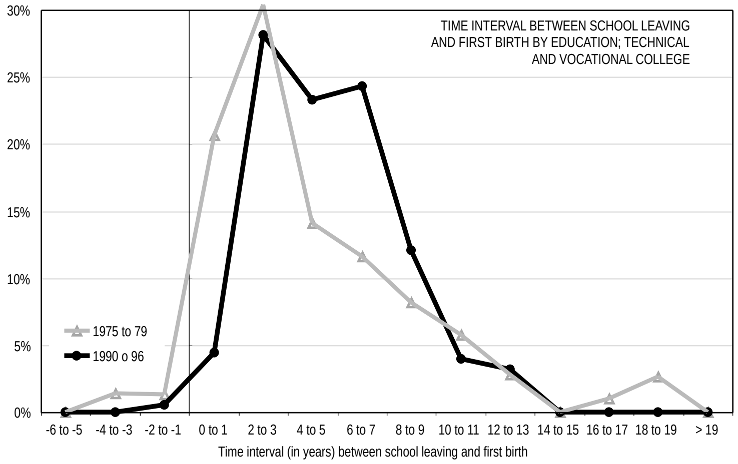
As can be seen in the following figures, the age distribution at first birth changed for all educational groups following the same pattern of change, i.e. increases in mean age, variance and symmetry.

Figure 50: Distribution of time interval from school leaving to first birth by education; first births 1975-79 and 1990-96






TIME INTERVAL BETWEEN SCHOOL LEAVING
AND FIRST BIRTH BY EDUCATION;
VOCATIONAL SCHOOL
30%
25%
20%
15%
10%
5%
0%
1975 to 79
1990 to 96
-6 to -5
-4 to -3
-2 to -1
0 to 1
2 to 3
4 to 5
6 to 7
8 to 9
10 to 11
12 to 13
14 to 15
16 to 17
18 to 19
> 19
Time interval (in years) between school leaving and first birth


TIME INTERVAL BETWEEN SCHOOL LEAVING
AND FIRST BIRTH BY EDUCATION; TECHNICAL
AND VOCATIONAL COLLEGE
30%
25%
20%
15%
10%
5%
0%
1975 to 79
1990 o 96
-6 to -5
-4 to -3
-2 to -1
0 to 1
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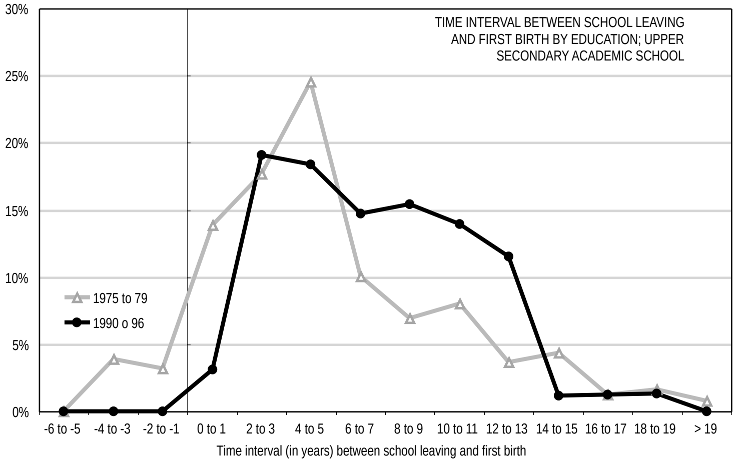
Time interval (in years) between school leaving and first birth


TIME INTERVAL BETWEEN SCHOOL LEAVING
AND FIRST BIRTH BY EDUCATION; UPPER
SECONDARY ACADEMIC SCHOOL
30%
25%
20%
15%
10%
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1975 to 79
1990 o 96
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-4 to -3
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0 to 1
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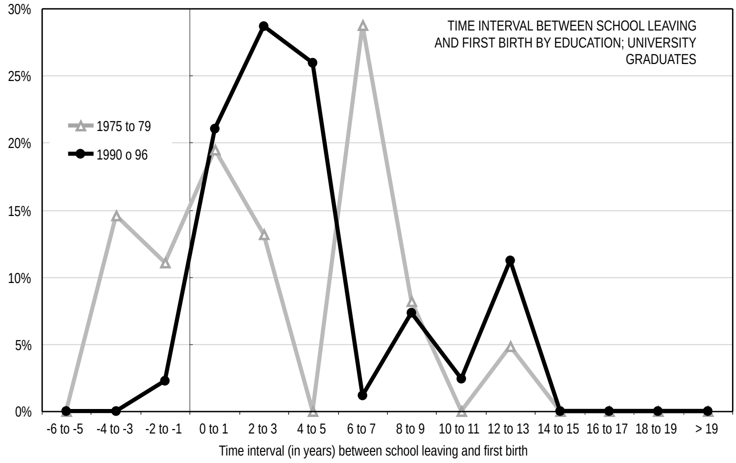
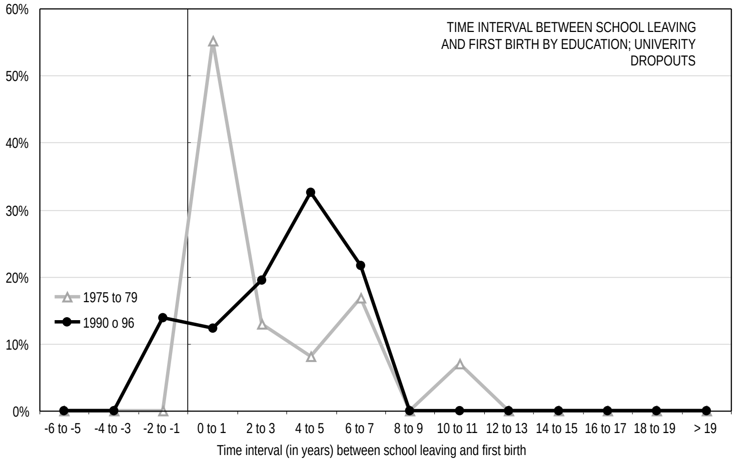
Time interval (in years) between school leaving and first birth

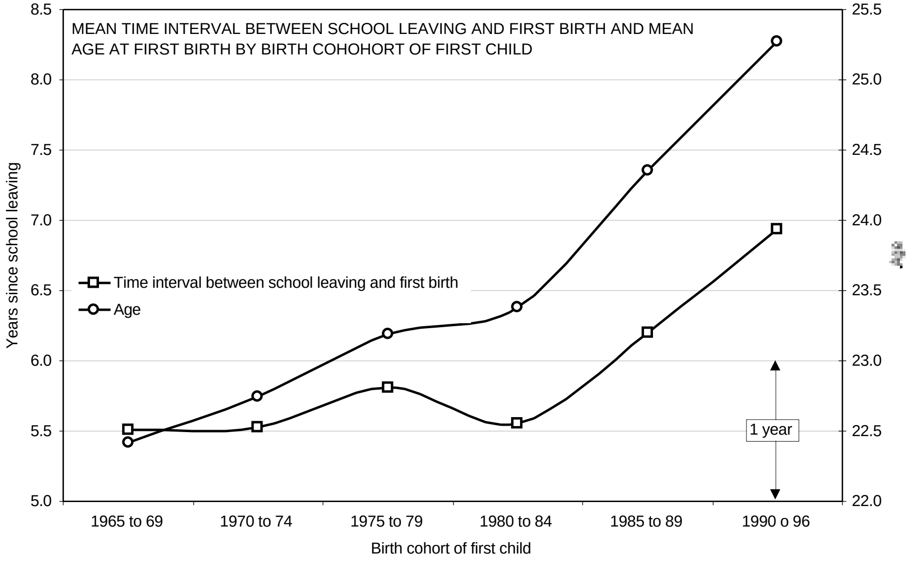




Source: Micro Census June 1996 program on education and births; own calculations

While the mean duration from school leaving to first birth increased for all educational groups, this increase is smaller than the general age increase. The following figure compares the mean age at first birth and the mean duration from leaving school to the first birth. As can be seen, the mean duration stayed at 5.5 years from the mid-1960s to the mid-1980s, while the mean age increased by almost one year in the same time period. Hence, most of the age increase in this time interval can be attributed to the changing educational composition of mothers that has an opposite effect on the two measures compared (the mean age at first birth increases with education while the time gap decreases). For the most recent ten years studied the picture changes: both the mean age at first birth further increased by around two years, and also the mean duration from school leaving to first birth increased considerably, namely by 1.5 years. Hence most of the effect can be attributed to the longer gap between leaving school and the first birth.

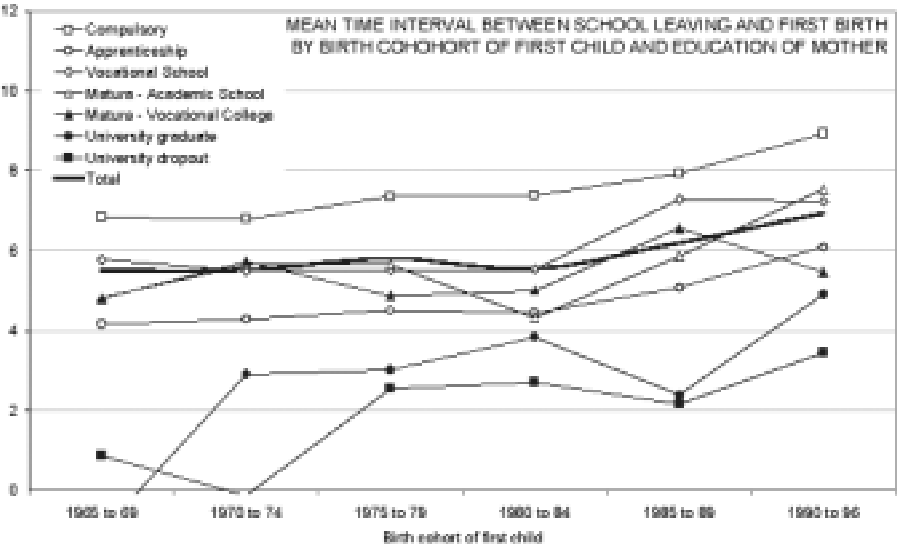
Figure 51: Mean age and mean time from leaving school to the first birth



Source: Micro Census June 1996 program on education and births; own calculations

The mean duration from leaving school to the first birth varies considerably between educational groups, with a span of six years between mothers with compulsory and university education. While the time interval from leaving school to the first birth increased for all educational groups, the aggregated curve stayed almost flat for the first four cohorts studied.

Figure 52: Mean time from school leaving to first birth by education

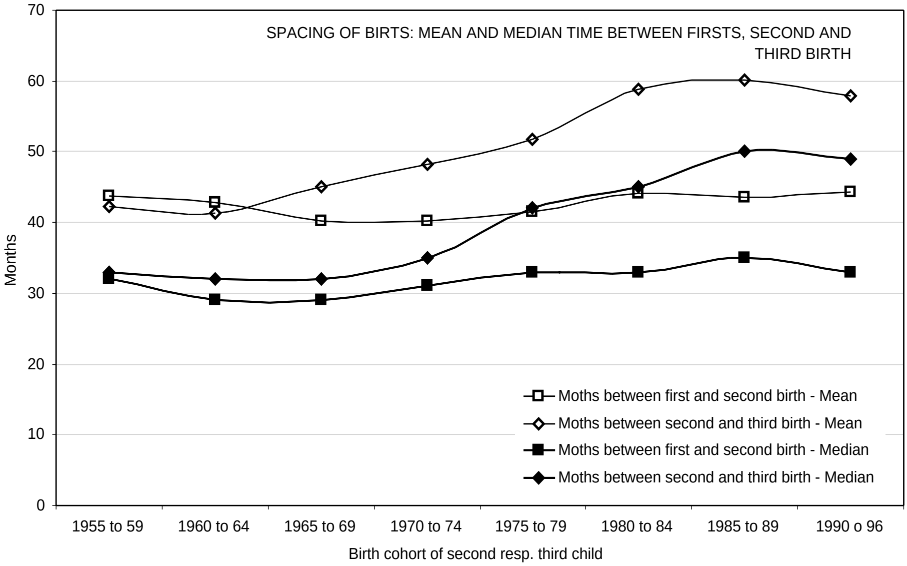


Source: Micro Census June 1996 program on education and births; own calculations

8.3 Spacing of Birth

The average time between first and second births changed only slightly over the last decades, whereas the mean time between second and third births increased by 1.5 years. The analysis of micro census data does not reveal significant differences among educational groups.

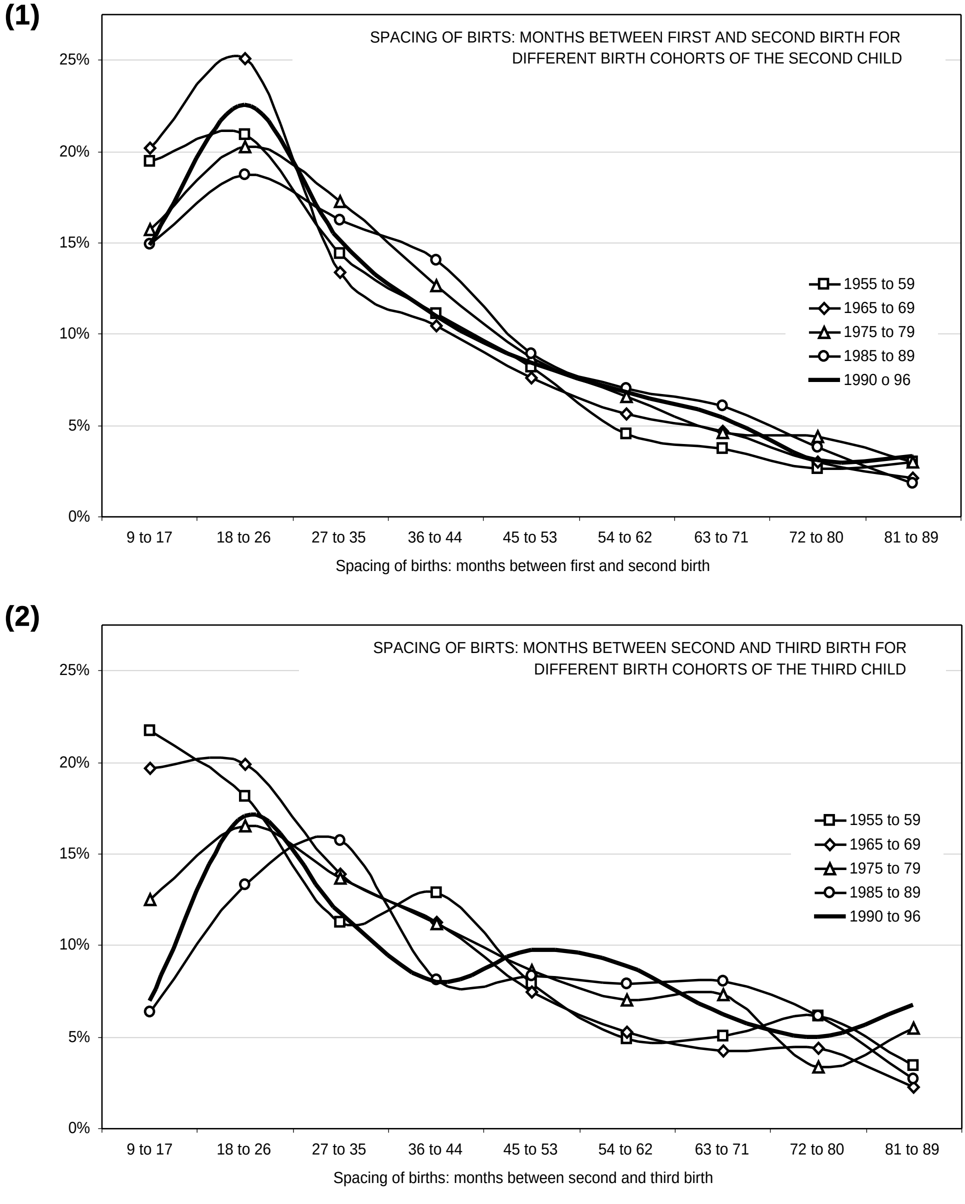
Figure 53: Time between first, second and third births: means and medians



Source: Micro Census June 1996 program on education and births; own calculations

The percentage of women giving birth again within less than 18 months following the first and second births decreased over time for both parities. As can be seen in the following figure, the distribution of durations is flatter for the higher birth order.

Figure 54: Distribution of time between (1) first and second and (2) second and third births for different birth cohorts



Source: Micro Census June 1996 program on education and births; own calculations

9 The Family and Education Microsimulation Model: implementation and parameterization

9.1 Introduction

Based on the descriptive and regression analyses of the previous chapters, this chapter describes the resulting behavioral models and their synthesis and implementation into a comprehensive dynamic microsimulation model, which allows us to project the educational composition of the population into the future. The computer implementation was realized using the FAMSIM+ microsimulation platform developed at the Austrian Institute for Family Studies and described in Appendix I. For the transition and duration tables of the model see Appendix II. Computer simulation is used following three aims, the first two of which will be described in this chapter. First, simulation is used in order to check if current partnership matching patterns by age and education can be maintained in future (in other words, if the future “spouse market” allows partnership formation with unchanged preferences). Second, we will use computer simulation in order to find appropriate cohort fertility measures by education. As we can only observe period measures, we will use computer micro-simulation in order to find “proper” parity distributions by educational group that produce observed birth numbers by education in a retrospective simulation projection under the assumption that there will be no more changes in the timing of births. Third, we will finally apply the microsimulation model to project the educational composition of the population into the future.

9.2 What is dynamic microsimulation?

Very generally, a microsimulation model can be defined as a model which uses simulation techniques and takes micro-level units — in the social sciences usually individuals, families or firms — as the basic units of analysis (O'Donoghue, 2001). Following this broad definition, dynamic microsimulation includes a broad variety of models and modeling approaches ranging from data-based empiric dynamic microsimulation to agent-based microsimulation grounded on the distributed artificial intelligence approach.

In the social sciences, dynamic microsimulation was introduced in the late 1950s, dominantly in the form of “empirical” dynamic microsimulation models.

These models are designed and used operatively for forecasting and policy recommendations (Klevmarken, 1997). This tradition can be traced back to a “direct” and an “indirect” source. The direct source of dynamic microsimulation can be found in Guy Orcutt's idea of mimicking natural experiments in economics, which led to the development of the DYNASIM model (Orcutt, 1957). The indirect source lies in the static tax benefit microsimulation models, resulting from the increased interest among policy-makers in distributional studies. As attempts are made to enlarge the initially static tax benefit models with behavioral models to capture the second-order effects of policies and simulate behavior over time, these tax-benefit models approach Orcutts's DYNASIM and/or its various successors. This tradition is also labeled data-based microsimulation, as it is usually based on empirical micro-data and dominated by statistical and econometric behavioral models. In general, there are various additional ways of modeling the behavior of the micro-units, ranging from simple rules to economic optimization behavior and agent-based models. In data-based models, theory is often sacrificed in favor of a highly detailed model with a good fit to the data. Behavior is mostly modeled implicitly, and so are corresponding assumptions, which can make models difficult to understand. In contrast, “abstract models” incorporate behavior explicitly. These models are rather designed and used to test and develop theories, that is, for explanation rather than prediction. This holds also true for context-driven agent-based microsimulation. Agents are defined by their behavior and act according to the environmental context they are placed in. Context-driven microsimulation goes back to the 1980s.

The term micro indicates the level of analysis, in the social sciences usually individuals or households. In contrast to static microsimulation models, in which these micro-units are only used as rather passive accounting units, the common element of all dynamic microsimulation approaches and traditions is that they analyze the behavior of a system by using the characteristics of micro-units that are changed — or autonomously change — according to a behavioral model. The main idea of microsimulation is that processes resulting from the actions and interactions of a large number of micro-units can be explained best by looking at the micro-units and their behavior. One expects to find more stable behavioral relationships on the micro-level than in aggregated data that are affected by structural changes, when the number or size of the micro-units in the population changes, even if the behavior of the individual micro-units and their individual characteristics do not change. These micro-units might be particles moving in line with probability laws, e.g. in fluids or thermodynamics, a field in which microsimulation was first introduced. They might also represent artificial species of ‘artificial societies’, as is the case in most agent-based simulations. But they can also represent individuals, families or households of empirical populations, as it is the case in ‘data-based’ microsimulation.

In **dynamic** microsimulation the behavior of the micro-units is modeled over time. Various approaches can be used in order to model behavior over time, ranging from simple transition tables to elaborated econometrical models, neuronal networks or artificial intelligence. Typical behavioral models are statistical models that, for a given set of personal characteristics, determine probabilities for a defined set of possible transitions like marriage, pregnancy or death. Monte-Carlo simulation is then used to determine if a transition takes place in the simulation experiment. This allows to dynamically update personal characteristics over time and add or remove micro-units to or from the population due to birth, death or migration. Dynamic microsimulation simultaneously addresses point-in-time “snapshot” distribution issues as well as longitudinal “life-path“ issues, making it a powerful and flexible tool for policy analysis. Another type of dynamic behavior is policy response, which might be modeled using econometrical approaches or based on theory such as utility maximization. Again, there is a wide range of possibilities for modeling individual behavior, from the modeling of a rational forward-looking utility-optimizing “homo economicus“ to more realistic human behavior including learning processes etc., as is done in agent-based simulation based on the artificial intelligence approach.

Dynamic microsimulation **models** are the result of a synthesis of various models usually including a population database as model representation of an empirical or artificial society, model representations of alternative tax-benefit systems, as well as behavioral models as outlined above.

For a review of more than three dozens of existing microsimulation models worldwide see Spielauer (2003).

9.3 Classification of microsimulation models

A first distinction can be made with regard to the intended use of a microsimulation model, which can either lie in projections (and consequently in producing forecasts and policy recommendations), or in the explanation of social phenomena. In their latter use, microsimulation models can be empirical models or abstract models. If designed and used operatively for forecasting and policy recommendations, such models ‘need to be firmly based in an empirical reality and its relations should have been estimated from real data and carefully tested using well-established statistical and econometric methods. In this case the feasibility of an inference to a real world population or economic process is of great importance’ (Klevmarken, 1997). In contrast, abstract models are rather designed and used for studying the implications of certain assumptions without any ambition to produce reliable forecasts. The “Family & Education Model” is a projection model.

In the data-based tradition, many microsimulation models have been developed for a wide range of purposes. Thus, they are general models, typically covering the whole household sector of a country. Apart from these general models, there are also very specialized microsimulation models, which typically concentrate on one specific behavior (most prominently, the labor market behavior) or population segment. The “Family & Education Model” can be seen as a base module of a general model.

