The effect of a student aid reform on graduation: a duration analysis*

Iida Häkkinen** and Roope Uusitalo***

February 6, 2003

Abstract

In this paper we evaluate the changes in the times-to-degree at the Finnish universities in the 1990s. In particular, we evaluate the effect of the 1992 student aid reform that was intended to shorten the duration of university studies. We find that the student aid reform had only a modest effect, and that this effect was limited to the fields with long median durations. Most of the decline in the observed times-to-degree can be explained by an increase in the unemployment rate that reduced student employment opportunities.

Key words: Times-to-degree; University education; Student aid; Duration analysis

JEL: I2

---

* We are thankful for comments and suggestions from the seminar participants at LSE Center of Economics of Education, Uppsala University, Government Institute for Economic Research, IZA European summer school in labor economics, ZEW Human Capital workshop, and EALE 2002 conference. Financial support from Yrjö Jahnsson Foundation is gratefully acknowledged.

** Department of Economics, Uppsala University, Box 513, SE-751 20 Uppsala, Sweden.
Tel: +46-18-471 7638. Fax: +46-18-471 1478. E-mail: iida.hakkinen@nek.uu.se

*** Department of Economics, Uppsala University and Labour Institute for Economic Research, Pitkänsillanranta 3 A, FIN-00530 Helsinki, Finland. Tel: +358-9-2535 7335. Fax: +358-9-2535 7332. E-mail: roope.uusitalo@labour.fi

1. Introduction

The long duration of the university studies has generated a lively public discussion in Finland. Critics of the current system argue that the universities are inefficient and that completing university education takes far too long. The main reason for the concern is that long study times delay the entry to the labor market. In addition to the private costs for the student and an extra burden on the university resources, late entry to the labor market also creates a considerable social cost by reducing the labor supply and increasing the dependency ratio.

The median graduation age for Finnish university students is 27.5. According to the OECD Education at a Glance (1998), this is the second highest figure in the OECD-countries. Only Danish students graduate at an older age. A partial explanation for the high graduation age in Finland is that the Finnish students begin their university studies later than elsewhere. However, this late starting age is far from being the whole story. University studies also take, on average, much longer than intended. Most university programs are designed so that they can be completed in five years. Yet, the median graduation time is much longer, 6.5 years.

Several reforms that were aimed to increase the efficiency of universities were carried out in the 1990s. The most important reform was a reform of the student aid system. In 1992, the old loan-based student aid system was replaced with a system that relies on student grants. At the same time, the maximum duration of the student aid was reduced.

The main argument for the student aid reform was that larger student grants would enable students to concentrate more on their studies, instead of dividing their time between studies and part-time work. Shorter grant duration should also improve incentives to complete the studies within the grant period. Formal target in the government action plan for higher education was that 75 percent of students should complete their master's degree in five years.

In this paper we evaluate the effect of the student aid reform on the duration of the university studies. We use large individual level panel data that follow the students from the start of their university career to the eventual graduation. The data allow us to control for a number of other factors that may influence graduation times. Particularly important are large changes in the student employment opportunities. During the period that we examine, the Finnish economy entered a severe recession. Unemployment rates increased from three to eighteen percent between 1991 and 1994. The unemployment rate for the 15 – 24 -year-olds was over 30 percent for three years. This increase in unemployment also reduced student part-time employment opportunities. Large changes in the economic environment can be expected to influence graduation times, no matter how the student aid system was reformed. With micro-level data from different regions differing in the severity of recession, we can account for the business cycle effects on student employment, and hence on the graduation times. We can also control for a number of individual and family specific factors, as well as, differences in ability.

Previous research on the effects of financial aid on graduation times has primarily focused on the Ph.D. programs. Ehrenberg and Mavros (1995) use data on all graduate students who entered the Ph.D. program at Cornell University. They find that the students receiving fellowships and research assistantships have higher completion rates and shorter times-to-degree than the students who receive teaching assistantships or tuition waivers, or the students who are totally self-supporting. Siegfried and Stock (2001) use data on Ph.D. graduates in economics in the US. They also find that students who receive fellowships graduate faster. In contrast, Booth and Satchell (1995) find no significant effects of research council funding on the graduation times of the British Ph.D. students. The only study on the length of undergraduate education we could find is an unpublished paper on the US four-year-college duration by van Ophem and Jonker (1999). They find that students receiving scholarships graduate faster, but argue that this might be due to their higher ability.