Another distinction regards the population type, namely cohort versus population models. Cohort models “age” a single cohort over its entire lifetime, predicting each individual's major life-course events. In contrast, dynamic population microsimulation models entire age cross-sections. Studies typically done with single cohort models investigate lifetime income and interpersonal distributions. Several limitations of these cohort models are derestricted when simulating a whole cross-section population, including issues of demographic change and distributional issues between cohorts. The “Family & Education Model” is a population model, or more precisely, a closed population model.

In microsimulation the terms open and closed population usually correspond to whether the matching of spouses is restricted to persons within the population. In open population models partners are usually attached as attributes to the “dominant“ individuals of the population with characteristics synthetically generated or sampled from a host population. In contrast, closed models allow to track kinship networks and also enforce more consistency, given a population that is large enough to find appropriate matches. Major drawbacks of closed models are the computational demands associated with mate matching and sampling problems. A related topic is how to model immigration. Approaches range from the cloning of existing ‘recent immigrants’ to sampling from a host population or even from different ‘pools’ of host populations representing different regions.

Models can be distinguished by their time framework that can be either continuous or discrete. Continuous time is usually associated with statistical models of durations to an event, following a competing risk approach. Beginning at a fixed starting point, a random process generates the durations to all events considered, with the event occurring next to the starting point being executed and all others censured. The whole procedure is repeated at this new starting point in time until the event ‘death’ of the simulated individual occurs. Continuous models are technically very convenient, as they allow to add new processes without changing the models of the existing processes as long as the statistical requirements for competing risk models are met (see Galler 1997 for a description of associated problems). An interesting problem arises when introducing time-dependent covariates like periodically updated economic indices (e.g. unemployment) or flow variables like personal income. The periodic update of indices would censor all other processes at every periodic time step with the model therefore converging against a discrete time model as shorter the periods are. Thus, discrete time models are mainly used in models that do not include tax-benefit or other accounting issues like demographic models. Discrete time models determine the states and transitions for every time period, while disregarding the exact points of time within the interval. Events are assumed to happen just once in a time period. As several events can take place within one discrete time period, short periods have to be used to avoid the occurrence of multiple events or all possible combinations of single events have to be modeled as events themselves. Discrete time frameworks are used in most dynamic tax-benefit models, with the older models usually using a yearly time-framework mainly due to computational restrictions. With computer power having become stronger and cheaper over time, monthly time steps have become predominant. As the time steps are shorter, they approach "pseudo-continuity", therefore also allowing the use of duration models. An example of the combination of both approaches is the Australian DYNAMOD model. The "Family & Education Model" follows the same approach, i.e. it predominantly models durations using monthly time steps.

The "Family & Education Model" is a typical data-based model. In data-based microsimulation a clear distinction can be made between the data representing the population, the model determining the behavior, the Monte-Carlo simulation typically used to run the model, and the software necessary for the whole exercise. Micro-econometric and statistical models are usually associated with this type of microsimulation. In such models the behavior is normally expressed in transition probabilities or duration times. Two main approaches can be distinguished according to the way of modeling time: (1) the continuous-time competing-risk approach to dynamic microsimulation modeling, and (2) approaches based on a discrete-time framework. These issues are explored in detail in Galler (1997).

Agent-based microsimulation based on the distributed artificial intelligence approach represents a very different modeling tradition. Agents are defined by their behavior and act according to the environmental context they are placed in. As stated before, today the "artificial society" approach is mainly used to explore theories. Micro-units are "intelligent" and acting agents, having goals and following rules. The following features characterize agents:

- agents have receptors, they get input from the environment;
- agents have cognitive abilities, beliefs and intentions;
- agents can follow different rules and take decisions on which rules to follow;
- agents live in groups of other agents and interact;
- agents can act and act simultaneously;
- agents can learn.

A synthesis might be desirable and could be approached by combining or allowing various “rules of motion“” and population types according to the respective research questions and goals. As an example, fertility might be modeled in a two-step process by combining a child-having decision model — a model that might incorporate theory and could be agent-based — with a (statistical) waiting-time model (Vencatasawmy, 2002).

9.4 The Family & Education Microsimulation Model

According to the classification scheme described above, the “Family & Education Model” is a general, dynamic, data based, closed population microsimulation projection model. The starting population was generated from the second wave of the 1996 Austrian micro census, which contains detailed event history data regarding educational careers and births. The model consists of four behavioral modules regarding mortality, education, partner matching and fertility. Transition rates and duration distributions are assumed time-invariant, i.e. the model is parameterized by time invariant transition rates and duration distributions.

Mortality

The month of death is determined at birth or, respectively, in the starting period (June 1996) of the simulation for persons contained in the starting population. We use the 1991 mortality tables for males and females.

Education

All individuals enter primary school in September following their 6th birth day. Regarding all school transitions and durations, we distinguish between 20 “student types” according to parents’ education, sex and municipality type. Each school considered is parameterized by the duration distribution (in years) and transition rates into all the possible school types following.

Regarding the first school choice between lower secondary school and lower secondary academic school we use observed graduation rates by parents' education, gender and municipality type for the birth cohort 1976-80 for all future cohorts. As described in the analytical part (Chapter 5), most changes over the last decades have leveled off for the most recent cohorts. The biggest changes have occurred regarding the diminishing gender differentials that might be assumed stable at the current level for future cohorts. The second broad change regards urban-rural differentials that also leveled off for the last birth cohorts and might be assumed to stay at its current level. The duration time for both lower secondary school types is assumed to be equal to the regular duration of four years for all students.

Regarding the second educational choice, again we believe that the graduation rates observed by parents' education, gender, municipality type and previously attended school for the birth cohort 1970-79 can be directly used for a reasonably good base scenario for future cohorts. In contrast to the lower secondary school types, the duration times are not set to the regular time for all students, but observed gender-specific distributions of school durations were applied.

Regarding university graduation we use estimated transition rates applying the logistic regression model discussed in Chapter 7. As was shown in the analysis, these rates almost converged for male and female students in urban and male students in rural areas. All rates were assumed to stabilize at this level. Regarding study durations, the observed gender-specific distribution for the graduation cohorts 1990-96 are directly applied. University dropouts are modeled separately based on estimated dropout rates using the logistic regression models of Chapter 7. Again, the gender-specific distribution of study-duration observed is used for the parameterization of the baseline model.

Partnerships

A partner is matched to a women when giving first birth which implicates that fertility is modeled independently of partnership status. Partners are matched using the observed educational and age patterns as analyzed in Chapter 9. As only the educational attainment of the male partner is used in the simulation, age differences are included in the model only in order to enforce more consistency. In the strict sense, following a closed population framework and generating a link to an existing male record would not be necessary as the partners' education could also be considered an attribute of women in the simulation. Rather than modeling partnership careers from their formation to their end by divorce, separation or death of one partner, only death is considered in this model: the death of a partner terminates the partnership career and in the case of giving birth, a new male partner is matched. Accordingly, the simulation is based on the following algorithm: at any birth event, it is determined if a partner has to be matched. If so, the educational attainment and age (in years) of a partner is determined by Monte-Carlo simulation. In the next step, a partner with these characteristics is searched in the population database and matched if found. If no partner can be found, another random draw of the partners' age is made until a partner with the educational characteristics can be found or a maximum number of iterations is reached. In this case, no partner is matched explicitly. The number of repetitions is stored with the history entry for further analysis. In the simulation runs based on this model, in around 94% of the cases no repetition is needed and in 99.6% less than three repetitions are needed indicating that the future "spouse market" allows for unchanged matching patterns.

Fertility

The fertility module implemented into the microsimulation model follows a simple scenario-based approach, allowing to study the effect of fertility differentials between educational groups on the future educational composition of the population. The timing of birth is modeled in dependence on school leaving age, assuming time-invariant distributions of duration from leaving school to the first birth for different educational groups and also taking into account rural-urban differentials. Accordingly, for each group of women distinguished, the model is parameterized by the probability distribution of giving birth in a given year before or after leaving school, on the condition that these women do not remain childless. After determining the birth year of the first child by Monte Carlo simulation, a random month is assigned. Spacing of births is modeled accordingly, parameterized by birth order using observed distributions.

Quantum of birth is parameterized by time-invariant parity distributions, i.e. for every distinguished group of women it is specified how many of them remain childless, have one child, two children etc. over the life course.

In the simulation, for each woman it is first determined if she will give birth (again), using Monte Carlo simulation based on the individual parity progression rate calculated from the model parameters. If so, the duration from the reference event (school leaving for first birth or last birth respectively) is determined by Monte Carlo simulation. After determining the year, a random month is assigned and the birth event is assumed to happen.

In order to parameterize the model, measures regarding the distribution of the timing and spacing of births as well as the parity distribution have to be set for all educational and rural urban groups distinguished. Fertility measures are cohort measures and, therefore, obviously not observable for the present, as it is unknown when and how many (additional) births a woman will give until the end of her fertile period. In order to parameterize the model, scenarios have to be created that produce simulation projections which are consistent with period measures observed, such as the births observed since 1996, the starting year of the simulation. In the base scenario timing (measured as distance from the school leaving age) and spacing of birth as observed in 1996 are assumed to remain stable over time, which reduces the problem of the selection of appropriate parameters regarding the parity distributions by education and municipality type. This is done by finding education-specific parity distributions that produce births which come close to the number of births observed since 1996 for the different educational groups. The parameterization of the base scenario is described in more detail below.

Beside the base scenario, an alternative scenario is created in order to investigate the effect of fertility differentials by education on the educational composition of the population. In this alternative scenario all women are assumed to have the same parity distribution and, therefore, the same cohort fertility.

For the timing of first birth, the distributions observed from leaving school to the first birth are used distinguishing seven educational groups. The educational groups are “compulsory”, “apprenticeship”, “vocational or technical school”, “vocational or technical *Matura*”, “academic *Matura*”, “university” and “university dropout”. The distributions are based on the micro census 1996 for birth cohorts 1990 to 1996.

For the duration distribution between births administrative data for 1996 from Statistics Austria were used, independent of birth order or educational background.

Regarding parity distributions by education and municipality type, plausible assumptions have to be made and the simulation results validated against empirical data. For Austria, administrative data are available for births by education and year, using a simplified educational scheme of “compulsory”, “apprenticeship”, “vocational or technical school”, “*Matura*” and “University” and not distinguishing between municipality types. As “initial guess”, the last observable parity distribution rates — i.e. for the birth cohorts 1950-54 — are used for the projection (see Appendix II for rates). As can be seen in the table below, a simulation projection of births for 1997-2000 based on these rates deviates from the observed births by -4%, which can be seen as good overall fit as projected births do not include migration. A decomposition of births by education of the mother reveals higher differences. The simulation produces too few births for women with apprenticeships or vocational or technical schools, while births of women with *Matura* lie 33% too high. It might be concluded that the fertility behaviors of the educational groups without a *Matura* diploma converge towards the behavior of the lowest educational group, while the fertility behavior of women of the "*Matura*" group moves closer to university graduates (who seem to have a higher fertility than the extremely low fertility of this group for the 1950-54 cohort).

Table 15: Observed and projected births 1997-2000 by Mothers' Education,

Births 1997-2000 by Mothers' Education	Compulsory	Apprentice-ship	Vocational & techni-cal School	Matura	University	**Total**	Without Matura	With Matura
Administrative data	67471	123429	55445	57392	17947	**321684**	246346	75338
Simulation projection result using parity distribution rates by education and region as observed 1950-54	67262	102438	47073	76585	15691	**309049**	216773	92276
Deviation	0%	-17%	-15%	33%	-13%	-4%	-12%	22%
Simulation projection result Base Scenario: CFR=2 rural without Matura, CFR=1,9 urban without Matura, CFR=1,35 all with Matura	65934	107723	55040	62845	17154	**308696**	228697	79999
Deviation	-2%	-13%	-1%	10%	-4%	-4%	-7%	6%

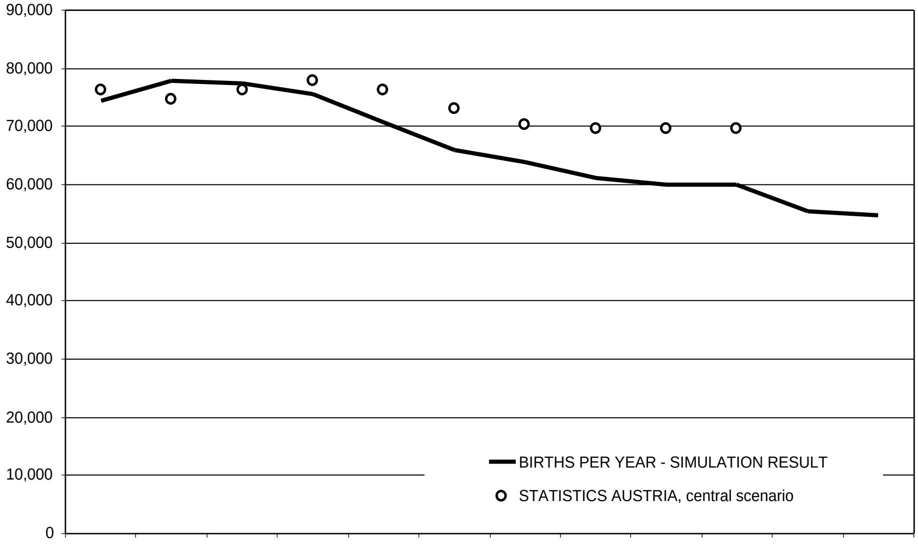
In a base scenario the cohort fertility rates of women without a *Matura* diploma are assumed to lie at 2.0 in rural and 1.9 in urban areas, while being at 1.35 for all others (see the assumed parity distributions in Appendix II). While this scenario moves the simulated births closer to the observed ones, it still does not produce "enough" births in the group of women without a *Matura* diploma (-7%), while there are still 6% "too many" births in the other group. The underlying assumption is that the cohort fertility will not exceed two in any educational group in the long run. It also might be assumed that part of the "missing" 7% can be explained by immigrants in 1996-2000 (and the strong immigration wave shortly before the survey period; most immigrants are considered to come from the group without *Matura* diploma). At the other hand, the fertility differential between the two main groups (with/without *Matura*) are kept moderate to stay "at the safe side", when analyzing the influence of the fertility differentials on the future educational composition of the population. As the model currently does not consider rural-urban migration which might lead to distortions, especially regarding higher educated groups, a unique fertility level is assumed for rural and urban women with a *Matura* diploma. On the population level, this parameterization results in a cohort fertility rate of 1.623, when the stable equilibrium regarding the educational composition of the population is reached (see below). This cohort fertility rate lies considerably higher than the currently observed periodic total fertility rate, which does not account for the changes in the timing of birth (the central scenario of the UN population projection for Austria assumes that the total fertility rate will increase to 1.65 until 2050).

10 The future educational composition of the Austrian population: scenarios and projection results

10.1 Births

The number of births projected in the base scenario will stay close to the central scenario of Statistics Austria for the next two decades and then fall considerably below. This difference can mainly be explained by the non-consideration of immigration in the base scenario. In contrast to the population projection of Statistics Austria, the micro-projection of births indicates a rising number of births in the coming years, caused by the catch-up effect of postponed births.

Figure 55: Microsimulation projection compared to the medium variant of the projection of Statistic Austria

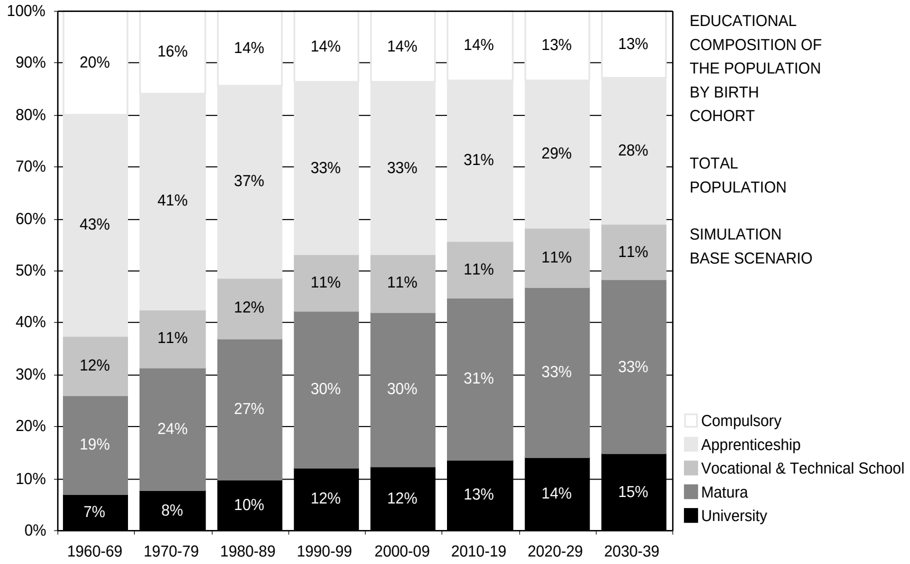


Source: Central Scenario of Statistic Austria; Statistische Nachrichten 9/2001

10.2 Educational composition by birth cohort

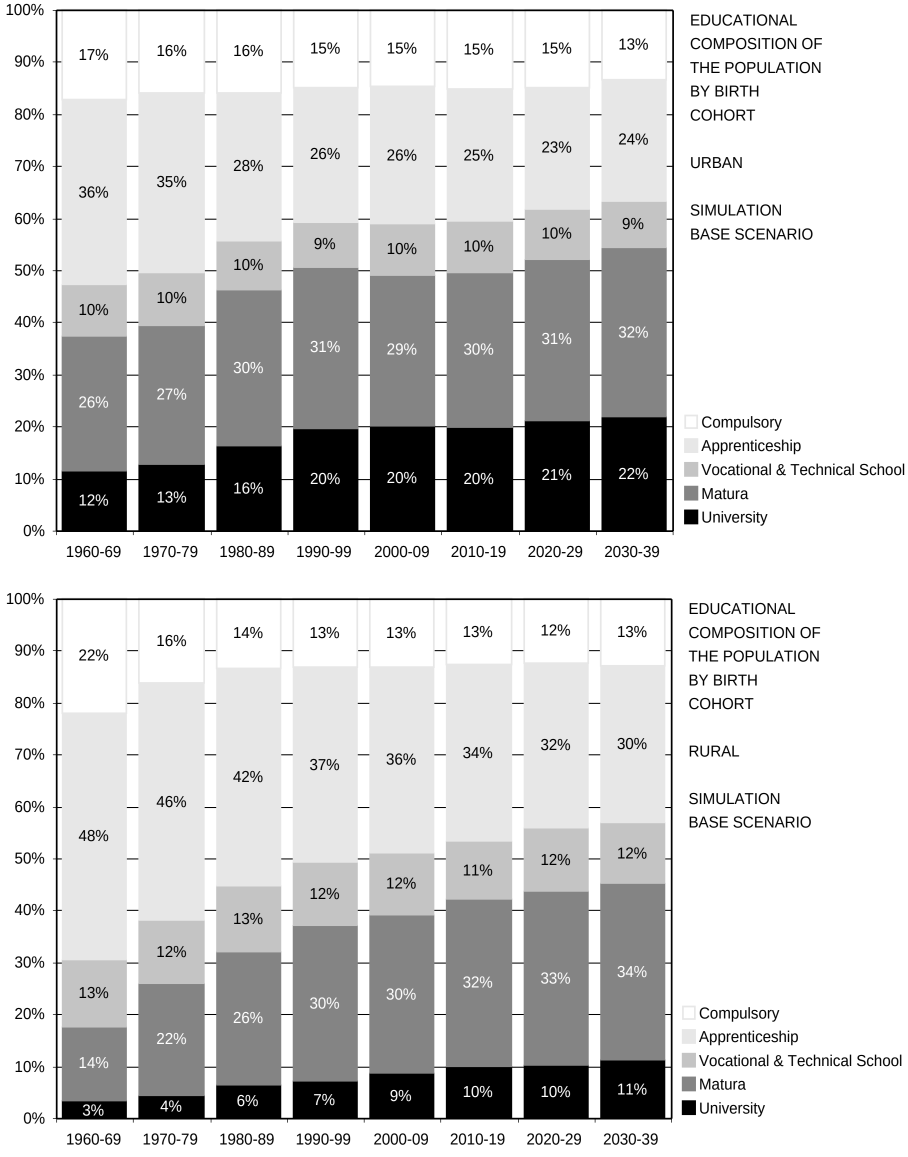
The micro-projection of the future educational composition of the population by birth cohort indicates an ongoing educational expansion on the population level until a stable equilibrium will be reached (see discussion below). As all transition rates are assumed to remain unchanged at their current level, the driving force behind this process is the changing educational composition of the parents' generation.

Figure 56: Educational composition of the population by birth cohort



The decomposition of this aggregated simulation projection result by municipality type reveals that most changes regarding birth cohorts from 1990 onwards have occurred in rural areas. While the percentage of university graduates is three times higher in urban areas for the 1990-99 birth cohorts, the rural university graduation rate will reach half the level of the urban rate for the 2030-39 birth cohort.

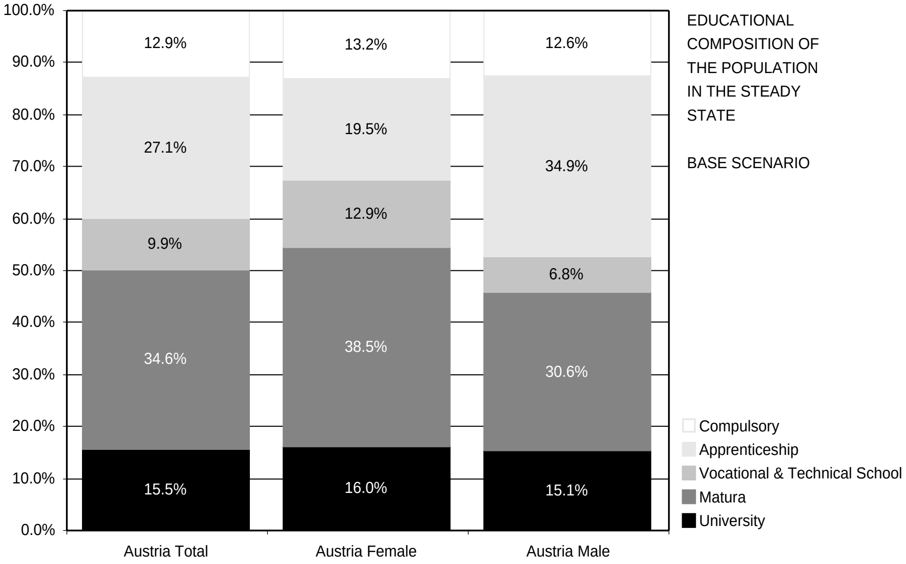
Figure 57: Educational composition of the population by birth cohort and municipality type

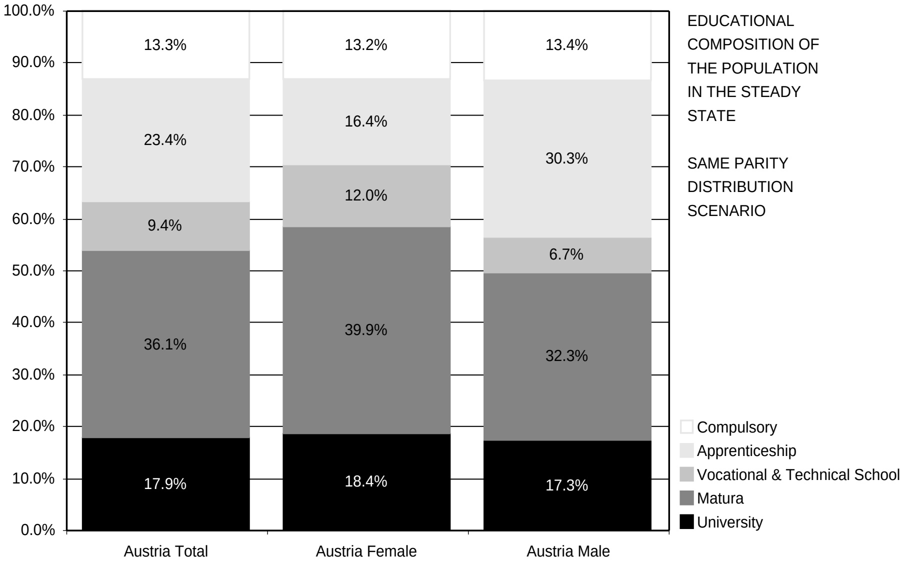


10.3 Educational composition in the long-term equilibrium

As the microsimulation model assumes unchanged behaviors on the micro level expressed in fixed (time-invariant) transition rates and duration distributions, the population converges towards a stable equilibrium with a stable educational composition. The following figures compare the long-term equilibriums by gender and municipality type for the base scenario and the alternative scenario of uniform fertility among all educational groups.

Figure 58: Educational composition of the population in the stable equilibrium for the base and alternative scenario



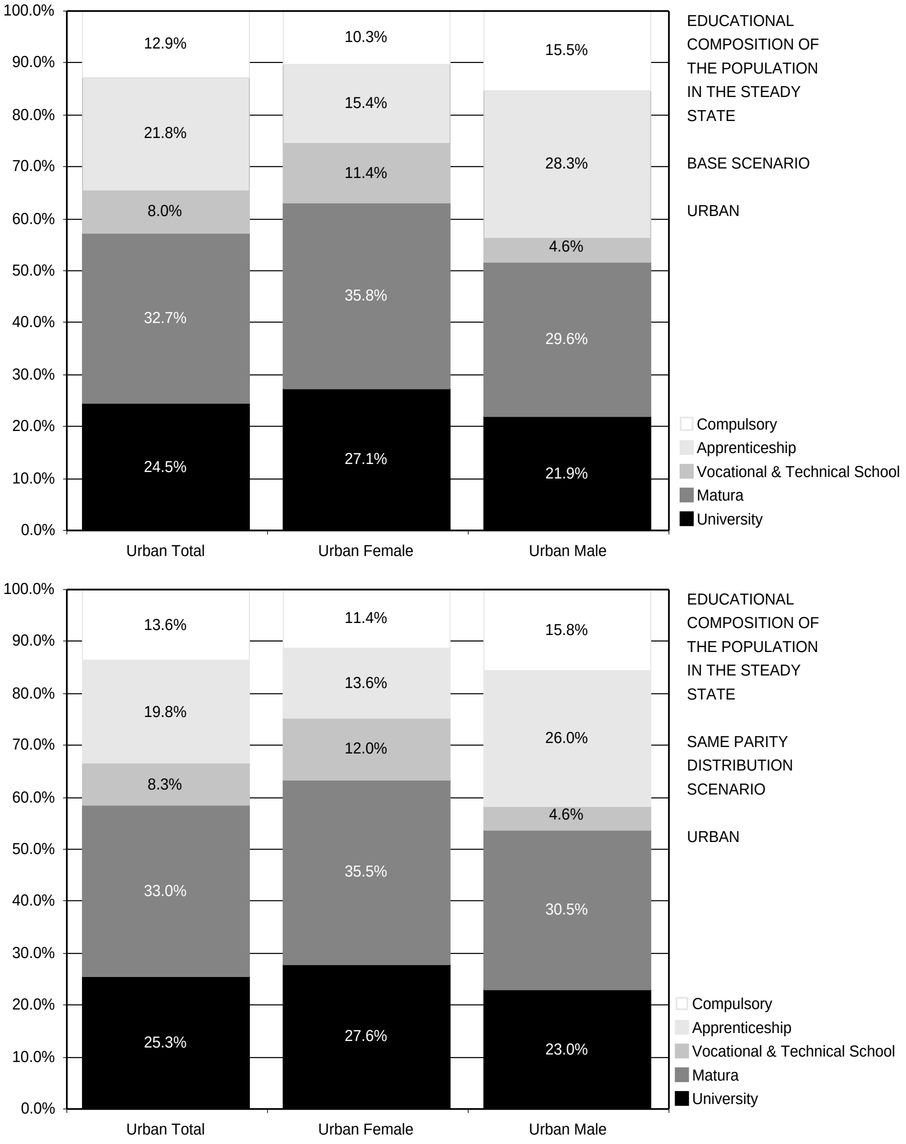


Fertility differentials between the educational groups result in lower rates of university graduates and people with a *Matura* diploma. Without fertility differentials, the rate of university graduates would be 15% higher, while the percentage of the apprenticeship group would be 14% lower. In the base scenario, 50% of the population will hold a *Matura* diploma or academic degree.

While the rate of university graduates is only slightly different between men and women on the population level, this difference is far more pronounced when decomposing the population by municipality type. In rural areas, the rate of university graduates is 10% higher for males, while it is almost 20% lower for males in urban areas.

In urban areas, almost a quarter of the population will have an academic degree and around one third will have a *Matura* diploma as highest educational attainment. In rural areas, university graduates will account only for 1/9 of the population.

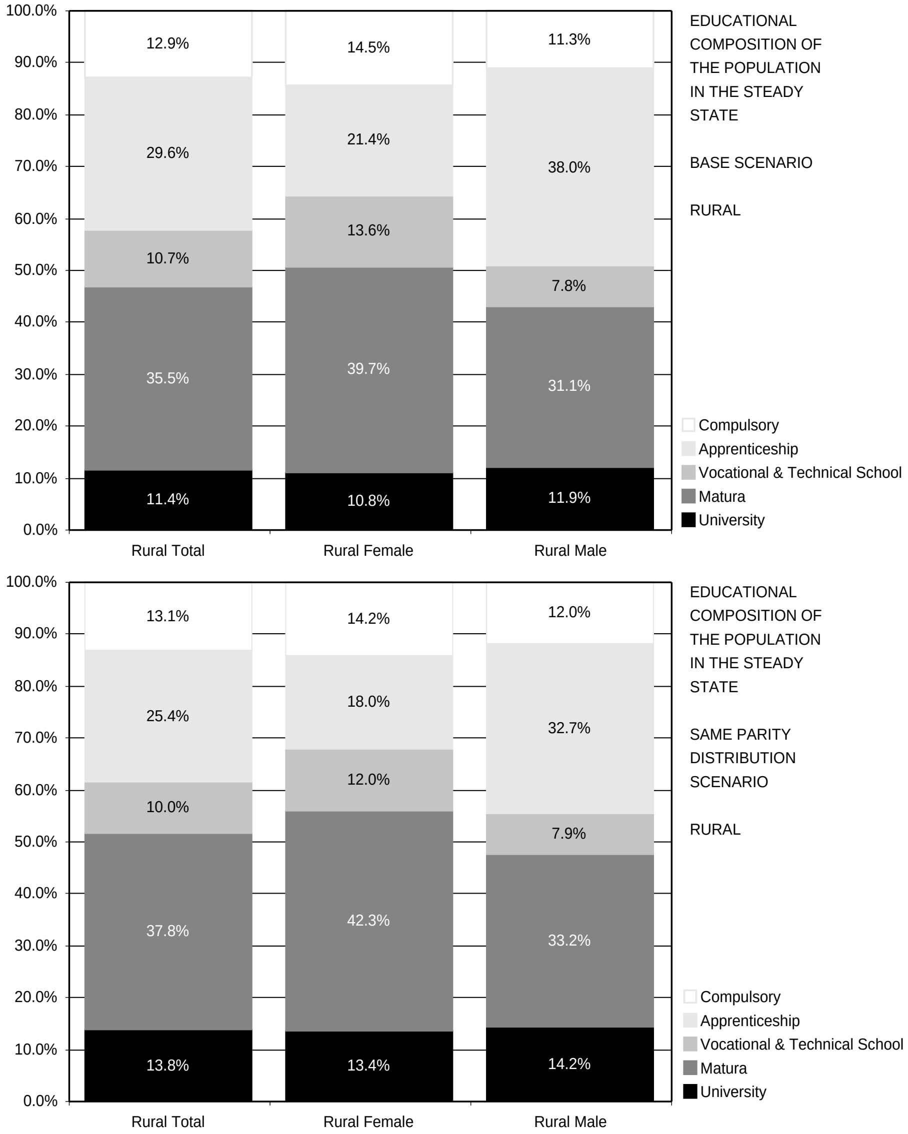
Figure 59: Educational composition of the population in the stable equilibrium for the base and alternative scenario — urban



While the rate of university graduates is only slightly different between men and women on the population level, this difference is far more pronounced when decomposing the population by municipality type. In rural areas, the rate of university graduates is 10% higher for males, while it is almost 20% lower for males in urban areas.

In urban areas, almost a quarter of the population will have an academic degree and around one third will have a *Matura* diploma as highest educational attainment. In rural areas, university graduates will account only for 1/9 of the population.

Figure 60: Educational composition of the population in the stable equilibrium for the base and alternative scenario — rural



Uniform fertility in all educational groups would rise the proportion of people with an academic degree or a *Matura* diploma to slightly more than 50% in rural areas and of university graduates by more than 20%.

11 Outlook and Conclusions

In this volume on "Family and Education" we studied the intergenerational educational transmission within families and the influence of education on partner choice and fertility.

In the last decades we observed a considerable educational expansion in Austria: with each age cohort more and more people reach higher levels of education. In contrast to this ongoing educational expansion at the population level, very stable behavioral relationships can be found on the micro-level when accounting for the parental educational attainment, rural urban differentials and gender.

The education of parents was identified as the key determinant of individual school careers with this influence being reinforced at every transition point. Regarding the first educational choice between the lower secondary and the lower secondary academic school we find probabilities to opt for the latter ranging from 7% for rural boys with parents that have only compulsory education to 86% for urban girls with at least one parent with an university diploma. For the first group, the probability to obtain a *Matura* diploma is 9,4%, compared to 84,3% of the latter. Regarding university education the range between this two groups is from 1,8% to 52,8%, or in other words, daughters of university graduates in cities have a 30 times higher probability to obtain an university diploma than sons of parents with compulsory education living in rural areas.

Assuming unchanged behavioral relations on the micro level, the educational composition of the population converges towards a stable equilibrium. In order to study the transition path as well as the resulting equilibrium we had to consider additional processes that influence the future educational composition of the Austrian population: partnership formation and fertility. We investigated the changing educational and age patterns of partnerships, that is, the composition of couples by educational attainment and related changes over time. We found considerable changes regarding the educational composition of couples. With diminishing gender differences regarding educational attainments, partnerships became more symmetric in the sense, that it became as likely for a women to have a partner with a higher or a lower educational attainment. In general, partnerships are highly homogeneous. We used computer microsimulation in order to find out if today's pattern can be maintained in the future or, put differently, if people will find partners corresponding to today's educational and age patterns also in future, what we found being the case.

The second related behavior that affects the future educational composition of the population are fertility differentials between educational groups. For the past, we can observe very typical demographic patterns that lead from very high fertility differentials between educational groups at the beginning of the last century to the emergence of the two-child-norm and the corresponding small fertility differentials, with fertility rates lying around replacement fertility in all groups. This process was reversed in the second half of the past century at generally lower fertility levels but with increasing fertility differentials. In our study we analyzed changes of parity distributions ("quantum of births") and duration times ("timing of births") from the time of leaving school to the first birth resp. the time between births ("spacing of births"). As today we can only observe period measures, we used computer micro-simulation in order to find "proper" parity distributions by educational groups which produce observed birth numbers by education in a retrospective simulation projection under the assumption that there will be no more changes in the timing of births. We found a bifurcation of fertility rates: almost replacement level for women without and around 1.2 for women with a *Matura* diploma.

Moving from analysis to synthesis, we putted the pieces together to a comprehensive microsimulation model. We applied the microsimulation model to project the educational composition of the population into the future. As all parameters are assumed time-invariant, the educational composition converges towards a stable equilibrium. In order to determine the effect of fertility differentials on this equilibrium, we also "run" a second scenario of uniform fertility behaviors and used the resulting equilibriums for comparative analysis. We found, that the educational expansion we experienced in the last decades will go on at a very moderate speed in the next decades until the equilibrium is reached. In the future equilibrium, half of the population will obtain a *Matura* diploma from which 30% will also graduate from university.

12 Appendix I: The FAMSIM+ microsimulation platform

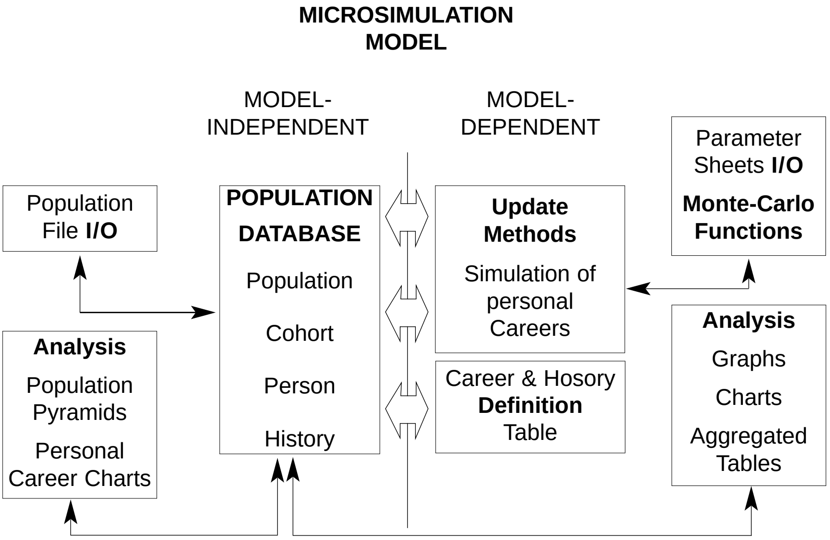
12.1 Introduction

This part describes the technical framework of the socio-demographic software platform FAMSIM+ developed at the Austrian Institute for Family Studies. This software is not only intended to run the model for educational projections developed in this study, but also as a research tool — a technical platform — for socio-demographic model builders.

The FAMSIM+ framework consists (1) of a population database that stores the whole life course of all individuals of the simulated population, (2) standard model outputs like population pyramids or a simulated future population census and (3) the “rules of motion” that determine the individual life courses. The software implementation of this framework constitutes the core modules of an extendible open microsimulation software platform. In order to make the software as reusable as possible, it is organized in a model-independent part and a model-dependent part, with the former part following two main design goals, namely to (1) restrict model builders as little as possible regarding general modeling options like the time framework of the model and (2) include a wide — and extendable — range of general model-independent analyses and data input/output tools.

The main element of the model-independent part of the software platform is the “static” part of the population database, i.e. a database that can read in a starting population from a file, convert it into the internal data structure and produce output in various formats like aggregated tables, population pyramids or a graphical representation of individual life course careers. The population database can handle a wide range of career-spells of parallel careers that make up the individual life course. The way in which a career spell is stored in the database is standardized, allowing to include any kind of career that can be coded in the given format. Careers and all associated states are labeled, with the labels being read in from a standardized “career & history definition table”. The main element of the model-dependent part are the updating methods of the population database, that is, the software-implementation of the model that defines how the individual life courses are simulated into the future. Another object of this framework is the parameter object that organizes parameter sheets like transition tables and provides methods for the calculation of transition probabilities or for the execution of Monte Carlo draws to determine if an event happens in the simulation. Although this parameter object is clearly model-dependent, its modules might be reusable in a variety of models. The following figure illustrates the components of a microsimulation model.

Figure 61: The model-dependent and model-independent components of a microsimulation model



12.2 Population Database

12.2.1 General Idea

In spite of the central focus on dynamics over time, many dynamic microsimulation models follow a rather static cross-sectional approach regarding the storage of micro data. Individual characteristics are stored in a cross-sectional database that is changed or “aged” over time, with new records being added at birth or deleted at death. In order to capture the dynamic changes over time, this cross-sectional database is then stored for each single time period representing waves of a simulated panel.

FAMSIM+ uses a “dynamic” population database in which instead of snapshot information on individual characteristics the whole life course of an individual can be stored and retrieved. . This approach is based on the life course perspective: the description of lives as event histories. Following this approach, life can be described — and stored — as a series of events. An event is defined as a qualitative change that occurs at a specific point in time and places an individual in a new status. Events are transitions between states, e.g. between marriage and divorce, that change the marital status of a person. States and events typically belong to different domains or careers, like partnership, job and educational careers that interact and influence each other. The collection of all possible states for each career to be considered in a specific analysis creates a state space that determines all possible trajectories and outcomes of individual life histories along with all possible transitions. Once defined, the description of individual lives consists of 'event history data', i.e. all events are recorded together with the time at which they occur or, alternatively, all states are recorded by precisely noting when they begin and when they end.

As a guiding principle, as much individual information as possible should be available for each point in time. In order to be able to handle large population samples, efficient data storage strategies have to be employed to keep the required memory space as small as possible. In this respect, a population database is used that can be handled in RAM by using program internal data structures that are currently limited to 254 megabyte. The use of a program internal data structure (vs. an external database) was chosen also for speed reasons, as individual records can be directly addressed and kept in a hierarchical object structure. Various test runs and prior model prototype development (Spielauer, 2001) helped to determine a "balanced" design allowing for 100,000-200,000 individuals that can keep track of 50-100 life events, and 2-4 individual accounts, e.g. of yearly individual social security benefits and contributions, family benefits and income data etc.

History event data play the most dominant variable type. As indicated above, events belong to different careers. While states usually correspond to qualitative variables (e.g. "employed") this concept will be extended, allowing states to be linked to other persons (e.g. "married" persons are linked to their spouse) or dynamic processes (e.g. an "employed" person might be linked to an income process).

12.2.2 Population I/O-Formats

In data-based microsimulation a clear distinction can be made between the data representing the population, the model determining the behavior, the Monte-Carlo simulation typically used to run the model, and the software necessary for the whole exercise. Regarding data, populations can be represented in various ways that usually correspond to survey designs:

- a single cross-sectional description of the characteristics and states of all individuals at a given time. Each person is represented by one data record.

- a panel description of the characteristics and states of all individuals at different times. Each person is represented by one data record for each point in time considered.
- a retrospective event history description of individual lives. Each person is represented by a list of events or states describing the individual life course.

In order to store the whole individual life course, the full information can be stored in the two latter formats, that is, by a panel wave per time unit or — more storage efficient — by storing events/states characterizing the individual life course. The central data format used in the framework developed here is the list type. Additionally, various routines for data conversions are provided as cross-sectional descriptions are necessary to display population data, e.g. in form of aggregated tables or population pyramids for a given point in time or to generate a simulated panel wave. The panel description is usually also needed as input for the estimation of statistical transition models, e.g. monthly data records might be used as input for logistic regression models.

Every person in the population is characterized by at least one list entry: its birth. The birth date marks the first month of the career "life" that can be of two alternative states: male or female.

Output can be produced accordingly, with career spells ordered by date or by the career type. Population input and output data of this form represent a population and its past at a given point in time: all individual life courses are censured at this time. Data output of a simulated future population might be used as data input again, e.g. in order to simulate a population further into the future using changed model parameters.

Another standard population data output provided by the microsimulation software consists of a "snapshot" cross-sectional file, containing all states and characteristics of each person for a given point in time. This file might be used for cross-sectional analyses of population characteristics for any given point of time.

As such a file can be produced for any time period, population data can be transformed in periodic (e.g. monthly) observations. This constitutes the third standard output format, with records ordered by person and time. For example, this allows to graph the individual life course careers for each individual and, as mentioned above, constitutes the data format needed for the estimation of transition models by statistical packages.

The standard I/O file provides maximum flexibility regarding the number and meaning of the different careers and their possible states in different model applications. Every model contains a description table containing the labels of all careers considered, their possible states and reasons for their ending.

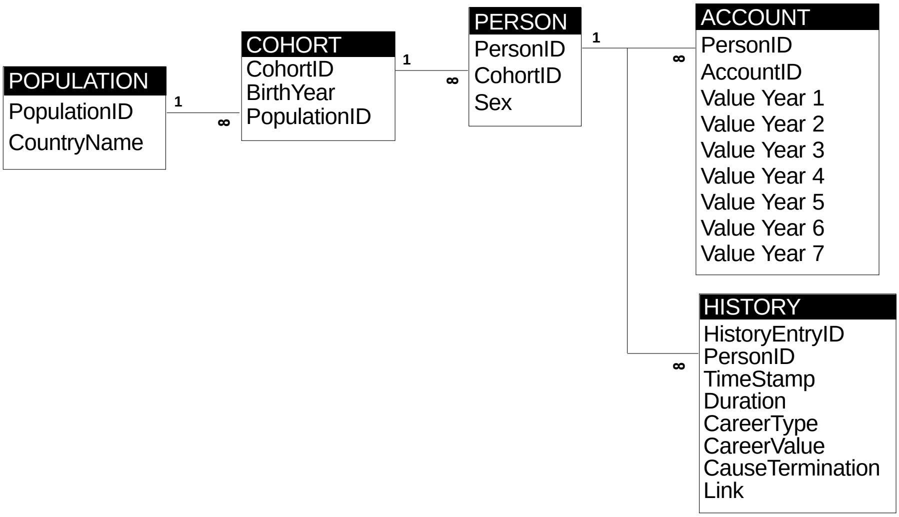
12.3 Object Structure

As the standard population input data file is read into the simulation software, the data are converted into the program-internal population representation. The program follows a hierarchical object structure. The most important object type is the individual person, with a series of attributes, some of which are complex objects themselves. Typical examples are:

- events/states characterized by time of occurrence, the career regarded, the new state and other characteristics (see above)
- accounts: time series of flows together with accounting routines

Persons belong to monthly cohorts that constitute other objects containing various retrieving methods, e.g. determining the number of persons of this cohort alive at a given moment in time. The population containing all cohorts considered stands on top of this object hierarchy .