The rest of this paper is organized as follows. We start by a short description of the Finnish university system. This is followed by a description of the student aid system, and the reform carried out in 1992. Section 3 describes our data sources, and section 4 the methods used in the evaluation. Empirical results are presented in section 5. Section 6 concludes.

2. The Finnish university system

There are twenty universities in Finland. The largest fields are engineering, humanities, and natural sciences. The number of university students has increased by some 40 % during the last ten years. In 2001, there were about 162,800 university students, of whom 20,600 were new entrants. Slightly more than half of the university students are female.

All universities in Finland are run by the state. Education is free, as there are no tuition fees. Universities select their students independently. Competition for the slots in higher education is fierce, and annual admission quotas apply to all fields of study. Less than a third of the applicants are admitted. Various entrance examinations form a central part of the selection process.

Most students are admitted to programs leading to a master's degree. The master's degree consists of one major and one or more minor subjects. The graduation requirement is, depending on the field of study, 160 or 180 credits. One credit corresponds roughly to one week of full-time study. For example, a typical one semester intermediate microeconomics course would yield five credits. Most programs are designed so that the graduation requirement can be fulfilled in five years. However, students can, in principle, stay enrolled as long as they wish. No strict limits on the duration of studies are imposed.

2.1 Student Financial Aid Reform

Before 1992, the student financial aid system was mainly based on subsidized student loans. Students also received a smaller study grant and a housing supplement, but the student loans were the cornerstone of the system. In 1991, the student grant was 640 marks (108 euro) per month, the maximum housing supplement 780 marks (131 euro) per month, and the maximum loan 1,800 marks (303 euro) per month. (Blomster 2000)

Financial aid was granted for up to seven academic years. In order to keep receiving student aid, a student had to complete at least 15 credits during the first year and at least 20 credits during the following years. The credit requirement was not really binding: fulfilling minimum requirements yielded 135 credits in seven years, which was still 25 credits short of the graduation requirement. There were also income limits for student earnings to ensure that the aid was used to finance full-time studies. A student was allowed to earn 3,000 marks (504 euro) per month before the student aid was cut.

In summer 1992, the financial aid system was profoundly reformed. Government subsidies for the student loans were abolished, but the government still provided guarantee for student loans up to 1,200 marks (202 euro) per month. The study grant was more than doubled - to 1,570 marks (264 euro) per month. Housing supplement was also slightly increased - to 884 marks (149 euro). Only minor changes to the student aid system have been carried out after 1992. Student aid is not indexed, so inflation has also decreased the real value of the student grant. (KELA 2001)

In Figure 1 we plot the real value of student aid since the creation of the student aid system in 1969. The figure shows that the 1992 reform was the largest single change in the history of the student aid. The total amount increased by some 13 percent, but more importantly the direct support, including the housing supplement, almost doubled.

Another important change that occurred in 1992 was a cut in the duration of the student aid. The maximum duration was reduced from seven years to 55 months. As the normal length of a study year is nine months (from September to May), the maximum grant duration was effectively reduced by about a year[1]. An exception was made for students who had received aid prior to July 1992. For these students the maximum duration remained at seven years.

The main aim of the student aid reform was to make studying more effective by distributing more financial aid at a faster rate[2]. However, the system has not functioned as planned. Removing the interest subsidy from the student loans made loans unpopular. Before 1992, roughly half of the students took out a loan. After the reform this fraction was less than a third (Raivola et. al. 2000). Rather than taking out the loan, many students have preferred to add to their income by working. According to a recent study on the students at the University of Helsinki, 75 percent of students worked during the semester 2000-2001 (Härkönen 2001).

[1] For exceptional circumstances, the aid period can also be extended by a maximum of nine months.

[2] The attempt to reduce times-to-degree was not the only for reforming the system. The system also became very expensive as the market interest rates increased and the rate paid by the student was fixed to 4.5%.

Expected effects of the student aid reform are not clear cut. The higher study grant lowers the cost of studying, making it possible for the students to stay longer at universities. On the other hand, the higher study grant also enables students to concentrate on their studies instead of working. This could shorten the graduation times. Cutting the maximum aid period from seven years to 55 months, should encourage students to graduate faster.

3. Data

We use data from the Employment Statistics (ES) of Statistics Finland. The data cover the whole population, and contain information on individual income, employment, education, household composition etc. Currently the ES data cover years from 1987 to 1999. The ES data combine information from approximately 30 official registers. For our purposes, the two most important source registers are the Student Register and the Register on Completed Education and Degrees. The Student Register records enrollment at the universities at the beginning of each term. The Register on Completed Education and Degrees contains the level and the field of achieved degrees and the date of their completion.