Figure 62: Relational structure of the population database



12.3.1 The Object HistoryList

Most of the individual information considered are events that describe the individual life course. Each of these events belongs to a specific career and leads to a new state. The “history list” can be seen as the database object that is used to store and retrieve individual life course information contained in the population input file. Each list entry corresponds to the six attributes per entry of the population input file already described above:

(1) CareerType
(2) FirstMonth
(3) LastMonth
(4) CareerState
(5) CauseEnd
(6) Link

A new entry into this “career list” will typically be made at the moment an event happens. At this time the “first month” is set and the career type and the new career state are recorded. Usually, the duration of the career spell and the cause of termination (if modeled) are not known at the beginning and are added later when another event changes the state of the career considered. The individual data records can contain a link to another person or to institutions (e.g. specific schools) or municipality types. This link is used e.g. to record the links of children to their mothers, of partners or (if modeled) of job spells to specific income processes.

The “history list” design is independent of the modeling of time, that is, it allows both a discrete time and a (pseudo) continuous time framework. Therefore, it allows to be used in conjunction with a very wide range of modeling approaches regarding the modeling of individual behaviors. Moreover, it permits to “prerecord” expected future events, that is, implement the “christal ball” approach followed e.g. in the Australian DYNAMOD model: DYNAMOD e.g. determines the date of death (which is then stored in the “christal ball”) at birth but allows for a dynamic change of this date if events (like sickness) occur that change the probability of death.

Allowing for the modeling of (pseudo) continuous time, also duration models can be used, which determine the time to an event. In such a competing risk framework, the durations to the next events of all careers considered are determined at a given time, with the first event censoring all others and determining the next point in time from which the procedure is repeated.

12.3.2 The Object Account

Individual accounts are used to keep track of financial flows. Typical financial flows are income, social security contributions and benefits or taxes paid. The time framework for these flows are full calendar years, with numbers being stored over the whole lifetime in order to allow for various individual accounting routines, e.g. the calculation of internal returns to social security payments etc.

The object “Account” provides a range of methods used to store and retrieve yearly flows and calculate stocks and various indices. These accounts can also be linked to interest rate vectors in order to calculate stocks for a given moment in time or calculate the present value of financial flows.

This design allows to add accounting routines at any level of detail that can make use of information on financial flows over the whole lifetime. Besides the accounting on the individual level, flows can be added up by birth cohorts and other specified groups in order to study the issues of intergenerational fairness and other distributional issues. With a typical parameterization (i.e. 100,000 individuals), the software platform can handle up to eight different accounts per person and is therefore suitable for a wide range of financial analyses. Individual accounts can be stored and retrieved in tab-delimited spreadsheet files.

12.3.3 The Object Person

The object “Person” is the central object of the software platform. Each person contains a history list object and (if used) various accounts. Persons therefore possesses a “full memory” regarding the whole life course as well as about financial flows like income histories and social security contributions paid and benefits received.

All methods setting and retrieving personal characteristics are implemented as part of the person object as well as all methods used to model financial transactions and flows of a person.

Most methods of the object “person” are model-specific, e.g. the methods used to simulate all life course careers into the future. Single careers are typically defined as objects themselves which can determine at any time if they can “update themselves”, i.e. if they have all the information required (like the states of other careers) to determine their state for the next period or the duration to the next event of this career. Careers that do not require any input from other careers will be processed separately, that is, for the whole life span at once. For example, in the educational projection model developed in the next part, the career “life” is determined at birth by setting the death date, while the career “births” waits for the information “school leaving age”.

These basic, model-independent methods can be used to produce aggregated tables or population pyramids by the states of a given career. For example, in order to produce a population pyramid by gender for a given month, all persons of the population are “asked” if they are (1) alive in this month, and if so, (2) if male or female and (3) of which age — all the information required to construct a population pyramid.

The most important model-dependent method is the method that "updates" all individual careers, that is, the method that simulates all careers as far into the future as possible given the current information. Other model-dependent methods are used to retrieve model-specific information, like the school leaving month, the highest educational attainment etc.

12.3.4 The Objects Cohort and Population

The object cohort consists of an array of persons being member of this cohort and a set of methods used to perform calculations and aggregations on the cohort level, e.g. to retrieve the number of people of a given cohort ever born or being alive in a given period etc. The organization of persons in a cohort facilitates accounting routines and allows for more efficient search algorithms, e.g. in partner matching models, as persons of a given age group can be addressed directly. The object "population" stands on top of the object hierarchy. It consists of a range of cohorts that together form the population and all population level accounting and data i/o methods.

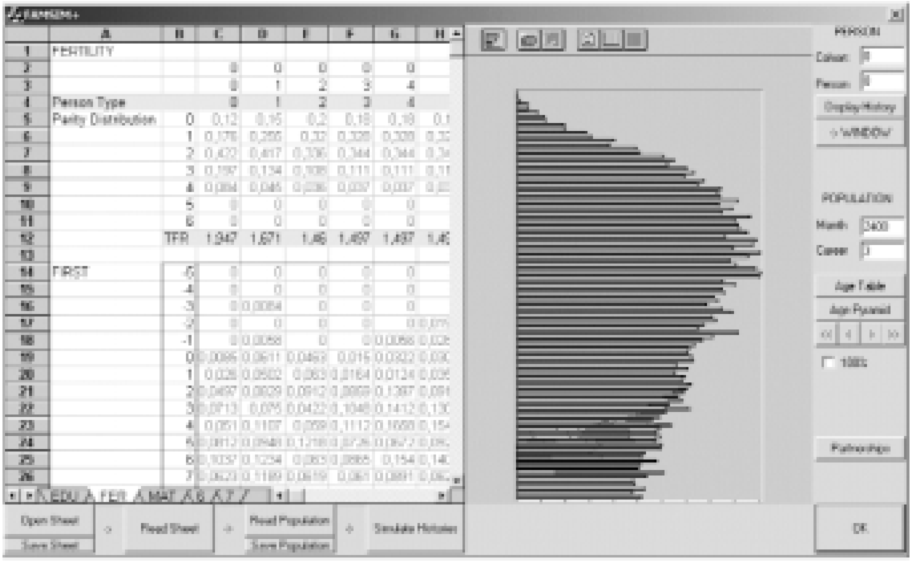
12.3.5 The Parameter Object

The parameter object organizes parameter sheets like transition tables and provides methods for the calculation of transition probabilities or the execution of Monte Carlo. It determines if an event happens in the simulation or the duration time to the next event. The parameter object is model-dependent, but its modules might be reusable in a variety of models. The parameter object uses Excel-compatible spreadsheets as basic input format. Typical methods read in single tables like transition tables, duration probabilities or the parameters of regression equations usually associated with life course careers. As an example, mortality rates might be read in from a table and then used to produce random draws of individual remaining life expectancies.

12.4 Software Implementation

A prototype of the software platform described above was implemented in object oriented C++. "Running" a simulation requires five steps. First, the parameter table has to be opened. This step opens an Excel-compatible spreadsheet containing all parameters of the model that can be directly used or changed by the user. Changed parameter spreadsheets can be saved for future use. Second, the parameters have to be read in by the program. The methods to read in the parameters and make them useable by the model are clearly model-dependent and have to be programmed by the model-builder (who can use existing methods as templates). In a third step a starting population has to be read in that has to be provided in the standardized file format. This step is model-independent and the input file is converted into the program internal population database. After executing a simulation run, the resulting population can be saved in the same file format for further analysis by standard statistical packages. The execution of a simulation run is the fourth step. The associated methods are model-dependent and have to be programmed by the model builder.

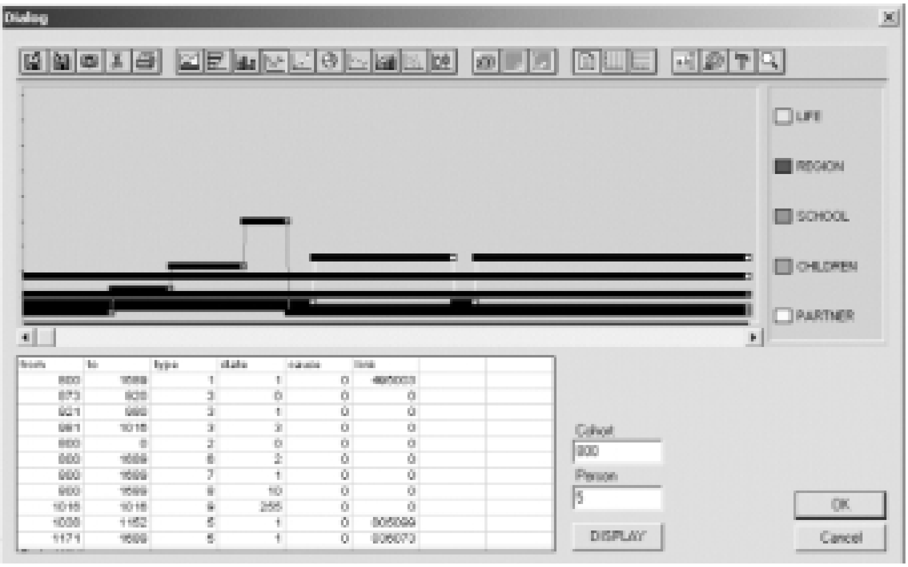
Figure 63: Main window of the software prototype



The software provides standardized spreadsheet table output in the form of age tables for a specified career and month. The only career that is model-independent is the career 1 “life”. Selecting this career and any month of the time horizon (the standard values are 1 to 2,400 corresponding to the January 1901 to December 2100) will produce a table by yearly age groups and sex. Equivalent output can also be produced in the form of an age pyramid. The user can navigate through time by clicking the next or previous month or year buttons.

The second type of standard model-independent output is the output on the individual level. By selecting a specific person — this is done by selecting a monthly birth cohort and the person number within this cohort — the persons’ history can be displayed graphically and in form of a table listing all single career spells. This table also lists the links to other persons that can be retrieved accordingly.

Figure 64: Individual career window of the software prototype



Being designed as an open and extendable simulation software platform, the model builder can extend and add new model output routines. For example, in the context of the model described in the next part, a “partnership report” was added that displays an aggregated table of partnerships matched in the simulation by the number of searches needed.

13 Appendix II: Model Parameterization

13.1 Mortality Rates

FEMALE MORTALITY				MALE MORTALITY			
0	0.00349	50	0.00195	0	0.00418	50	0.00383
1	0.00054	51	0.00212	1	0.00076	51	0.00444
2	0.00033	52	0.00253	2	0.00040	52	0.00486
3	0.00020	53	0.00247	3	0.00030	53	0.00523
4	0.00019	54	0.00276	4	0.00025	54	0.00571
5	0.00015	55	0.00286	5	0.00022	55	0.00619
6	0.00014	56	0.00300	6	0.00018	56	0.00684
7	0.00013	57	0.00324	7	0.00020	57	0.00700
8	0.00013	58	0.00361	8	0.00012	58	0.00825
9	0.00009	59	0.00390	9	0.00014	59	0.00869
10	0.00008	60	0.00443	10	0.00012	60	0.01012
11	0.00009	61	0.00477	11	0.00012	61	0.01140
12	0.00010	62	0.00521	12	0.00015	62	0.01292
13	0.00012	63	0.00574	13	0.00017	63	0.01395
14	0.00013	64	0.00614	14	0.00018	64	0.01530
15	0.00015	65	0.00684	15	0.00027	65	0.01696
16	0.00019	66	0.00757	16	0.00044	66	0.01804
17	0.00017	67	0.00804	17	0.00052	67	0.01994
18	0.00023	68	0.00901	18	0.00060	68	0.02083
19	0.00026	69	0.01000	19	0.00069	69	0.02326
20	0.00026	70	0.01083	20	0.00067	70	0.02578
21	0.00027	71	0.01249	21	0.00066	71	0.02757
22	0.00028	72	0.01392	22	0.00069	72	0.03065
23	0.00026	73	0.01578	23	0.00062	73	0.03416
24	0.00028	74	0.01823	24	0.00067	74	0.03798
25	0.00027	75	0.02047	25	0.00070	75	0.04103
26	0.00028	76	0.02396	26	0.00067	76	0.04674
27	0.00031	77	0.02623	27	0.00061	77	0.05095
28	0.00032	78	0.02970	28	0.00068	78	0.05885
29	0.00035	79	0.03438	29	0.00073	79	0.06473
30	0.00036	80	0.03967	30	0.00072	80	0.07247
31	0.00040	81	0.04347	31	0.00078	81	0.08025
32	0.00047	82	0.05014	32	0.00082	82	0.08815
33	0.00050	83	0.05697	33	0.00085	83	0.09803
34	0.00048	84	0.06598	34	0.00084	84	0.11050
35	0.00052	85	0.07536	35	0.00099	85	0.12399
36	0.00052	86	0.08527	36	0.00107	86	0.13670
37	0.00064	87	0.09736	37	0.00110	87	0.15260
38	0.00065	88	0.11141	38	0.00118	88	0.16530
39	0.00073	89	0.12776	39	0.00138	89	0.18906
40	0.00079	90	0.13501	40	0.00137	90	0.19774
41	0.00081	91	0.15405	41	0.00155	91	0.22079
42	0.00101	92	0.16965	42	0.00172	92	0.24358
43	0.00108	93	0.19005	43	0.00190	93	0.26184
44	0.00115	94	0.20408	44	0.00215	94	0.27865
45	0.00133	95	0.22838	45	0.00245	95	0.30750
46	0.00141	96	0.25804	46	0.00262	96	0.33325
47	0.00154	97	0.27850	47	0.00288	97	0.34571
48	0.00174	98	0.32000	48	0.00329	98	0.41145
49	0.00202	99	0.37714	49	0.00376	99	0.41928
		100	1.00000			100	1.00000

1996 Mortality Table for Austria, Source Statistics Austria

Fertility

13.2 Parity progression and cohort fertility rates for the birth cohorts 1950-54; Source Micro census 1996, own calculations

	RURAL					URBAN				
	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY
PPR 1	0.91	0.90	0.90	0.91	0.85	0.90	0.85	0.82	0.90	0.53
PPR 2	0.82	0.78	0.73	0.77	0.80	0.73	0.66	0.55	0.69	0.46
PPR 3	0.51	0.38	0.40	0.37	0.20	0.40	0.33	0.35	0.37	0.15
PPR 4	0.38	0.26	0.30	0.25	0.13	0.35	0.22	0.33	0.22	0.10
CFR	2.18	1.94	1.90	1.93	1.68	1.91	1.63	1.48	1.79	0.82

13.3 Parity Distribution – Base Scenario

	MUNICIPALITY TYPE	RURAL					URBAN				
	EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY
PARITY	0	10.00%	10.00%	10.00%	25.00%	25.00%	15.00%	15.00%	15.00%	25.00%	25.00%
	1	18.00%	18.00%	18.00%	26.25%	26.25%	17.00%	17.00%	17.00%	26.25%	26.25%
	2	43.20%	43.20%	43.20%	39.00%	39.00%	40.80%	40.80%	40.80%	39.00%	39.00%
	3	20.16%	20.16%	20.16%	8.29%	8.29%	17.68%	17.68%	17.68%	8.29%	8.29%
	4	8.64%	8.64%	8.64%	1.46%	1.46%	9.52%	9.52%	9.52%	1.46%	1.46%
	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CFR	1.994	1.994	1.994	1.350	1.350	1.897	1.897	1.897	1.350	1.350

13.4 Parity Distribution – Alternative Scenario

	MUNICIPALITY TYPE	RURAL					URBAN				
	EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY
PARITY	0	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
	1	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%
	2	43.20%	43.20%	43.20%	43.20%	43.20%	43.20%	43.20%	43.20%	43.20%	43.20%
	3	20.16%	20.16%	20.16%	20.16%	20.16%	20.16%	20.16%	20.16%	20.16%	20.16%
	4	8.64%	8.64%	8.64%	8.64%	8.64%	8.64%	8.64%	8.64%	8.64%	8.64%
	5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	CFR	1.994	1.994	1.994	1.994	1.994	1.994	1.994	1.994	1.994	1.994

13.5 Timing of First Birth Rural

	MUNICIPALITY TYPE	RURAL						
	EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNI-	ACADEMIC MATURA	VOCATIONAL & TECHNICAL MATURACOMPULSORY	UNIVERSITY	UNIVERSITY DROPOUT
FIRTST BIRTH: YEARS FROM SCHOOL LEAVING	-2	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	5,92%
	-1	0,00%	0,58%	0,00%	0,00%	0,56%	2,23%	7,98%
	0	0,85%	6,11%	4,63%	1,50%	3,22%	12,76%	4,55%
	1	2,60%	5,02%	6,30%	1,64%	1,24%	8,31%	7,69%
	2	4,97%	8,30%	9,12%	8,59%	13,97%	16,34%	5,02%
	3	7,13%	7,50%	4,22%	10,48%	14,12%	12,36%	14,51%
	4	5,10%	11,07%	5,90%	11,12%	16,58%	10,27%	18,77%
	5	8,12%	9,48%	12,18%	7,26%	6,72%	15,68%	13,86%
	6	10,37%	12,34%	6,30%	8,65%	15,40%	0,00%	18,12%
	7	6,23%	11,89%	6,19%	6,10%	8,91%	1,14%	3,61%
	8	7,13%	9,50%	9,37%	10,05%	9,72%	1,26%	0,00%
	9	9,87%	5,08%	9,74%	5,40%	2,37%	6,04%	0,00%
	10	10,94%	3,86%	6,71%	6,14%	1,73%	2,39%	0,00%
	11	6,24%	1,73%	7,38%	7,78%	2,23%	0,00%	0,00%
	12	5,10%	1,40%	3,58%	3,61%	1,51%	0,00%	0,00%
	13	2,85%	1,74%	1,99%	7,90%	1,71%	11,23%	0,00%
	14	2,71%	0,88%	2,34%	0,65%	0,00%	0,00%	0,00%
	15	1,40%	0,83%	0,28%	0,55%	0,00%	0,00%	0,00%
	16	2,57%	0,26%	0,43%	1,23%	0,00%	0,00%	0,00%
	17	0,98%	0,39%	2,30%	0,00%	0,00%	0,00%	0,00%
	18	1,20%	1,23%	0,73%	1,00%	0,00%	0,00%	0,00%
	19	0,66%	0,00%	0,00%	0,36%	0,00%	0,00%	0,00%
	20	2,98%	0,00%	0,32%	0,00%	0,00%	0,00%	0,00%

13.5 Timing of First Birth Urban

	MUNICIPALITY TYPE	URBAN						
	EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNI-	ACADEMIC MATURA	VOCATIONAL & TECHNICAL MATURACOMPULSORY	UNIVERSITY	UNIVERSITY DROPOUT
FIRTST BIRTH: YEARS FROM SCHOOL LEAVING	-2	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	5,92%
	-1	0,00%	0,58%	0,00%	0,00%	0,56%	2,23%	7,98%
	0	0,85%	6,11%	4,63%	1,50%	3,22%	12,76%	4,55%
	1	2,60%	5,02%	6,30%	1,64%	1,24%	8,31%	7,69%
	2	4,97%	8,30%	9,12%	8,59%	13,97%	16,34%	5,02%
	3	7,13%	7,50%	4,22%	10,48%	14,12%	12,36%	14,51%
	4	5,10%	11,07%	5,90%	11,12%	16,58%	10,27%	18,77%
	5	8,12%	9,48%	12,18%	7,26%	6,72%	15,68%	13,86%
	6	10,37%	12,34%	6,30%	8,65%	15,40%	0,00%	18,12%
	7	6,23%	11,89%	6,19%	6,10%	8,91%	1,14%	3,61%
	8	7,13%	9,50%	9,37%	10,05%	9,72%	1,26%	0,00%
	9	9,87%	5,08%	9,74%	5,40%	2,37%	6,04%	0,00%
	10	10,94%	3,86%	6,71%	6,14%	1,73%	2,39%	0,00%
	11	6,24%	1,73%	7,38%	7,78%	2,23%	0,00%	0,00%
	12	5,10%	1,40%	3,58%	3,61%	1,51%	0,00%	0,00%
	13	2,85%	1,74%	1,99%	7,90%	1,71%	11,23%	0,00%
	14	2,71%	0,88%	2,34%	0,65%	0,00%	0,00%	0,00%
	15	1,40%	0,83%	0,28%	0,55%	0,00%	0,00%	0,00%
	16	2,57%	0,26%	0,43%	1,23%	0,00%	0,00%	0,00%
	17	0,98%	0,39%	2,30%	0,00%	0,00%	0,00%	0,00%
	18	1,20%	1,23%	0,73%	1,00%	0,00%	0,00%	0,00%
	19	0,66%	0,00%	0,00%	0,36%	0,00%	0,00%	0,00%
	20	2,98%	0,00%	0,32%	0,00%	0,00%	0,00%	0,00%

13.7 Educational Transitions and Durations

GENDER	FEMALE										MALE									
MUNICIPALITY TYPE	RURAL					URBAN					RURAL					URBAN				
PARENTS' EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY
Primary School																				
Duration 4 years	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Lower Secondary School	90.7%	85.1%	66.6%	47.5%	27.2%	81.6%	74.2%	53.8%	34.5%	14.4%	93.4%	87.4%	79.2%	45.7%	32.1%	80.2%	79.7%	53.9%	37.4%	17.7%
Lower Secondary Academic School	9.3%	14.9%	33.4%	52.5%	72.8%	18.4%	25.8%	46.2%	65.5%	85.6%	6.6%	12.6%	20.8%	54.3%	67.9%	19.8%	20.3%	46.1%	62.6%	82.3%

Lower Secondary School

Duration 4 years	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Other Schools and Colleges	0.5%	0.3%	0.5%	1.5%	2.3%	0.4%	0.3%	0.4%	1.3%	2.1%	0.3%	0.2%	0.4%	1.1%	2.0%	0.3%	0.2%	0.4%	1.0%	1.9%
Upper Sec. Academic School	1.3%	4.9%	8.5%	19.0%	38.7%	1.2%	2.8%	6.3%	7.3%	20.0%	1.0%	2.4%	1.6%	15.3%	24.1%	2.2%	2.3%	14.6%	12.5%	18.8%
Apprenticeship	45.2%	43.8%	33.3%	17.7%	12.9%	43.2%	51.4%	22.9%	19.5%	6.7%	74.8%	70.5%	51.6%	40.3%	24.1%	60.2%	69.0%	56.1%	47.9%	31.3%
Vocational & Technical College	10.0%	16.4%	21.3%	30.4%	25.8%	7.4%	10.4%	20.8%	34.1%	40.0%	4.6%	10.0%	22.5%	23.6%	31.0%	5.4%	8.0%	9.8%	18.8%	12.5%
Vocational & Technical School	19.2%	18.7%	26.2%	22.8%	6.5%	9.9%	17.4%	31.3%	29.3%	20.0%	6.4%	8.4%	18.1%	12.5%	3.4%	5.4%	7.5%	9.8%	12.5%	6.3%
Leaving School	23.9%	15.8%	10.2%	8.6%	13.9%	37.8%	17.8%	18.3%	8.4%	11.3%	13.0%	8.5%	5.7%	7.2%	15.2%	26.6%	13.0%	9.4%	7.3%	29.4%

Lower Secondary Academic School

Other Schools and Colleges	3.5%	4.3%	5.1%	4.3%	3.8%	3.3%	4.0%	4.6%	3.9%	3.3%	2.5%	3.2%	4.0%	3.3%	2.9%	2.4%	3.0%	3.6%	2.9%	2.6%
Upper Sec. Academic School	26.3%	38.7%	38.6%	63.85%	67.6%	38.9%	52.0%	50.0%	63.1%	77.9%	35.3%	27.0%	31.6%	50.0%	74.0%	36.8%	51.3%	47.4%	48.1%	60.2%
Apprenticeship	15.8%	7.5%	7.1%	3.2%	0.0%	0.0%	8.0%	0.0%	3.1%	0.0%	11.8%	10.1%	8.8%	2.6%	0.0%	10.5%	10.3%	5.3%	5.2%	2.2%
Vocational & Technical College	17.5%	27.4%	25.7%	22.2%	13.2%	33.3%	22.0%	25.0%	23.1%	10.4%	26.5%	27.0%	42.1%	25.0%	18.0%	42.1%	25.6%	28.9%	26.0%	19.4%
Vocational & Technical School	14.0%	11.3%	7.1%	0.0%	2.9%	5.6%	10.0%	16.7%	3.1%	5.2%	5.9%	11.2%	1.8%	5.3%	0.0%	0.0%	0.0%	2.6%	2.6%	0.0%
Leaving School	22.8%	10.8%	16.3%	6.8%	12.4%	18.9%	4.0%	3.7%	3.8%	3.2%	18.1%	21.5%	11.8%	13.8%	5.1%	8.1%	9.8%	12.2%	15.2%	15.7%

Educational Transitions and Durations (cont.)

GENDER	FEMALE										MALE									
MUNICIPALITY TYPE	RURAL					URBAN					RURAL					URBAN				
PARENTS' EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY
Apprenticeship																				
Duration 2 years	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
3 years	80.7%	80.7%	80.7%	80.7%	80.7%	80.7%	80.7%	80.7%	80.7%	80.7%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%	68.0%
4 years	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	27.2%	27.2%	27.2%	27.2%	27.2%	27.2%	27.2%	27.2%	27.2%	27.2%
5 years	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%
6 years	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
7 years	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Other Schools and Colleges	0.5%	0.6%	0.6%	2.1%	4.8%	0.7%	1.0%	1.0%	3.4%	7.5%	1.2%	1.6%	1.5%	5.3%	11.6%	1.9%	2.5%	2.5%	8.3%	17.4%
Leaving School	99.5%	99.4%	99.4%	97.9%	95.2%	99.3%	99.0%	99.0%	96.6%	92.5%	98.8%	98.4%	98.5%	94.7%	88.4%	98.1%	97.5%	97.5%	91.7%	
82.6%6 years	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%
7 years	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Other Schools and Colleges	0.5%	0.6%	0.6%	2.1%	4.8%	0.7%	1.0%	1.0%	3.4%	7.5%	1.2%	1.6%	1.5%	5.3%	11.6%	1.9%	2.5%	2.5%	8.3%	17.4%
Leaving School	99.5%	99.4%	99.4%	97.9%	95.2%	99.3%	99.0%	99.0%	96.6%	92.5%	98.8%	98.4%	98.5%	94.7%	88.4%	98.1%	97.5%	97.5%	91.7%	82.6%

Vocational & Technical College

Duration																				
3 years	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	76.0%	66.8%	66.8%	66.8%	66.8%	66.8%	66.8%	66.8%	66.8%	66.8%	66.8%
4 years	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%
5 years	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%
6 years	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
7 years	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Other Schools and Colleges	2.2%	2.3%	1.8%	5.3%	14.0%	4.1%	4.4%	3.3%	9.6%	23.8%	4.0%	4.3%	3.2%	9.3%	23.2%	7.4%	7.9%	6.0%	16.5%	36.7%
Leaving School	97.8%	97.7%	98.2%	94.7%	86.0%	95.9%	95.6%	96.7%	90.4%	76.2%	96.0%	95.7%	96.8%	90.7%	76.8%	92.6%	92.1%	94.0%	83.5%	63.3%

Upper Secondary Academic School

Duration																				
4 years	80.5%	80.5%	80.5%	80.5%	80.5%	80.5%	80.5%	80.5%	80.5%	80.5%	76.7%	76.7%	76.7%	76.7%	76.7%	76.7%	76.7%	76.7%	76.7%	76.7%
5 years	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	16.6%	18.5%	18.5%	18.5%	18.5%	18.5%	18.5%	18.5%	18.5%	18.5%	18.5%
6 years	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
7 years	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
Other Schools and Colleges	44.4%	36.2%	36.8%	37.2%	24.1%	34.6%	27.4%	27.8%	28.2%	10.0%	20.0%	15.1%	15.4%	15.6%	9.0%	14.3%	10.6%	10.8%	11.0%	6.2%
University	7.2%	13.7%	16.5%	39.9%	44.8%	25.5%	36.3%	42.5%	40.7%	70.3%	25.5%	29.7%	65.1%	39.1%	48.8%	41.0%	41.4%	36.9%	47.8%	62.1%
Uni dropout	1.8%	3.0%	2.7%	7.7%	6.9%	9.5%	12.2%	10.5%	11.9%	16.5%	4.6%	4.8%	7.7%	5.5%	5.5%	11.1%	10.1%	6.6%	10.1%	10.6%
Leaving School	46.6%	47.1%	44.0%	15.2%	24.2%	30.4%	24.2%	19.2%	19.2%	3.2%	49.9%	50.4%	11.8%	39.8%	36.7%	33.7%	38.0%	45.7%	31.2%	21.2%

Educational Transitions and Durations (cont.)

GENDER	FEMALE										MALE									
MUNICIPALITY TYPE	RURAL					URBAN					RURAL					URBAN				
PARENTS' EDUCATION	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY	COMPULSORY	APPRENTICESHIP	VOCATIONAL OR TECH-NICAL SCHOOL	MATURA	UNIVERSITY
Vocational & Technical College																				
Duration																				
5 years	91.1%	91.1%	91.1%	91.1%	91.1%	91.1%	91.1%	91.1%	91.1%	91.1%	83.7%	83.7%	83.7%	83.7%	83.7%	83.7%	83.7%	83.7%	83.7%	83.7%
6 years	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%
7 years	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%
Other Schools and Colleges	11.3%	16.5%	9.4%	18.1%	13.8%	8.0%	11.9%	6.6%	13.1%	9.9%	3.3%	5.0%	2.7%	5.6%	4.1%	2.3%	3.5%	1.9%	3.9%	2.8%
University	0.8%	1.5%	0.0%	3.7%	2.7%	3.2%	2.7%	30.5%	5.8%	26.2%	16.7%	15.3%	11.0%	5.0%	17.5%	4.9%	16.1%	24.8%	18.7%	37.8%
University dropout	0.3%	0.5%	0.0%	1.1%	0.6%	1.8%	1.4%	11.3%	2.5%	9.2%	4.5%	3.7%	2.0%	1.0%	2.9%	2.0%	5.9%	6.7%	5.9%	9.6%
Leaving School	87.7%	81.5%	90.6%	77.2%	82.8%	87.1%	84.0%	51.6%	78.6%	54.7%	75.6%	76.0%	84.3%	88.4%	75.5%	90.8%	74.5%	66.7%	71.5%	49.7%
Other schools and colleges																				
Duration																				
1 year	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%	28.7%	28.7%	28.7%	28.7%	28.7%	28.7%	28.7%	28.7%	28.7%	28.7%
2 years	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.9%	40.2%	40.2%	40.2%	40.2%	40.2%	40.2%	40.2%	40.2%	40.2%	40.2%
3 years	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%	22.7%	22.7%	22.7%	22.7%	22.7%	22.7%	22.7%	22.7%	22.7%	22.7%
4 years	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
5 years	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%	1.8%
Leaving School	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

University

Duration																				
4 years	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%
5 years	13.8%	13.8%	13.8%	13.8%	13.8%	13.8%	13.8%	13.8%	13.8%	13.8%	12.6%	12.6%	12.6%	12.6%	12.6%	12.6%	12.6%	12.6%	12.6%	12.6%
6 years	16.4%	16.4%	16.4%	16.4%	16.4%	16.4%	16.4%	16.4%	16.4%	16.4%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
7 years	23.3%	23.3%	23.3%	23.3%	23.3%	23.3%	23.3%	23.3%	23.3%	23.3%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%
8 years	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	21.6%	18.6%	18.6%	18.6%	18.6%	18.6%	18.6%	18.6%	18.6%	18.6%	18.6%
9 years	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	10.3%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%	13.2%
10 years	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%	6.0%
11 years	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
12 years	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	0.9%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%
14 years	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%	4.2%
Leaving School	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

University Dropout

Duration																				
1 year	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
2 years	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	23.7%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
3 years	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	5.3%	18.8%	18.8%	18.8%	18.8%	18.8%	18.8%	18.8%	18.8%	18.8%	18.8%
4 years	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%
5 years	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
6 years	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
7 years	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8 years	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
10 years	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Leaving School	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

13.9 Partner Matching by Age

		AGE OF FEMALE PARTNER AT FIRST BIRTH												
		15	16	17	18	19	20	21	22	23	24	25	26	27
AGE DIFFERENNCE OF MALE PARTNER	-10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	-9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	-8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.12%	0.50%	0.00%	0.21%	0.16%
	-7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.12%	0.12%	0.00%	0.21%	0.16%
	-6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%	0.93%	0.12%	0.00%	0.21%	0.33%
	-5	0.00%	0.00%	0.00%	0.00%	0.33%	0.14%	0.88%	0.12%	0.70%	0.25%	0.77%	1.28%	0.66%
	-4	0.00%	0.00%	0.00%	0.00%	0.67%	0.14%	0.22%	0.12%	0.46%	0.25%	1.29%	1.60%	0.66%
	-3	0.00%	0.00%	0.00%	0.00%	1.67%	0.54%	0.44%	1.21%	1.16%	1.00%	1.80%	3.53%	2.96%
	-2	0.00%	0.00%	2.41%	1.16%	2.33%	1.63%	1.53%	2.67%	2.32%	2.24%	2.84%	2.88%	4.93%
	-1	0.00%	0.00%	3.61%	0.58%	2.00%	2.72%	4.16%	3.88%	3.94%	6.23%	5.15%	4.81%	5.92%
	0	0.00%	7.69%	3.61%	4.65%	4.00%	7.63%	8.10%	9.22%	6.26%	7.98%	11.34%	12.82%	12.17%
	1	0.00%	3.85%	9.24%	5.81%	8.00%	12.81%	12.25%	13.11%	15.78%	12.97%	12.89%	12.18%	15.79%
	2	10.00%	3.85%	9.24%	14.53%	16.67%	15.80%	15.75%	13.83%	16.47%	13.97%	17.01%	15.38%	12.17%
	3	10.00%	19.23%	9.24%	10.47%	14.67%	12.53%	15.97%	17.96%	10.67%	12.97%	10.82%	7.69%	9.54%
	4	10.00%	19.23%	9.64%	14.53%	15.33%	11.99%	8.53%	8.74%	8.82%	10.97%	7.99%	7.69%	9.21%
	5	10.00%	19.23%	9.64%	9.88%	11.00%	8.17%	7.22%	8.50%	8.12%	8.48%	8.76%	6.09%	9.21%
	6	10.00%	11.54%	13.25%	9.30%	7.00%	9.54%	7.22%	6.31%	8.35%	5.99%	5.93%	6.09%	3.62%
	7	10.00%	3.85%	12.05%	5.23%	6.00%	6.81%	3.72%	2.91%	5.80%	4.24%	4.12%	7.05%	3.29%
	8	20.00%	3.85%	2.41%	5.81%	1.33%	3.54%	4.16%	2.43%	2.32%	3.74%	3.35%	1.28%	2.96%
	9	20.00%	3.85%	3.61%	5.23%	1.33%	1.09%	3.28%	1.94%	2.32%	3.24%	1.80%	3.85%	2.30%
	10	0.00%	1.28%	1.20%	3.49%	2.33%	1.63%	1.75%	0.97%	1.16%	1.00%	0.77%	1.60%	1.32%
	11	0.00%	1.28%	1.61%	2.33%	1.67%	0.54%	1.09%	1.70%	1.39%	0.50%	1.29%	1.28%	0.33%
	12	0.00%	1.28%	1.61%	0.58%	1.67%	0.82%	0.66%	1.21%	1.16%	0.50%	0.17%	0.21%	0.66%
	13	0.00%	0.00%	1.61%	1.16%	0.33%	0.54%	0.66%	0.73%	0.70%	0.50%	0.17%	0.21%	0.33%
	14	0.00%	0.00%	1.20%	0.58%	0.33%	0.45%	0.44%	0.24%	0.31%	0.75%	0.17%	0.21%	0.44%
	15	0.00%	0.00%	4.82%	4.65%	1.33%	0.91%	1.97%	1.94%	0.62%	1.50%	1.55%	1.60%	0.88%

Partner Matching by Age (cont.)

	28	29	30	31	32	33	34	35	36	37	38	39	40	>40
-10	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
-9	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
-8	0.47%	1.09%	0.00%	2.75%	1.22%	3.28%	5.09%	5.09%	5.09%	2.31%	2.31%	2.31%	2.31%	9.09%
-7	0.47%	0.55%	0.00%	0.92%	2.44%	1.64%	2.64%	2.64%	2.64%	2.31%	2.31%	2.31%	2.31%	9.09%
-6	0.47%	0.55%	0.71%	0.92%	1.22%	2.46%	0.85%	0.85%	0.85%	2.31%	2.31%	2.31%	2.31%	9.09%
-5	0.47%	0.55%	1.43%	3.67%	1.22%	2.46%	8.69%	8.69%	8.69%	3.46%	3.46%	3.46%	3.46%	9.09%
-4	3.76%	2.19%	3.57%	5.50%	3.66%	1.64%	1.28%	1.28%	1.28%	3.46%	3.46%	3.46%	3.46%	9.09%
-3	4.23%	2.73%	3.57%	1.83%	6.10%	4.92%	3.95%	3.95%	3.95%	3.59%	3.59%	3.59%	3.59%	9.09%
-2	3.76%	6.56%	6.79%	3.67%	3.66%	1.64%	4.88%	4.88%	4.88%	5.00%	5.00%	5.00%	5.00%	9.09%
-1	9.39%	7.65%	6.79%	11.93%	3.66%	6.56%	4.02%	4.02%	4.02%	5.00%	5.00%	5.00%	5.00%	9.09%
0	9.39%	10.38%	11.07%	12.84%	9.76%	8.20%	14.60%	14.60%	14.60%	7.88%	7.88%	7.88%	7.88%	9.09%
1	9.39%	10.38%	11.07%	7.34%	10.98%	8.20%	12.36%	12.36%	12.36%	7.88%	7.88%	7.88%	7.88%	9.09%
2	19.25%	11.48%	11.43%	8.26%	8.54%	9.84%	8.44%	8.44%	8.44%	10.13%	10.13%	10.13%	10.13%	9.09%
3	9.86%	9.29%	6.43%	13.76%	15.85%	13.11%	8.12%	8.12%	8.12%	10.13%	10.13%	10.13%	10.13%	0.00%
4	8.92%	11.48%	6.43%	7.34%	6.10%	1.64%	4.95%	4.95%	4.95%	8.72%	8.72%	8.72%	8.72%	0.00%
5	6.57%	6.01%	4.29%	5.50%	6.10%	4.92%	1.71%	1.71%	1.71%	8.72%	8.72%	8.72%	8.72%	0.00%
6	3.29%	2.19%	5.71%	3.67%	1.22%	4.92%	4.88%	4.88%	4.88%	4.29%	4.29%	4.29%	4.29%	0.00%
7	2.82%	3.83%	5.00%	2.75%	1.22%	6.56%	1.82%	1.82%	1.82%	4.29%	4.29%	4.29%	4.29%	0.00%
8	1.41%	3.83%	2.86%	1.38%	3.66%	6.56%	2.28%	2.28%	2.28%	2.10%	2.10%	2.10%	2.10%	0.00%
9	1.88%	1.09%	2.14%	1.38%	2.44%	1.64%	1.71%	1.71%	1.71%	2.10%	2.10%	2.10%	2.10%	0.00%
10	1.88%	1.64%	1.43%	0.92%	1.83%	1.64%	2.71%	2.71%	2.71%	2.10%	2.10%	2.10%	2.10%	0.00%
11	0.23%	1.64%	1.43%	0.92%	1.83%	3.28%	1.78%	1.78%	1.78%	2.10%	2.10%	2.10%	2.10%	0.00%
12	0.23%	2.19%	2.14%	0.92%	1.22%	1.64%	1.39%	1.39%	1.39%	2.10%	2.10%	2.10%	2.10%	0.00%
13	0.23%	0.55%	2.14%	0.92%	1.22%	1.64%	0.93%	0.93%	0.93%	0.00%	0.00%	0.00%	0.00%	0.00%
14	0.23%	1.09%	0.71%	0.46%	2.44%	1.64%	0.93%	0.93%	0.93%	0.00%	0.00%	0.00%	0.00%	0.00%
15	1.41%	1.09%	2.86%	0.46%	2.44%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

13.6 Spacing of Births

BIRTH INTERVALS IN YEARS	1	0.233
	2	0.232
	3	0.137
	4	0.100
	5	0.075
	6	0.055
	7	0.043
	8	0.032
	9	0.024
	10	0.018
	11	0.013
	12	0.010
	13	0.009
	14	0.006
	15	0.004
	16	0.003
	17	0.002
	18	0.001
	19	0.001
	20	0.002

13.8 Partner Matching by Education

		PARTNER' EDUCATION				
		COMPULSORY	APPRENTICESHIP	VOCATIONAL & TECHNICAL SCHOOL	MATURA	UNIVERSITY
FEMALE EDUCATION	COMPULSORY	30.72%	30.72%	30.72%	30.72%	30.72%
	APPRENTICESHIP	6.34%	6.34%	6.34%	6.34%	6.34%
	VOCATIONAL & TECHNICAL SCHOOL	5.93%	5.93%	5.93%	5.93%	5.93%
	MATURA	7.56%	7.56%	7.56%	7.56%	7.56%
	UNIVERSITY	2.45%	2.45%	2.45%	2.45%	2.45%

Familie und Ausbildung

Intergenerationelle Bildungstransmission in Familien und der Einfluss der Bildung auf Partnerwahl und Fertilität. Analysen und Mikrosimulationsprojektionen für Österreich[1]

Einleitung

Die Studie untersucht zum Einen, inwieweit Bildungsentscheidungen von der elterlichen Bildungsschicht, Geschlecht und Wohnort abhängen und versucht zum Anderen, die Bildungszusammensetzung der österreichischen Bevölkerung zu prognostizieren. Die Studie beruht auf Mikrozensusdaten des Jahres 1996, welche insbesondere individuelle Schulkarrieren enthalten. Basierend auf diesen Daten werden die Einflussgrößen auf individuelle Bildungsentscheidungen statistisch analysiert und in einem weiteren Schritt Modelle gebildet, welche in das FAMSIM+ Familienmikrosimulationsmodell integriert wurden. Zur Prognose der zukünftigen Bildungszusammensetzung der österreichischen Bevölkerung müssen zwei weitere Sachverhalte berücksichtigt werden: die unterschiedliche Fertilität von Frauen aus verschiedenen Bildungsschichten sowie die bildungsmäßige Zusammensetzung von Partnerschaften. Letzteres ist wichtig, da in den Modellen der höhere Bildungsabschluss beider Eltern als wichtigster Einflussfaktor auf die Bildungskarriere der Kinder identifiziert wurde. Sowohl bezüglich der bildungsmäßigen Zusammensetzung von Paaren als auch bezüglich der Unterschiede in der Anzahl und dem Timing von Geburten sind in den letzten Jahrzehnten deutliche Veränderungen aufgetreten.

FAMSIM+ ist ein dynamisches Mikrosimulationsmodell mit einer geschlossenen Gesellschaft, das heißt, alle PartnerInnen müssen in der gegebenen Population von anfänglich ca. 80.000 Personen gefunden werden. Die Startpopulation wurde aus dem Mikrozensus 2/1996 gewonnen (Schwarz & Spielauer 2003). Das Leben all dieser Personen wird ab 1996 für die Zukunft simuliert,

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[1] Deutsche Kurzfassung einiger Resultate der als ÖIF-Schriftenreihe erschienenen Studie "Family and Education – Intergenerational educational transmission within families and the influence of education on partner choice and fertility. Analysis and microsimulation projection for Austria" von Martin Spielauer, Franz Schwarz, Karin Städtner und Kurt Schmid

dies betrifft insbesondere deren Ausbildungskarrieren, Partnerschaften und Kinder, deren Geburt im Computer simuliert wird. Die simulierten Personen altern also und verlassen die Population bei deren Tod. Dieses Modell wird verwendet, um die zukünftige Bildungszusammensetzung der österreichischen Bevölkerung zu prognostizieren.