In this study, we use a research database that the Statistics Finland has created by drawing a random sample of 350,000 individuals, aged between 12 and 74 in 1990 from the ES data. This sample is representative, and includes approximately eight percent of the population in the relevant age. The research database is a balanced panel: the individuals in the data are followed from 1987 to 1999. Completed degrees are also available from the year 2000.

From the ES sample, we select all students whose first university enrollment year was between 1987 and 1995. For these students, we collect information on each student's secondary school graduation date, the first and the last university enrolment date, the name of the university where enrolled, the field of study, the university graduation date, and the degree achieved (if the student had graduated by August 2000). In addition, we record the student's sex, age, marital status, presence of children, months in employment and total annual earnings. For the time-variant variables, these data are collected for each year the student has been enrolled. In addition, we use the full ES sample (not only the students) to calculate the field specific unemployment rates of the recent graduates (graduated less than five years ago), and add this information to the student records.

In the ES data the students can be linked to their parents. We were able to obtain data on the parents' income and education for most students. To reduce the effect of measurement error, we add up the income of both parents and calculate the average over three years, following the year of entry to the university. We also have information on secondary school grades, but only for those students who finished secondary school after 1990. We use the mean score of the four compulsory exams to measure the overall success in the matriculation examination. As the parents data and the matriculation examination results are available for only a sub-sample, we calculate all estimates for both the full sample and the smaller sample with complete data.

We added information specific to the field of study and location of the university from two additional sources. We used the KOTA database of the Ministry of Education to calculate student-teacher ratios in different programs at different universities. We calculated this by dividing the total number of enrolled students in the program by total man-years of the teaching faculty. We also used the KOTA database to obtain information on the median duration of completed degrees in different fields. Information on local labor market conditions was available from the regional database of the Statistics Finland (ALTIKA). We obtained municipality-level unemployment rates for each year at each university location from this database, and matched this information to the students at the corresponding universities.

The graduation date is recorded in months. In principle, the students may graduate at any time during the academic year. This is reflected in the graduation dates that are rather dispersed in the data, even though there are clear peaks in May and December. We measure the duration of studies as the number of months starting from September of the first enrolment year. For the students who have not achieved a degree by our last observation date (August 2000), we mark the durations as censored at this point. Some of these students are drop-outs, but some still continue their studies. To maintain consistency across different student cohorts, we also measure all other incomplete spells up to the time of the last enrolment date. So if a student started in September 1990, never graduated, and was last enrolled in the fall term of 1994, we record this spell as being censored in September 1994. The duration of this incomplete spell is, therefore, 48 months.

Since we only have information on enrollment, and not on the credits or on the courses passed, we cannot identify the drop-outs. It is impossible to make a distinction between active students and "hang-around" students, who are enrolled at a university but have no intention to finish and should, therefore, be considered as drop-outs[3]. Because we cannot distinguish between inactive and active students, we consider all students who registered themselves as "present" in a given year, as students continuing their studies.

4. Methods

A natural way of modeling times to degree is a duration model. The duration model specifies the graduation hazard as a function of exogenous covariates. The main advantages of the duration model, compared to the regression framework, are that right-censored observations can be handled in a straightforward way, and that time-variant covariates can be introduced without conceptual problems. We use a standard proportional hazard model with a Weibull baseline hazard.

The graduation hazard, i.e. the probability of graduating after t months of study, given that the student is still enrolled, is

$$l_t = f(x, b)\, l_0(t), \tag{1}$$

where x is an observed vector of covariates, b is a vector of estimated parameters, and $l_0(t)$ is the baseline hazard. For the Weibull model the baseline hazard is

$$l_0(t) = pt^{p-1}. \tag{2}$$

The shape of the hazard function depends on the value of p. The hazard is increasing if $p > 1$, and decreasing if $p < 1$.

Recorded spells can end due to graduation, drop-out, or censoring at the last observation date. In principle, it is possible to estimate a competing risks model, and analyze separately the factors that affect the graduation and the drop-out hazards. Because identifying the

[3] Students receive discounts e.g. for public transport. As the registration costs are low, it is often beneficial to register as a student, even if one has no plans to take part in any courses or examinations.

drop-outs is not possible in our data, we focus on graduates, and treat the drop-outs as censored.[4]

We also need to account for the unobserved heterogeneity among the students. As time passes, students who put more effort in their studies graduate faster and the sample becomes increasingly composed of “lazier” students. To allow for this, we assume that unobserved heterogeneity follows a Gamma distribution and enters the hazard function multiplicatively. These assumptions yield a mixture distribution, known as the Burr distribution (Lancaster 1990). The hazard of the Burr-distribution is

$$l_t = \frac{f(x,b)\,pt^{p-1}}{1+s^2 f(x,b)\,pt^{p}}. \qquad (3)$$

With no unobserved heterogeneity ($s^2 = 0$), the Burr-distribution distribution reduces to the Weibull distribution.

Inclusion of time-variant covariates in the model creates a problem that is more severe than what is usually encountered in the hazard models. In the standard model, a change in a covariate has an immediate effect on the hazard. Our case is more complicated since the effects are likely to involve considerable lags. For example, more lucrative work opportunities at the boom of the business cycle may draw students to the labor market, and delay their graduation. The effect on the graduation times cannot be seen until the students actually graduate several years later. This could already be during an economic downturn. Graduation hazards are, therefore, a function of the entire time path of the exogenous variables.

Another problem with the time-variant covariates is that they are by construction endogenous. For example, the amount of student aid is meaningfully defined only until the student graduates. Also the student aid reform can only influence the older cohorts if they stay at the university until the reform date. The observed time path of the covariates, therefore,

[4] Competing risk model would yield identical results for the graduation hazard if one makes the assumption that the graduation and the drop-out hazards are independent.

depends on the spell duration[5]. With endogenous covariates it is not possible to interpret the hazard as a probability of ending the spell conditional on the time path of the covariates up to time *t*, because the conditioning event is itself a function of *t* (Lancaster 19990).

We solve this endogeneity problem by replacing the time-varying covariates by their averages over the first four years of study. We calculate this average for each student, irrespective of whether she is still enrolled or not. This way the observed covariate path is independent of the spell duration. This approach also makes the graduation hazard a function of not just the current, but also the past values of the covariates. Our results could also be interpreted as the effect of an average exposure to some covariate values during the first four years[6].

5. Empirical results

5.1 Descriptive Analysis

The Ministry of Education follows the duration of university studies by tabulating the median duration of the completed degrees. We begin our analysis by calculating the same statistic for our sample, and present the numbers in Table 1. The results show that the median duration of completed degrees has slightly declined over time, but is still almost six years in 2000. The average length of complete spells is higher and more volatile, reflecting the influence of a few very long durations.

The change in the median length of the completed spells tells little about the changes in the duration of university education. First, possible changes in the drop-out rates influence the numbers. Second, an increase in the inflow of new students increases the fraction of short, on-going spells, and creates a downward trend in the length of the completed spells. Finally, any policy change that would increase graduation hazards of those with long ongoing durations, would generate a temporary increase in the average length of the completed spells.

[5] Kalbfeisch and Prentice (1980) refer to covariates that are defined only until the termination of a spell as internal.

[6] Another possibility would be to assume that the graduation hazard is a function of the cumulative average of the covariate values up to the graduation date. This could be a better measure of the average exposure, particularly for those with long spells, but cumulative average is not exogenous with respect to the spell duration.

A better statistic is the median length of completed degrees by the year of entry. We present this at the lower part of Table 1. The median is calculated for the whole entry cohort, effectively defining the drop-outs as not yet graduated. Also the median duration by the year of entry shows that the graduation times have become slightly shorter. The median has declined by four months from 1987 to 1993. Interestingly, the cohorts that entered after the student aid reform (1992 and 1993) have the shortest median times-to-degree. We do not know whether the declining trend continues in the later cohorts, because the median student from the 1994 entry cohort did not graduate by the end of our observation period.

The slight decline in the median duration may, of course, be due to other factors than the student aid reform. The student composition has changed because of an increase in admissions. Also the changes in the labor market opportunities and in the distribution of students across fields, may influence the median graduation times. We will try to isolate these effects in the next section. Before that, it is useful to examine the distribution of graduation times in more detail.

Figure 2 plots the Kaplan-Meyer survival functions in the five largest fields: education, business, engineering, natural sciences, and humanities. Variation across the fields is, indeed, substantial. Half of the students in teacher education, but less than ten percent of the students in humanities, graduate in five years. The median graduation time in humanities is almost eight years. Survival rates are also high in natural sciences and engineering.