Das österreichische Schulsystem: Besonderheiten und vereinfachtes Modell

Im internationalen Vergleich können verschiedene Charakteristika als typisch für das österreichische Schulsystem angesehen werden. Ein erstes Merkmal ist die frühe, erste Bildungsentscheidung zwischen Hauptschule und Unterstufe einer Allgemeinbildenden Höheren Schule (AHS) im Alter von zehn Jahren, die im EU-Raum ansonsten nur in Teilen Deutschlands anzutreffen ist. Ein zweites Charakteristikum ist die hohe Berufsorientierung des Schulsystems. Österreich hat ein sehr ausdifferenziertes Angebot an Lehren und berufsbildenden Schulen, dem im internationalen Vergleich gegenüber allgemeinbildenden Schulen ein viel höheres Gewicht zukommt. Als positive Auswirkung wird damit oft die vergleichsweise niedrige Jugendarbeitslosigkeit in Zusammenhang gebracht, der durch die starke und frühe Spezialisierung eine niedrigere und spätere Flexibilität bezüglich Berufs- und Karrierewechsel entgegengestellt wird. Die vorherrschende Organisationsform als Halbtagsschule, welche in gewisser Weise eine starke Beteiligung der Eltern (und privater Nachhilfe etc.) erfordert, ist ein weiteres typisches österreichisches Merkmal, genauso wie die vergleichsweise geringe Quote der UniversitätsabsolventInnen. Auffallend sind auch die hohen Dropout-Quoten an den Universitäten (etwa 50%) und die langen Studienzeiten mit durchschnittlich siebeneinhalb Jahre bis zum Magister. Das österreichische Schulsystem ist auch teuer. Gegenüber dem PISA-Gewinner Finnland wendet Österreich 0,5 Prozentpunkte mehr seines BIP für Bildung auf.

In dieser Studie wird ein sehr vereinfachtes Modell des österreichischen Schulsystems verwendet und es werden nur die Hauptentscheidungen in der Schulkarriere modelliert. Insbesondere werden acht Schultypen unterschieden:

- Volksschule
- AHS-Unterstufe
- Hauptschule
- AHS-Oberstufe
- Lehren (duales System)
- Berufsbildende Mittlere Schulen (BMS)
- Berufsbildende Höhere Schulen mit Matura (BHS, HTL – Höhere Technische Lehranstalt etc.)
- Universitätsstudien

Bezüglich höchster abgeschlossener Schule werden fünf Typen unterschieden:

- Pflichtschule – Sekundarstufe I
- Lehre
- BMS } Sekundarstufe II
- Matura
- Universität

Bei der Modellierung von Fertilität werden darüber hinaus die Maturatypen (AHS, BHS/HTL) unterschieden und Universitäts-Dropouts separat berücksichtigt. Im Laufe der Schulkarriere ergeben sich dabei drei wichtige Entscheidungen: die erste zwischen AHS und Hauptschule, die zweite mit 14 Jahren zwischen „Beendigung der Pflichtschule“ und den vier oben angeführten Schulformen der Sekundarstufe II sowie die dritte, MaturantInnen betreffende Entscheidung für oder gegen ein Universitätsstudium. Im Modell werden nur abgeschlossene Schulen berücksichtigt und die Daten entsprechend codiert: ein Schulwechsel von einer HTL zu einer AHS wird entsprechend als AHS-Besuch codiert. Neben den Schulformen werden im Modell auch die Verteilungen der Studiendauern nach soziodemographischen Merkmalen berücksichtigt. Die wichtigsten im Modell verwendeten Merkmale sind:

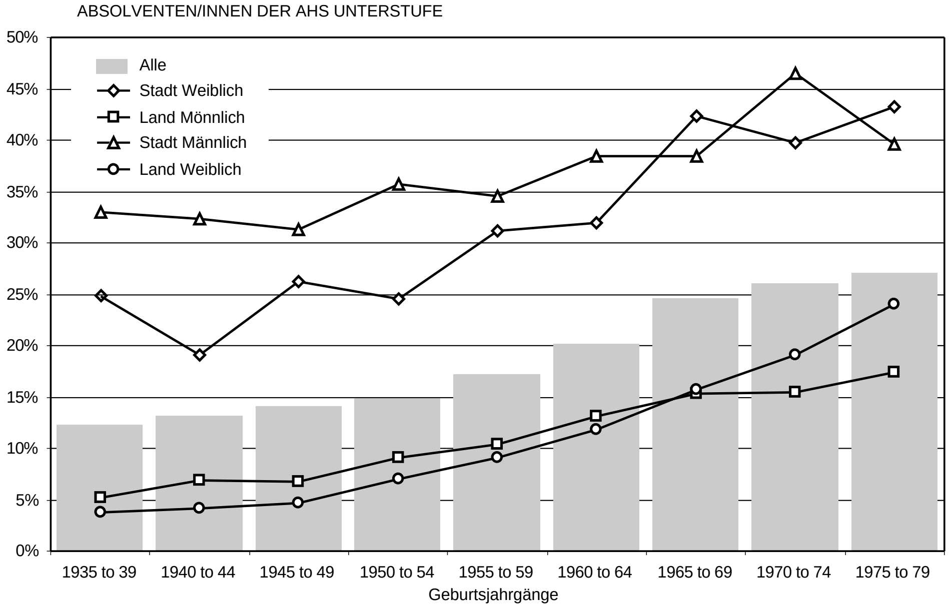
- Gemeindegröße im Alter von 15 Jahren (Stadt / Land)
- Geschlecht
- Höchster Bildungsabschluss beider Elternteile (fünf Typen, s.o.)

Durch die Kombination dieser Merkmale werden Kinder entsprechend einer von 20 Gruppen zugeordnet. Es wird untersucht, wie stark der Einfluss der einzelnen Größen auf Schulentscheidungen ist.

Die erste Bildungsentscheidung

Eines der Charakteristika des österreichischen Bildungssystems ist die frühe erste Bildungsentscheidung zwischen der AHS-Unterstufe und der Hauptschule im Alter von zehn Jahren. Sieht man den Verlauf über die Zeit, kann man eine Verdoppelung der AbsolventInnen der AHS-Unterstufe in den letzten Jahrzehnten beobachten, wobei der Anteil in der Stadt allerdings doppelt so hoch ist als am Land. Aufgeholt, und am Land sogar „überholt", haben die Mädchen.

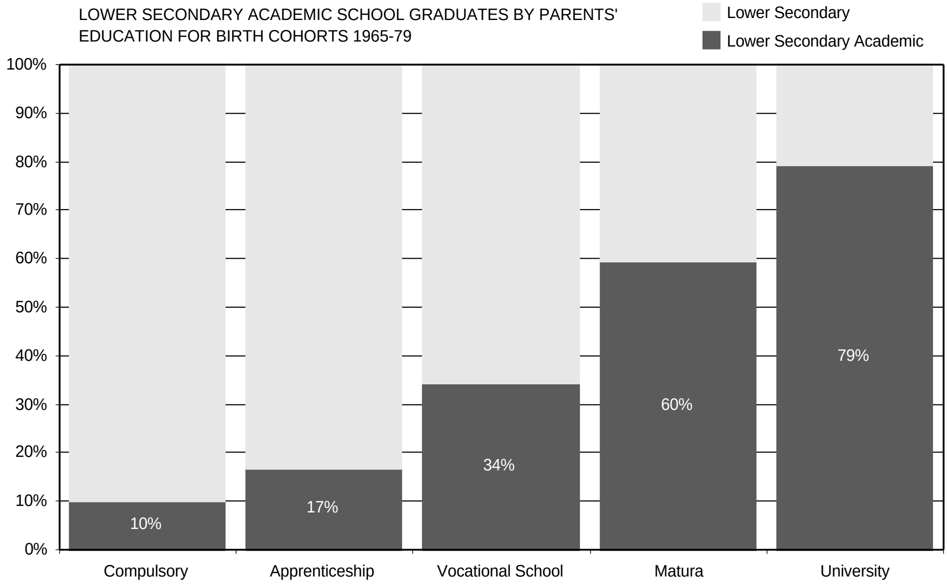
Grafik 1: AbsolventInnen der AHS-Unterstufe



Quelle: Mikrozensus 2/1996, eigene Berechnungen

Unterscheidet man nach den fünf Bildungsschichten der Eltern (Pflichtschule, Lehre, BMS, Matura, Universität, wobei immer die höhere Bildung beider Elternteile betrachtet wird), wird der große Einfluss dieser Variable deutlich:

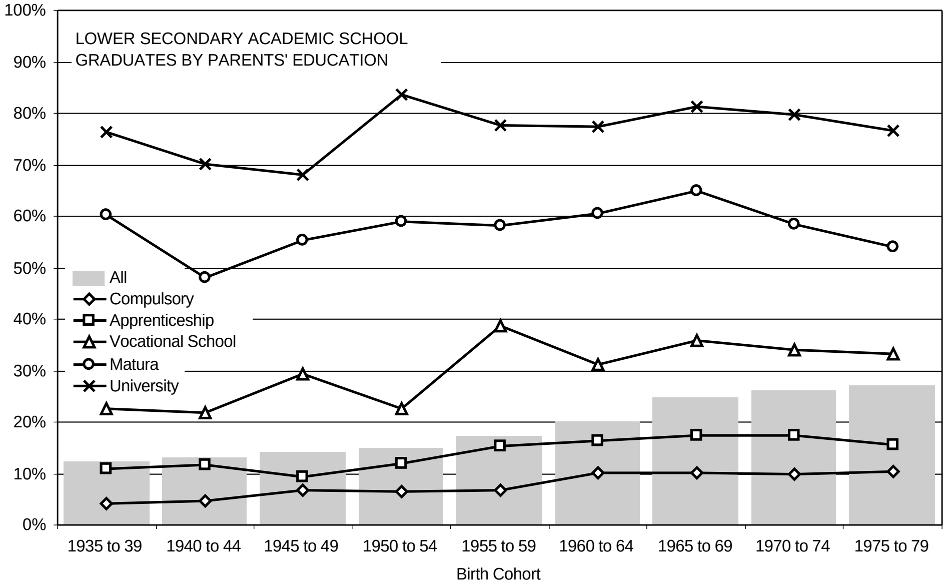
Grafik 2: AbsolventInnen der AHS-Unterstufe nach Bildung der Eltern



Quelle: Mikrozensus 2/1996, eigene Berechnungen

Je nach Bildungsschicht der Eltern liegt die Wahrscheinlichkeit, die AHS-Unterstufe zu absolvieren, zwischen 10 und fast 80%. Diese Unterschiede haben sich in den letzten Jahrzehnten nicht wesentlich verändert. Kann bis zum Geburtsjahr 1960 noch ein Anstieg in den unteren Bildungsschichten beobachtet werden, sind ab diesem Zeitpunkt keine wesentlichen Niveauverschiebungen mehr feststellbar.

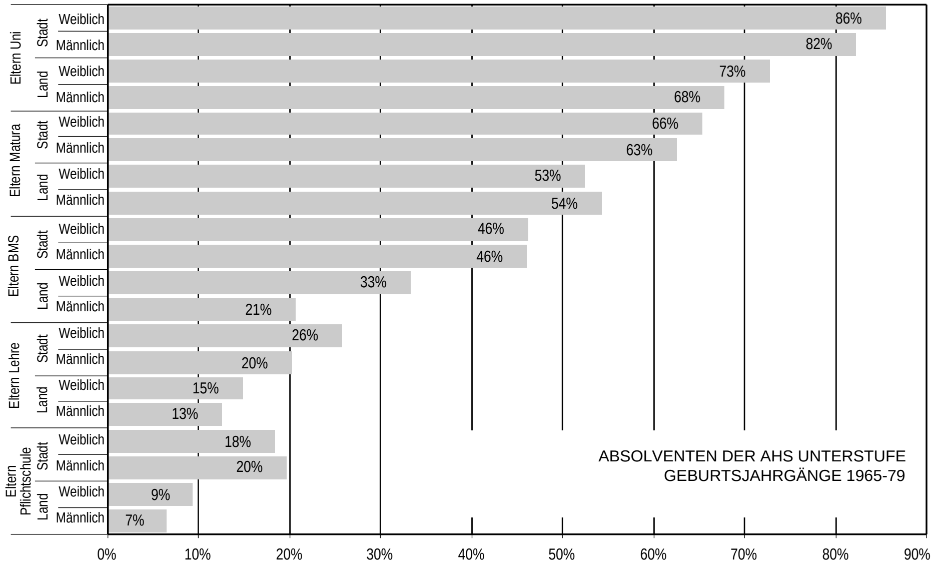
Grafik 3: AbsolventInnen der AHS-Unterstufe nach Bildung der Eltern: Zeitverlauf



Quelle: Mikrozensus 2/1996, eigene Berechnungen

Geht man mehr ins Detail und schließt in die Analyse auch die Gemeindegröße und das Geschlecht ein, ergibt sich ein noch differenzierteres Bild. Die Chancen, mit 14 Jahren eine AHS-Unterstufe absolviert zu haben, liegen zwischen 7 und 86%.

Grafik 4: AbsolventInnen der AHS-Unterstufe nach Bildung der Eltern, Gemeindetyp und Geschlecht



Quelle: Mikrozensus 2/1996, eigene Berechnungen

Diese Raten haben sich in den letzten 15 Jahren nur unwesentlich verändert, das heißt, die Zunahme der Gesamtrate resultiert hauptsächlich aus einer sich verändernden Bildungszusammensetzung der Elterngeneration. Die Veränderungen können am besten mithilfe eines logistischen Regressionsmodells gezeigt werden. Wie in nachfolgender Tabelle zu sehen ist, haben sich die Regressionskoeffizienten und damit die Odds-Ratios in den letzten 15 Jahren nicht mehr wesentlich verändert.

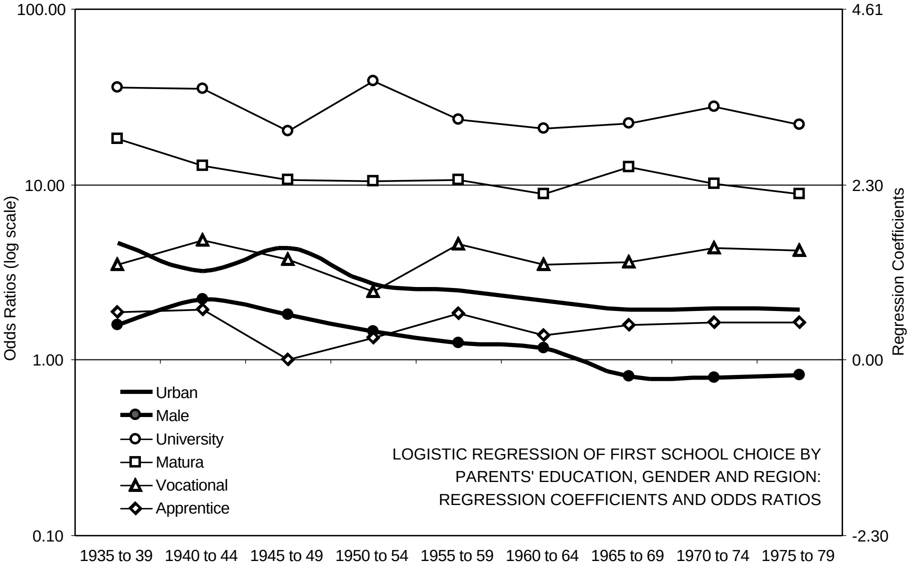
Tabelle 1: Logistische Regressionskoeffizienten, Standardfehler und Odds-Ratios für Abschluss der AHS-Unterstufe nach Geburtskohorten von 1935 bis 1979

	1935 to 39	**1940 to 44**	**1945 to 49**	**1950 to 54**	**1955 to 59**	**1960 to 64**	**1965 to 69**	**1970 to 74**	**1975 to 79**
Urban	1,533*** (0,247) 4,634	1,171*** (0,161) 3,225	1,465*** (0,157) 4,328	1,002*** (0,148) 2,723	0,908*** (0,123) 2,478	0,783*** (0,114) 2,187	0,667*** (0,113) 1,948	0,686*** (0,116) 1,986	0,669*** (0,118) 1,952
Male	0,457* (0,236) 1,579	0,797*** (0,154) 2,218	0,602*** (0,151) 1,825	0,374*** (0,141) 1,453	0,219* (0,118) 1,245	0,159 (0,107) 1,172	-0,215** (0,108) 0,807	-0,223** (0,109) 0,800	-0,191* (0,108) 0,826
University	3,574*** (0,404) 35,642	3,560*** (0,261) 35,161	2,997*** (0,279) 20,018	3,667*** (0,339) 39,125	3,150*** (0,231) 23,341	3,037*** (0,243) 20,849	3,106*** (0,221) 22,330	3,330*** (0,230) 27,932	3,096*** (0,213) 22,116
Matura	2,907*** (0,351) 18,306	2,551*** (0,228) 12,823	2,364*** (0,223) 10,638	2,342*** (0,204) 10,397	2,357*** (0,195) 10,561	2,183*** (0,185) 8,872	2,533*** (0,169) 12,597	2,306*** (0,181) 10,031	2,186*** (0,189) 8,898
Vocational	1,260*** (0,474) 3,524	1,566*** (0,285) 4,789	1,324*** (0,256) 3,760	0,902*** (0,257) 2,466	1,528*** (0,197) 4,611	1,244*** (0,180) 3,471	1,292*** (0,182) 3,638	1,479*** (0,176) 4,387	1,434*** (0,188) 4,197
Apprentice	0,625*** (0,302) 1,868	0,659*** (0,198) 1,932	0,004*** (0,200) 1,004	0,285*** (0,182) 1,330	0,605*** (0,148) 1,832	0,329*** (0,131) 1,390	0,463*** (0,136) 1,588	0,499*** (0,154) 1,648	0,499*** (0,171) 1,647
Constant	-4,060** (0,263)	-3,972*** (0,179)	-3,564 (0,163)	-3,093 (0,137)	-2,926*** (0,122)	-2,545** (0,105)	-2,319*** (0,112)	-2,234*** (0,135)	-2,315*** (0,157)
Chi-Square DF=6	235,342	481,944	447,393	402,518	492,710	448,950	573,311	538,130	485,107
Nagelkerke R Square	0,373	0,353	0,335	0,288	0,273	0,227	0,291	0,301	0,278

*Signifikanzniveaus: *** über 99%, ** über 95% und *über 90%*

Die folgende Illustration stellt die Koeffizienten graphisch dar:

Grafik 5: Logistische Regressionskoeffizienten und Odds-Ratios für Abschluss der AHS-Unterstufe nach Geburtskohorten von 1935 bis 1979



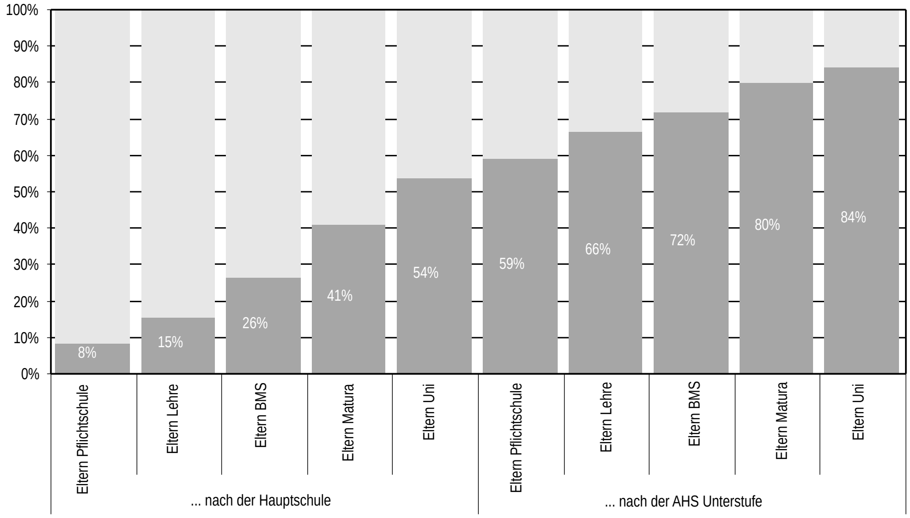
Quelle: Logistische Regression auf Basis des Mikrozensus 2/1996, eigene Berechnungen

Während der Einfluss der elterlichen Bildung über die Zeit unverändert hoch blieb, hat sich der Einfluss des Geschlechts umgekehrt und „begünstigt“ jetzt Mädchen. Der Einfluss der Stadt hat sich etwas verringert, insgesamt ist für die letzten 15 Jahre keine Veränderung zu sehen.

Die zweite Bildungsentscheidung

Die zweite Bildungsentscheidung ist eine Entscheidung zwischen fünf Alternativen: Abschluss der Pflichtschule durch Erfüllung der Schulpflicht (Besuch einer beliebigen Schule bis die neun Pflichtschuljahre erreicht sind), Lehre, BMS, AHS, BHS / HTL. Neben den Charakteristiken Geschlecht, Stadt / Land und Bildung der Eltern spielt bei dieser Entscheidung auch der vorherige Schulbesuch eine große Rolle. Wie stark ist der Einfluss der ersten Bildungsentscheidung auf die weiteren? Bleibt der Einfluss der elterlichen Ausbildung trotz der ersten „Vorselektion“ auch mit 14 Jahren bestehen? Die Ergebnisse sind auch hier sehr deutlich. Gut illustriert wird dies am Anteil der Jugendlichen, die eine Matura abschließen. Dieser Anteil liegt bei Jugendlichen mit Hauptschulabschluss je nach Ausbildung der Eltern zwischen 8 und 54%, nach der AHS-Unterstufe liegt der Anteil zwischen 59 und 84%.

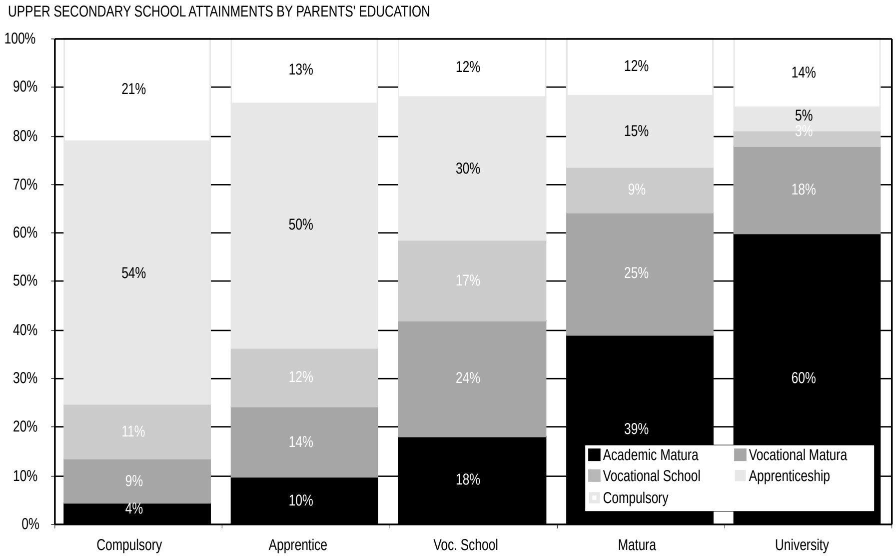
Grafik 6: Anteil der MaturantInnen nach der Ausbildung der Eltern



Quelle: Mikrozensus 2/1996, eigene Berechnungen

Je höher die Ausbildung der Eltern, umso geringer wird insbesondere die Wahrscheinlichkeit einer Lehre – die Raten liegen zwischen 54% und 5% – und umso höher der Anteil an MaturantInnen. Wie aus der folgenden Grafik ersichtlich ist, vergrößert sich auch der Anteil der AHS-MaturantInnen an der Gesamtheit der MaturantInnen mit der Höhe der Ausbildung der Eltern.

Grafik 7: Schulabschlüsse auf der Sekundarstufe II nach Ausbildung der Eltern



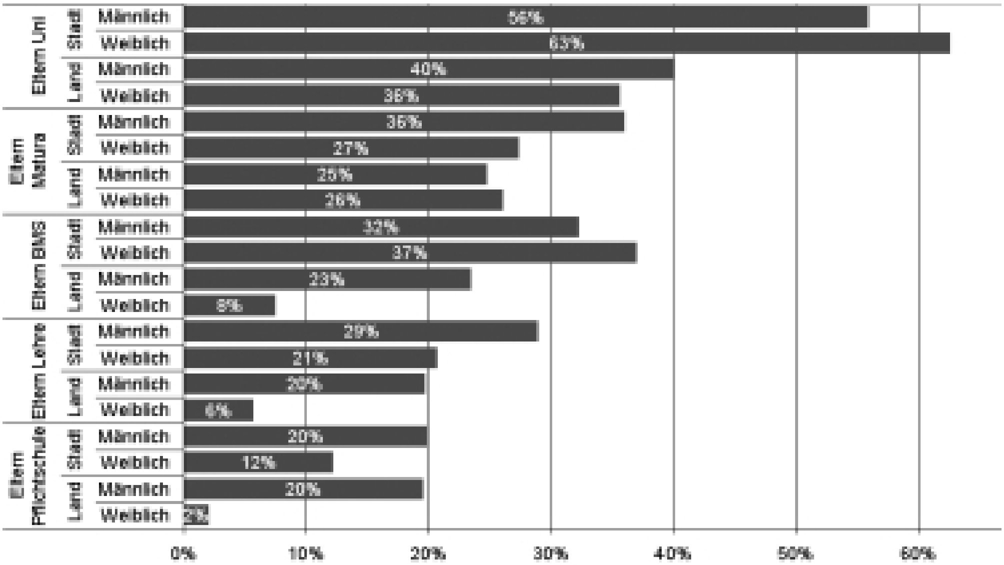
Quelle: Mikrozensus 2/1996, eigene Berechnungen

Eine genaue Analyse der zweiten Schulentscheidung sowie deren Veränderungen über die Zeit auch unter Berücksichtigung von Geschlecht und Gemeindegröße ist in der vollen Studie (Spielauer et al. 2003) nachzulesen. Wie diese Studie zeigt, sind die Veränderungen in den letzten 15 Jahren auch hier gering und es kann als plausibles Grundszenario der Bildungsprognose von zeitinvarianten Raten ausgegangen werden.

Universitätsstudien

Für alle Jugendlichen, die eine Matura abgeschlossen haben, stellt sich die Frage eines Universitätsstudiums (auf die vielen anderen Weiterbildungsmöglichkeiten wird hier aus Platzgründen nicht eingegangen). Aus internationaler Sicht fallen bezüglich Hochschulstudium folgende Charakteristika auf: Österreich hat von den Industrieländern eine der niedrigsten AbsolventInnen-Quoten, an den Universitäten liegt die Dropout-Quote bei etwa 50% und die durchschnittlichen Studiendauern liegen weit über den Regelzeiten (siebeneinhalb Jahre bis zum Magister). Wie viel Prozent der MaturantInnen schließen ein Studium ab? Auch hier sind die Unterschiede gravierend. Besonders benachteiligt sind Mädchen aus unteren Bildungsschichten am Land, ganz allgemein erfolgt die Reihung der Wahrscheinlichkeiten wieder nach der Ausbildung der Eltern: sie liegen zwischen 2 und 63%.

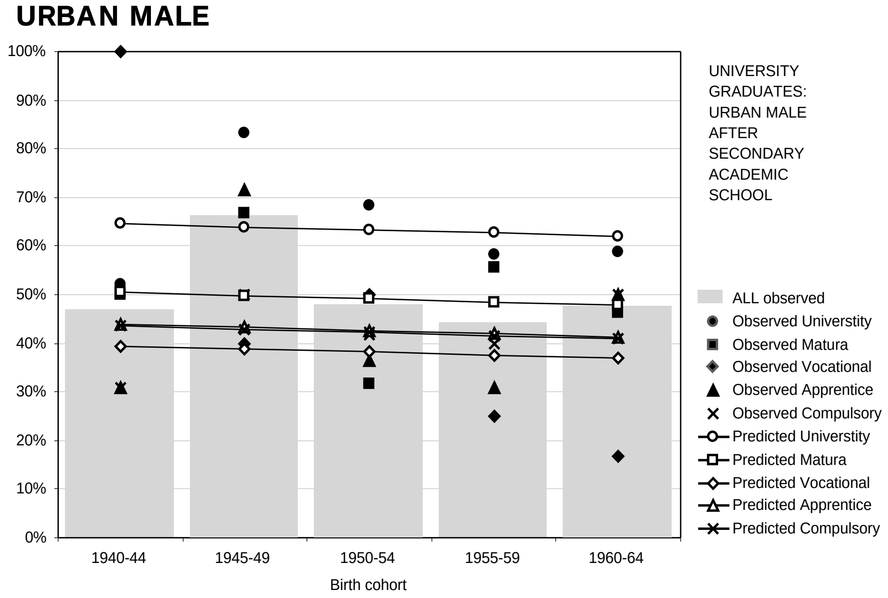
Grafik 8: Universitätsabschlüsse nach der Matura



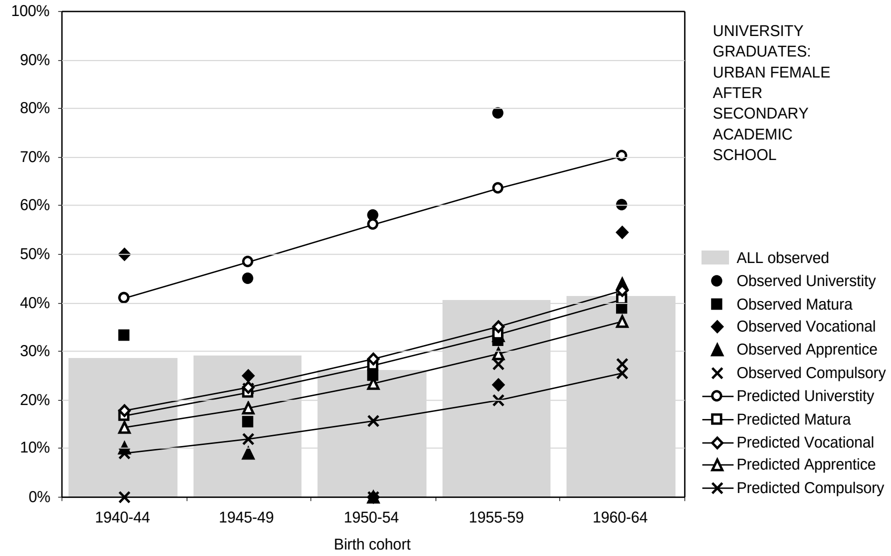
Quelle: Logistische Regression auf Basis des Mikrozensus 2/1996, eigene Berechnungen

Interessante Veränderungen der AbsolventInnen-Quoten können bezüglich des zeitlichen Verlaufs festgestellt werden. Die folgende Grafik zeigt den Anteil von AHS-MaturantInnen, welche ein Studium abschließen getrennt nach Geschlecht und Stadt / Land. Für männliche Jugendliche in der Stadt haben sich diese Raten über die Zeit nicht verändert. Eine "Staffelung" der Raten erfolgt, wie zu erwarten, nach der Ausbildung der Eltern. Insgesamt schließen über 45% der männlichen Maturanten in der Stadt ein Studium ab. Die weiblichen Raten in der Stadt liegen für die letzte betrachtete Geburtenkohorte fast am gleichen Niveau, verzeichneten aber in der Vergangenheit einen starken Anstieg. Das genau umgekehrte Bild ergibt sich für männliche Jugendliche am Land. Hier war der Besuch einer AHS in der Vergangenheit äußerst selektiv und fast alle (der wenigen) Maturanten besuchten später eine Universität. Mittlerweile haben sich die Raten denen der Stadt angeglichen und liegen mit 40% etwa am selben Niveau wie in den bereits betrachteten anderen Gruppen. Deutlich darunter – nämlich nur halb so hoch – liegen die Raten für Mädchen am Land, für die sich in der Vergangenheit kaum Veränderungen ergeben haben. haben.

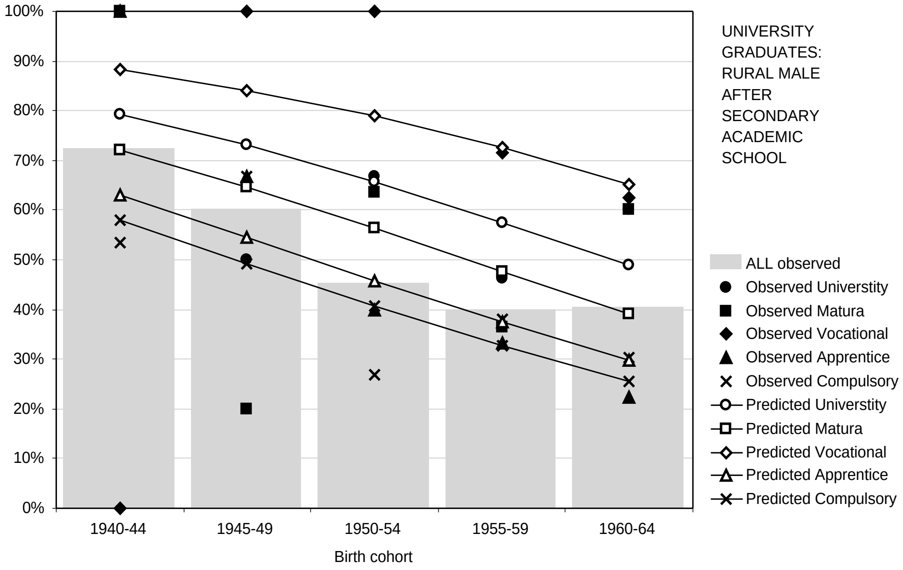
Grafik 9: Universitätsabschlüsse nach der AHS-Matura im Zeitverlauf getrennt nach Gemeindetyp und Geschlecht

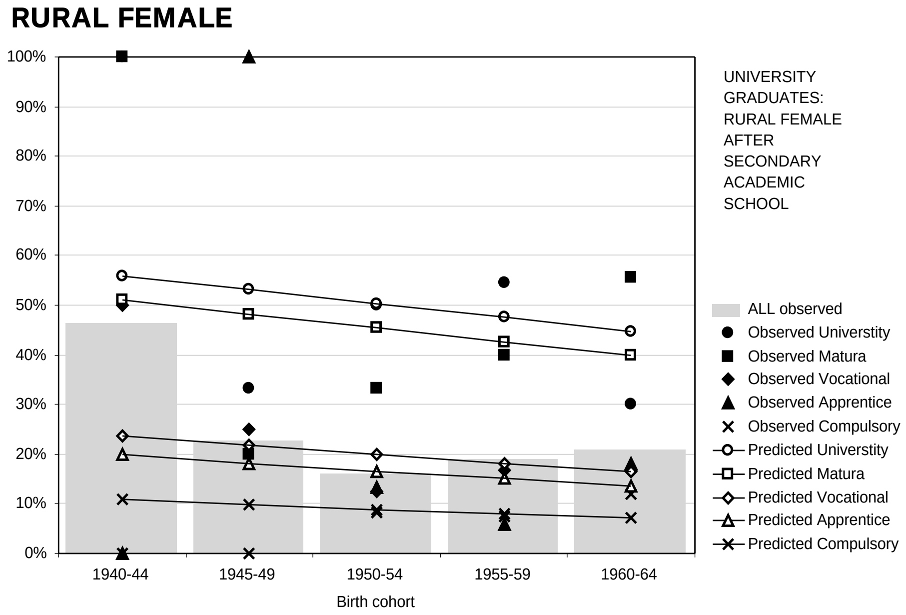


URBAN FEMALE



RURAL MALE





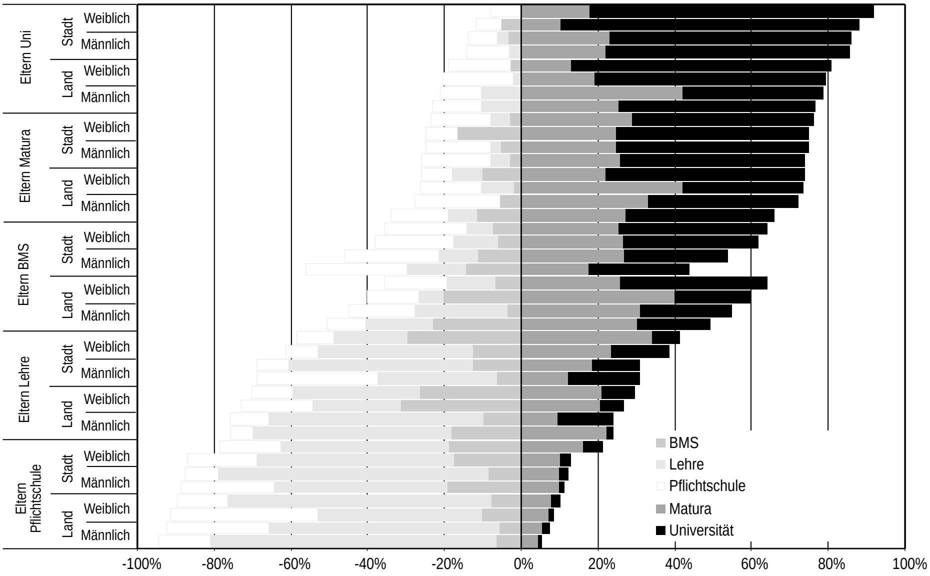
Quelle: Logistische Regression auf Basis des Mikrozensus 2/1996, eigene Berechnungen

Für die Bildungsprognose dieser Studie wird angenommen, dass sich die Raten in Zukunft nicht mehr ändern – die Veränderungen über die Zeit werden als Konvergenz zu den stabilen städtischen Raten für männliche Jugendliche interpretiert.

Höchste abgeschlossene Schulbildung und intergenerationelle Dynamik

Die folgende Grafik fasst die Verteilung der höchsten abgeschlossenen Schulbildung nach elterlicher Herkunft, Stadt / Land und Geschlecht zusammen (auf der rechten Seite sind die Bildungsabschlüsse mit Matura dargestellt). Es wird ein klares Ranking mit der elterlichen Ausbildung als wichtigsten Faktor ersichtlich, gefolgt von Stadt-Land-Unterschieden.

Grafik 10: Höchster Bildungsabschluss nach Ausbildung der Eltern, Gemeindetyp und Geschlecht

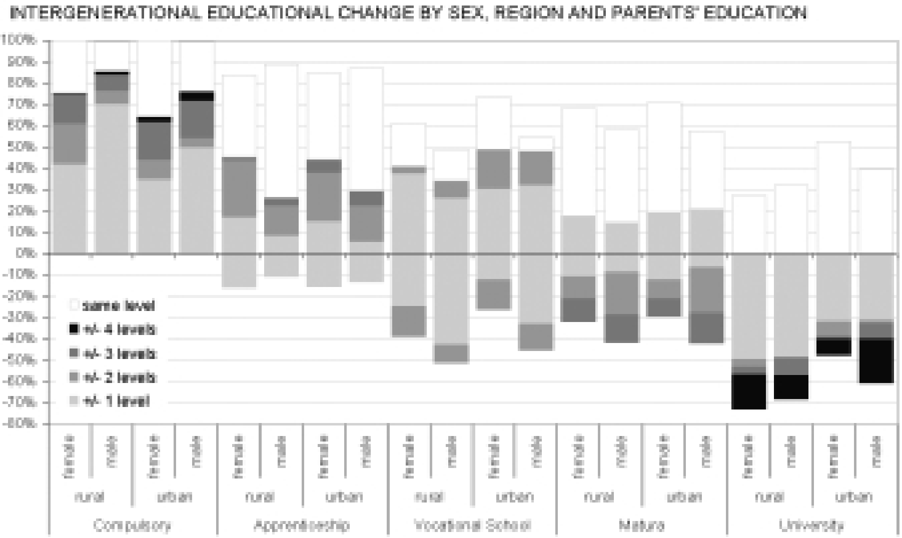


Quelle: Analyse- und Regressions-Ergebnisse auf Basis des Mikrozensus 2/1996, eigene Berechnungen

Trotz des starken Selektionscharakters des Schulsystems gibt es natürlich auch eine intergenerationelle Mobilität, die die höchste abgeschlossene Schulbildung betrifft. Nicht alle Akademikerkinder studieren und auch in den am meisten benachteiligten Gruppen schaffen es einige (wenige) zu hohen Bildungsabschlüssen. Die folgende Grafik zeigt, zu welchen Anteilen Kinder gegenüber ihren Eltern einen höheren oder niedrigeren Bildungsabschluss aufweisen. Als Beispiel wird ein am Land wohnendes Mädchen herangezogen: Haben beide

Elternteile nur die Pflichtschule besucht, liegt die Chance eines höheren Bildungsabschlusses der Tochter bei etwa 75%, die Wahrscheinlichkeit eines Studienabschlusses hingegen nahezu bei Null. Hat hingegen zumindest ein Elternteil die Universität absolviert, so liegt die Wahrscheinlichkeit, dass dieser „Status“ von der Tochter nicht erreicht wird bei 75%, die Wahrscheinlichkeit eines Universitätsabschlusses liegt aber mit 25% im Vergleich „fast unendlich“ höher.

Grafik 11: Intergenerationelle Bildungsmobilität nach Ausbildung der Eltern, Gemeindetyp und Geschlecht



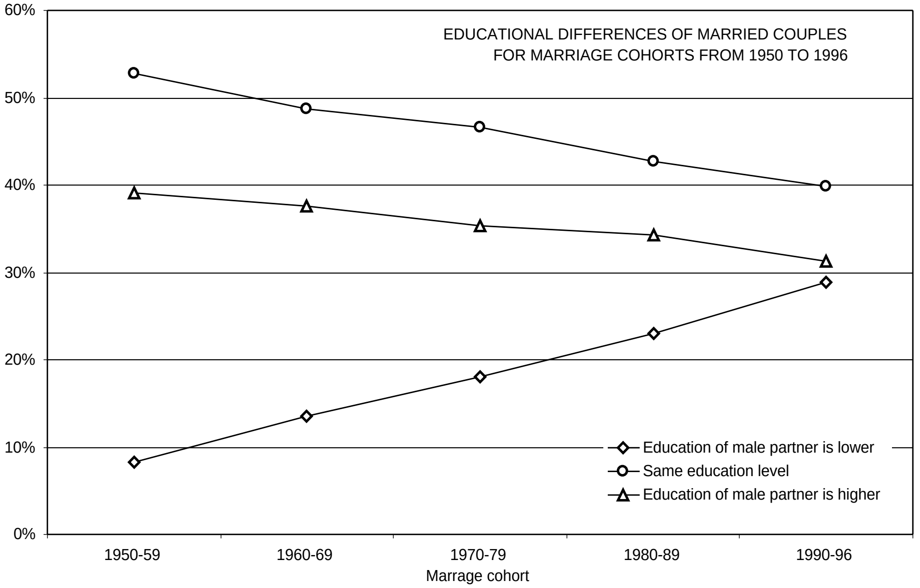
Quelle: Analyse- und Regressions-Ergebnisse auf Basis des Mikrozensus 2/1996, eigene Berechnungen

Computersimulationen, die auch die unterschiedliche Fertilität von Frauen mit verschiedenen Bildungsabschlüssen berücksichtigen, ergeben, dass diese Mobilitätsraten nur noch eine mäßige Bildungsexpansion erwarten lassen (s.u.). Ob die resultierende Bildungsverteilung in der österreichischen Bevölkerung sowie die soziale Mobilität als „ausreichend“ betrachtet werden, ist eine politische Entscheidung. Die jüngsten Forschungsergebnisse können und sollen hierzu vor allem eine bessere Datengrundlage bereitstellen.

Partnerschaften und Bildung

Zur Prognose der zukünftigen Bildungszusammensetzung der österreichischen Bevölkerung müssen zwei weitere Sachverhalte berücksichtigt werden: die unterschiedliche Fertilität von Frauen aus verschiedenen Bildungsschichten sowie die bildungsmäßige Zusammensetzung von Partnerschaften. Letzteres ist wichtig, da in den Modellen der höhere Bildungsabschluss beider Eltern als wichtigster Einflussfaktor auf die Bildungskarriere der Kinder identifiziert wurde. Betrachtet man Heiratskohorten über die Zeit, ist eine deutliche Veränderung von Bildungsunterschieden in Partnerschaften zu beobachten. Hatte in 40% der 1950 bis 1959 geschlossenen Ehen der Mann und in nur knapp 10% die Frau eine höhere Ausbildung als die Partnerin / der Partner, wurde mittlerweile bezüglich Bildungsunterschieden eine Symmetrie erreicht. Zu 40% haben beide Partner den gleichen Bildungsabschluss, zu je 30% hat die Frau bzw. der Mann einen höheren Abschluss.