Figure 3 plots the empirical hazard rate for the whole sample. It is immediately obvious that the hazard is highly non-monotonous. The estimated hazard of graduation is almost zero for the first three years. It then increases rapidly until the seventh study year. If a student is still enrolled after seven years, the conditional probability of graduating starts to decrease. A likely explanation for the non-monotonous hazard function is heterogeneity across individuals. Those who are left after seven years are those who had lower graduation hazards to begin with. A full life table behind the hazard function estimates is presented in Table 2. In addition to displaying the hazard rate, the table shows that half of the students graduate within seven years, and 83 percent during the 13-year observation period. The mode in the graduation times is between five and six years, but there are a substantial number of students who graduate later than seven years after entering university. The fraction of the censored observations is rather high, particularly after the fifth year. This is mainly due to the incomplete spells at the last observation date.

5.2 Duration model

First we estimate a duration model with dummy variables for each entry cohort. To capture the differences across the study fields, we also add twenty dummy variables indicating the field of study. The other included covariates are sex, presence of children, interaction of the presence of children and the sex, marital status, language group, age at entry, student-teacher ratio, and an indicator if the student has changed field during the first four years. As described in the previous section, we estimate the model with a Weibull baseline hazard and Gamma frailty. The results are presented as hazard ratios; coefficients greater than one indicate that the covariate increases the graduation hazard.

In the interest of saving space, we do not report the coefficients of the field dummies. Other coefficient estimates are in Table 3. We find that older, married, and female students have higher completion hazards. The presence of children does not have a statistically significant effect; the point estimates suggest that the effect could be negative for women. Swedish speakers have lower graduation hazards. A higher student-teacher ratio lowers the graduation hazard. We also find that differences across fields are large, even after accounting for the student composition. Graduation hazards are particularly low in humanities, natural sciences, music, theology and arts. Graduation hazards are highest in education, business, law, and health care. Estimates at the bottom of the table show that there is strong positive duration dependence, and substantial unobserved heterogeneity across students.

The year dummies in column 1 show an interesting pattern. The coefficients for the entry year dummies for 1988-1991 are not significantly different from the omitted category, 1987. In contrast, all the coefficients for 1992-1995 are significant, and roughly equal in size. The result indicates that, all else equal, the cohorts that entered after the student aid reform in 1992 have significantly higher graduation hazards.

In column 2, we replace the entry cohort dummies with a reform dummy that equals one for the post 1992 entry cohorts. The post 1992 dummy is significant, and shows that the graduation hazards are higher for the students who entered under the reformed student aid system. As the model in column 2 is nested in the model of column 1, we can test for the parameter restrictions. The hypothesis that the time pattern is adequately described by the post 1992 dummy only, is not rejected (p-value = 0.56). Converting the hazard ratios to the expected change in the graduation times indicates that the median graduation time of the post 1992 cohorts is approximately three months shorter than that of the earlier entry cohorts.

In column 3, we add unemployment rates to the model. To capture the student employment opportunities, we measure the unemployment rate at each university location. We also try to account for the graduation incentives by inserting to the model the unemployment rate of recent graduates in the same field of study. We find that higher local unemployment rate significantly increases the graduation hazard. In contrast, the unemployment rate among the recent graduates has a negative, though not statistically significant, effect. After adding the labor market variables, the coefficient of the post 1992 dummy declines, and is no longer significant. Our interpretation of this result is that shorter graduation times for the post reform entry cohorts are fully explained by higher unemployment that decreased employment opportunities. Another interesting observation is that the effect of the student-teacher ratio is robust to changes in specification. Higher student-teacher ratio lowers the graduation hazard in all specifications.

The results do not change in column 4 where we include ability measures and parents income. A higher score in the matriculation exam increases the graduation hazard, but has little influence on the other coefficients. Also parents' income has a small, but insignificant positive effect on the graduation hazards. [7]

The fundamental identification problem in evaluating the effects of the student aid reform is the lack of cross-sectional variation in the student aid system. Simply including the unemployment rate may not be sufficient to control for the different labor market situation faced by the different entry cohorts.

[7] As a robustness check, we re-estimated all the models using Cox semi-parametric proportional hazard model. The point estimates were somewhat different, but the sign and the significance of the key variables were not affected. We take this as evidence on that the results are not driven by restrictive assumptions on the functional form. The results of the Cox model are in the appendix in Table 3b.