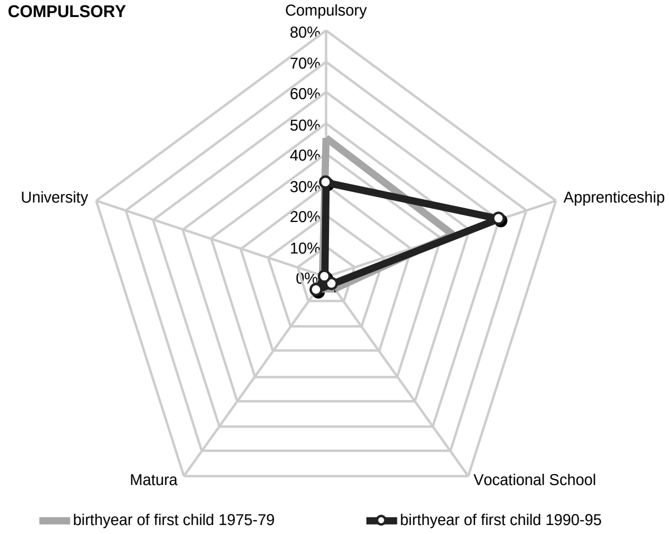
Grafik 12: Bildungsunterschiede in Partnerschaften im Zeitverlauf

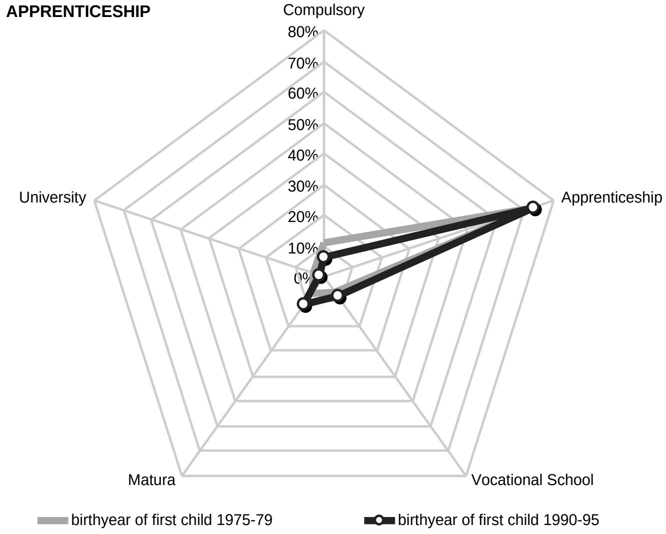


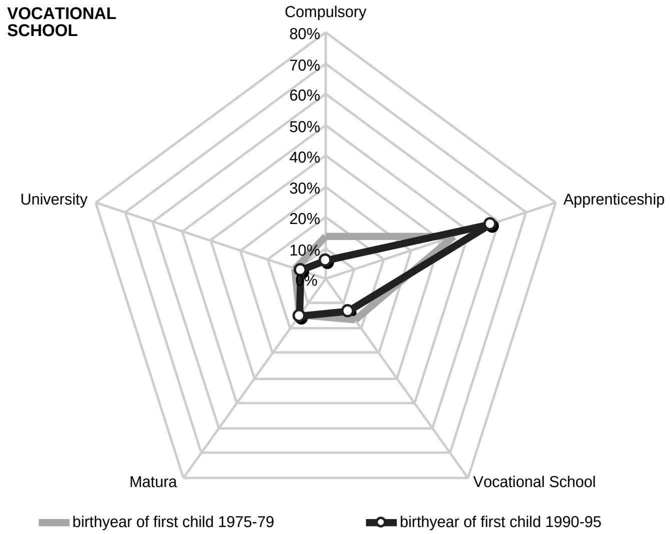
Quelle: Mikrozensus 2/1996, eigene Berechnungen

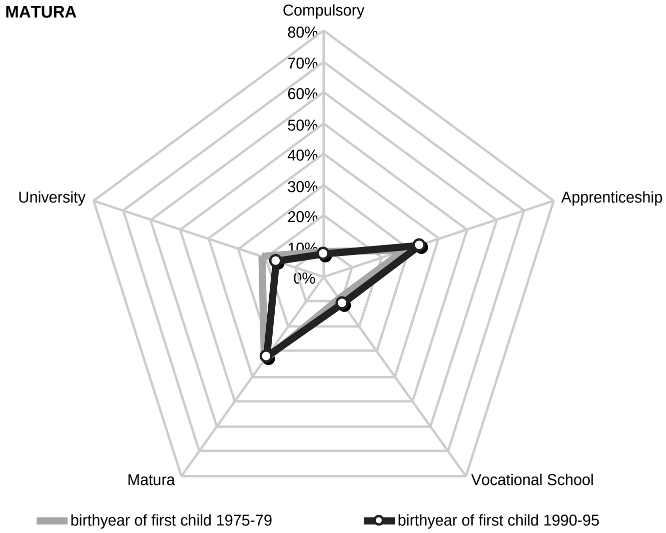
Da für nicht verheiratete Paare keine Daten zum Zeitpunkt des Beginns der Partnerschaft vorliegen und außerdem nur Paare mit Kindern den Gegenstand der Analyse bilden, wird in der Folge die Geburt des ersten Kindes als Proxy für den Beginn der Partnerschaft verwendet. Die folgende Illustration zeigt die Verteilung der Bildungsabschlüsse der männlichen Partner getrennt nach den fünf unterschiedenen Bildungsabschlüssen der Frau für zwei Geburtskohorten des ersten Kindes: 1975-79 und 1990-95. Veränderungen gab es vor allem in der untersten und obersten Bildungsschicht, insgesamt kommen etwa 90% der PartnerInnen aus der gleichen oder einer benachbarten Bildungsschicht.

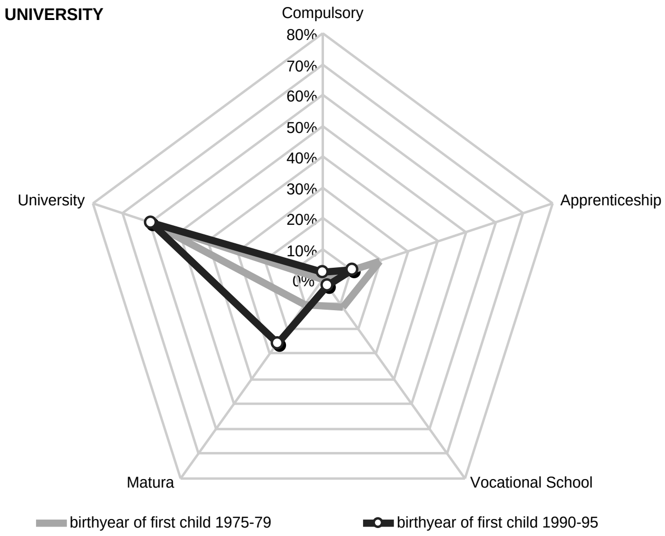
Grafik 13: Verteilung der Bildungsunterschiede in Partnerschaften






VOCATIONAL SCHOOL
Compulsory
80%
70%
60%
50%
40%
30%
20%
10%
0%
Apprenticeship
Vocational School
Matura
University
birthyear of first child 1975-79
birthyear of first child 1990-95


MATURA
Compulsory
80%
70%
60%
50%
40%
30%
20%
10%
0%
Apprenticeship
Vocational School
Matura
University
birthyear of first child 1975-79
birthyear of first child 1990-95



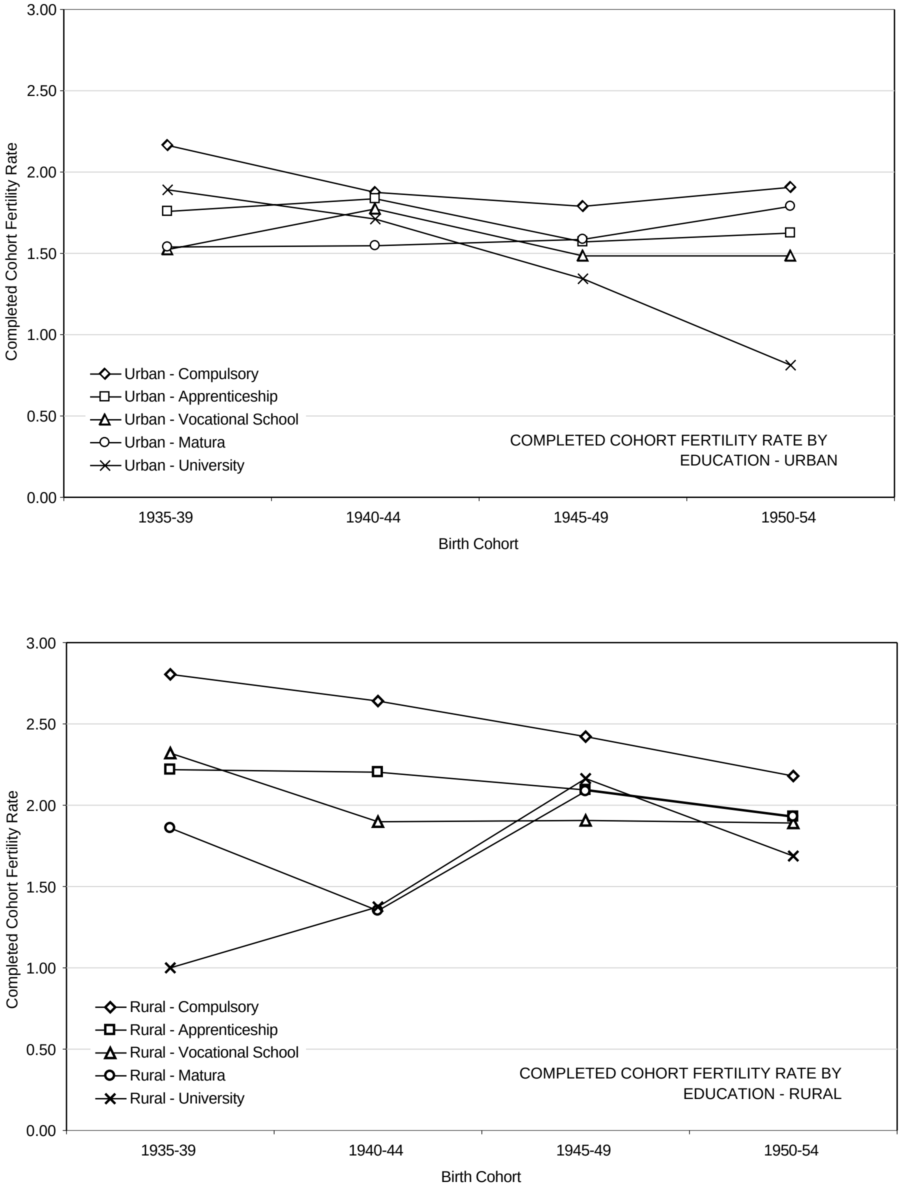
Quelle: Mikrozensus 2/1996, eigene Berechnungen

Im Simulationsmodell wird angenommen, dass die heutigen Muster beibehalten werden, insbesondere auch die hier nicht näher ausgeführte Verteilung der Altersunterschiede. Da es sich bei FAMSIM+ um ein geschlossenes Modell handelt, müssen passende PartnerInnen in der simulierten Population gefunden werden. Dies ermöglicht(e) es, diese Annahme (positiv) auf Konsistenz zu testen.

Bildung und Fertilität

Bis zur Mitte des vorigen Jahrhunderts kann nach Geburtskohorten und ausgehend von sehr hohen Fertilitätsunterschieden zwischen den Bildungsschichten eine Konvergenz dieser Raten zu einem Wert in der Nähe von zwei Kindern pro Frau beobachtet werden (Zwei-Kind-Norm). Die folgenden Grafiken illustrieren diese Veränderungen getrennt nach Stadt und Land. Der Vergleich zeigt auf, dass diese Veränderungen in der Stadt schon früher stattfanden und die Fertilität in Städten generell niedriger ist.

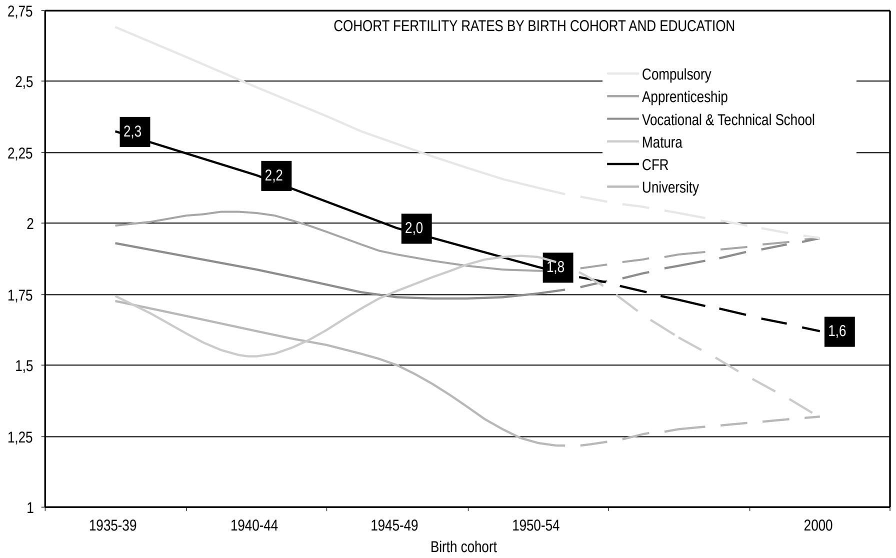
Grafik 14: Kohortenfertilitäten nach Bildungsschicht im Zeitverlauf



Quelle: Mikrozensus 2/1996, eigene Berechnungen

Wie veränderte sich die Kohortenfertilität für die in der zweiten Hälfte des letzten Jahrhunderts geborenen Frauen? Da für diese Gruppe die fertile Lebensperiode noch nicht abgeschlossen ist, kann nur aus der Periodenfertilität auf Kohortenmasse geschlossen werden. In dieser Studie wurden durch Computer-Mikrosimulation in retrospektiven Projektionen nach Bildung differenzierte Kohortenfertilitäten ermittelt, welche (unter der Annahme unveränderten Timings und Spacing von Geburten ab 1996) die tatsächlich in den letzten Jahren beobachteten Geburtenzahlen nach Bildungsschicht reproduzieren. Die Simulationsergebnisse lassen darauf schließen, dass insbesondere die Matura einen deutlichen Einfluss auf die Kinderzahl hat, wobei die Unterschiede innerhalb der Gruppe der Frauen mit (resp. ohne) Matura abnehmen. Die Kohortenfertilität von um 1970 geborenen Frauen liegt demnach für alle Frauen ohne Matura in der Nähe von zwei, während die Fertilität aller Frauen mit Matura bei etwa 1,25 anzusiedeln ist. Zu einer starken Abnahme der Fertilitätsrate kam es bei der Gruppe der Maturantinnen, welche sich ähnlich wie Universitätsabsolventinnen verhalten.

Grafik 15: Kohortenfertilitäten nach Bildungsschicht im Zeitverlauf: Simulationsergebnisse



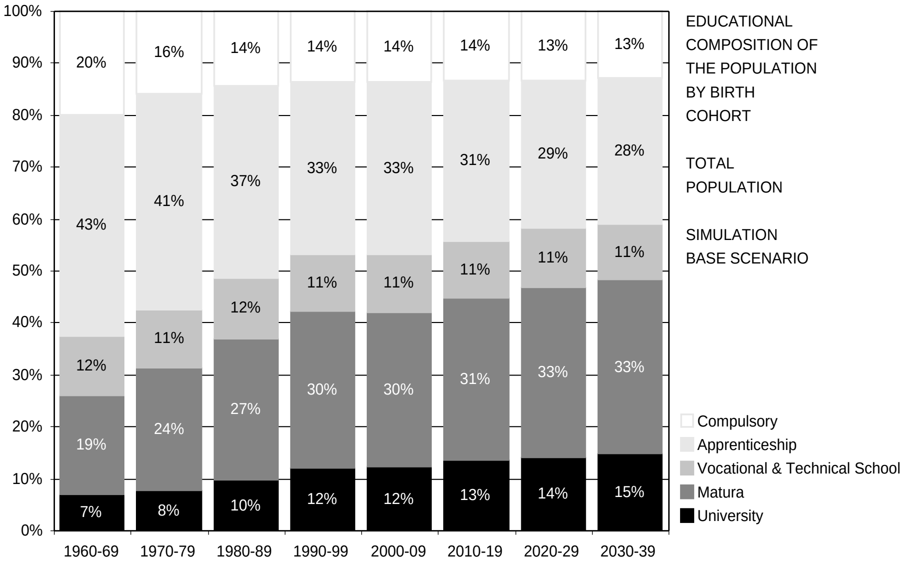
Quelle: Mikrosimulation

Entsprechend diesen Ergebnissen wurde in der folgenden Bildungsprognose das Modell so parametrisiert, dass sich langfristig Kohortenfertilitäten von knapp zwei für Frauen ohne Matura und 1,25 für Frauen mit Matura ergeben.

Bildungsprognose

Die unter den oben angeführten Annahmen erstellte Prognose der Bildungszusammensetzung der Bevölkerung nach Geburtskohorten geht davon aus, dass sich das Tempo der Bildungsexpansion bereits deutlich abgeschwächt hat und sich unter Zugrundelegung der heutigen intergenerationellen Mobilität nur noch mäßige Anstiege in den Anteilen höherer Bildungsabschlüsse ergeben.

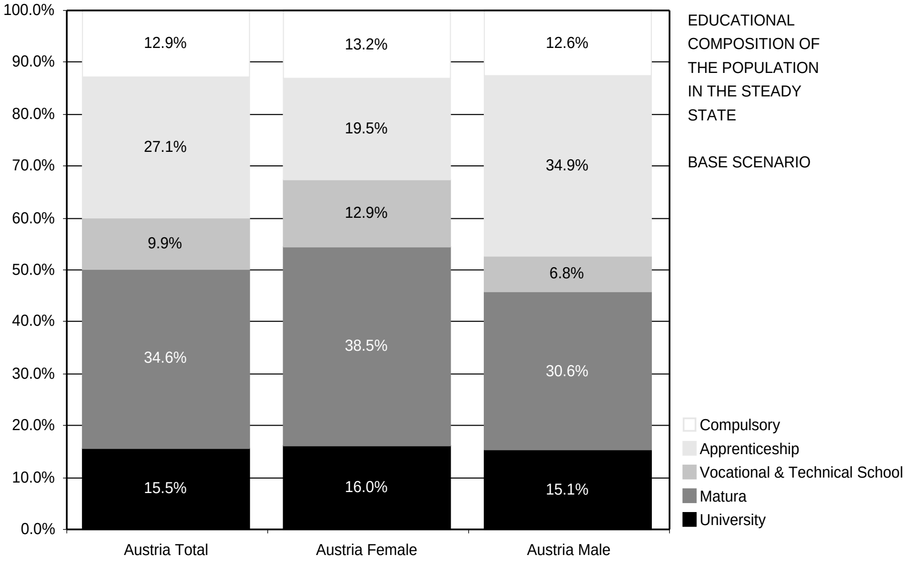
Grafik 16: Bildungsprognose



Quelle: Mikrosimulation

Unter der Annahme unveränderter Mobilitätsraten (und eines unveränderten Schulsystems) wird in der Simulation für nach 2040 geborene Personen ein Steady State erreicht in dem die Bildungsexpansion zum Stillstand kommt. In diesem Gleichgewichtszustand liegt der Anteil von UniversitätsabsolventInnen bei etwa 15,5%, jeweils die Hälfte der Bevölkerung hat eine bzw. keine Matura.

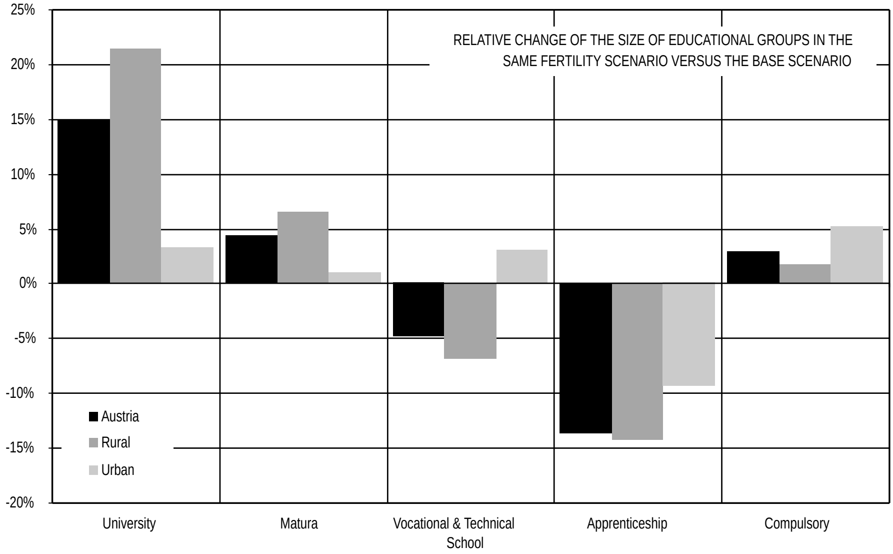
Grafik 17: Bildungsprognose: Gleichgewichtszustand



Quelle: Mikrosimulation

Dieses Ergebnis reagiert sensibel auf Fertilitätsunterschiede von Frauen unterschiedlicher Bildungsabschlüsse. Wie weitere Simulationsexperimente zeigen, gäbe es bei gleicher Fertilität aller Frauen 15% mehr UniversitätsabsolventInnen, die Gruppe der Lehrlinge wäre hingegen um 15% kleiner.

Grafik 18: **Bildungsprognose: Einfluss der Fertilitätsunterschiede nach Bildung auf die zukünftige Bildungsverteilung in der Bevölkerung**



Quelle: Mikrosimulation

Zusammenfassung

Die Ergebnisse der Studie weisen auf eine starke soziale Selektion hin, die durch das Schulsystem bei jedem Verzweigungspunkt des Systems verstärkt wird. Deutliche Veränderungen über die Zeit gab es bezüglich der Geschlechterunterschiede – hier haben Mädchen deutlich aufgeholt – und einer gewissen Abnahme der Stadt-Land-Unterschiede, welche aber nach wie vor hoch sind. Während insgesamt mit jeder Geburtskohorte mehr Jugendliche hohe Bildungsabschlüsse erreichen, haben sich die Raten auf individueller Ebene – unter Berücksichtigung der elterlichen Ausbildung, Gemeindegröße und Geschlecht – seit den 1970er-Jahren nur noch wenig geändert, sondern sind vielmehr Ergebnis der höheren Bildungszusammensetzung der Elterngeneration. Die Bildungszusammensetzung von Partnerschaften betreffend wurde in den letzten Jahren eine „Symmetrie“ dahingehend erreicht, dass der gleiche Anteil von Frauen einen Partner mit höherer und niedrigerer Ausbildung haben. Bezüglich der Fertilität lassen Ergebnisse der Computersimulation darauf schließen, dass insbesondere die Matura einen deutlichen Einfluss auf die Kinderzahl hat, wobei die Unterschiede innerhalb der Gruppe der Frauen mit (resp. ohne) Matura abnehmen. Den Abschluss der Studie bildete eine Prognose der Bildungszusammensetzung der Bevölkerung nach Geburtskohorten, aus der hervorgeht, dass sich das Tempo der Bildungsexpansion bereits deutlich abgeschwächt hat und unter Zugrundelegung der heutigen intergenerationellen Mobilität nur noch mäßige Anstiege in den Anteilen hoher Bildungsabschlüsse ergeben.

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