More convincing evidence on the effects of the student aid reform can be found by examining the differences in the changes of the graduation hazards across groups of students. It can be argued that, even though the change in the student aid was similar in all groups, the reform could have stronger effects in some groups than others. For example, the students with less wealthy parents are probably more dependent on the student aid. The effect of the reform should, therefore, be larger for the students from poor families. Also the effect of restricting the duration of student aid should be stronger in the fields where the average graduation times are longer.

We test these ideas by re-estimating the model interacting the reform dummy with the parents' income and the average study duration of the field. We create a dummy variable "Poor parents" equal to one if the parents' income is in the lowest quartile, and add it to the model interacted with the reform dummy[8]. Similarly, we define a dummy that equals one if the average graduation time in the field exceeds the maximum duration of the student aid.

Table 4 presents the results of the models with the interaction terms. As before, we first present the results without the labor market measures in column 1, add the unemployment rates in column 2, and re-estimate the model with the smaller sample that contains the matriculation exam results in column 3. The results indicate that the interactions between parents' income and post 1992 dummy are small and insignificant. In contrast, the interaction between the average study time and the reform dummy is positive and significant. The student aid reform appears to have shortened the graduation times in the fields where graduation times are long. The threat effect of the student aid running out seems responsible for the slight decrease in the graduation times.

[8] We experimented with different measures of parental income but these did not change the results much. Choosing the lowest quartile for the interactions is motivated by the results in Table 3 which show that the lowest quartile has slightly lower hazard rates, but there is little difference between the other quartiles. It should also be noted that the quartiles are calculated from the sample used in the estimations and refers to the lowest quartile among the parents of the university students, not to the lowest quartile in population.

6. Conclusion

Median duration of university studies in Finland currently exceeds the planned duration by one and a half years. Considerable efficiency gains could be achieved if the students accumulated same amount of knowledge in five years than what they currently do in six or seven years. The difficult question is whether there are feasible policy options that would shorten the graduation times.

Our results indicate that the student aid reform had only a modest effect on the graduation times. The effect was concentrated in the fields with long average duration. This suggests that the limits in the aid duration were more important than a switch from the loan-based to the grant-based system. However, the most important reason for the slight decline in the times-to-degree appears to be the increase in unemployment that decreased student employment opportunities. Unfortunately, the large changes in the unemployment make the evaluation of the effect of the student aid reform that occurred at the onset of recession difficult, and our results should be read with that in mind.

Changing the parameters of the student aid system is not the only policy option for the government aiming to produce more graduates at a faster rate. Our results indicate that an increase in the university resources could have a considerable effect. Lowering the student-teacher ratio increases the graduation hazards. However, this policy could be rather expensive, and it is not clear whether the benefits of shorter graduation times would be sufficient to cover the increase in the expenditure.

Appendix

Table A1. Descriptive statistics.

Variable	All students		Graduates	
	Obs	Mean	Obs	Mean
Female	9,403	0.54	5,080	0.56
Children	9,403	0.05	5,080	0.04
Married	9,398	0.08	5,075	0.07
Unemployment rate of graduates in field	9,403	7.35	5,080	6,34
Local unemployment rate	9,403	13.58	5,080	12.23
Swedish speaking	9,386	0.08	5,069	0.07
Age at the beginning of studies	9,403	21.23	5,080	20.91
Changed study field during the first four years	9,403	0.09	5,080	0.09
Parents' income	9,090	51,644	4,942	52,387
Mean score in Matriculation Examination	4,638	5.08	2,058	5.15
Student-teacher ratio	9,372	19.27	5,058	18.37
Median graduation time	9,403	6.64	5,080	6.51
Humanities	9,403	0.167	5,080	0.127
Theology	9,403	0.014	5,080	0.012
Industrial Arts	9,403	0.009	5,080	0.008
Music	9,403	0.010	5,080	0.007
Theatre	9,403	0.003	5,080	0.005
Visual Arts	9,403	0.001	5,080	0.001
Physical Education	9,403	0.005	5,080	0.008
Social Sciences	9,403	0.095	5,080	0.089
Psychology	9,403	0.010	5,080	0.011
Healthcare	9,403	0.003	5,080	0.004
Dentistry	9,403	0.007	5,080	0.012
Veterinary	9,403	0.004	5,080	0.005
Law	9,403	0.034	5,080	0.039
Business	9,403	0.095	5,080	0.121
Natural Sciences	9,403	0.156	5,080	0.138
Pharmacy	9,403	0.021	5,080	0.009
Agriculture and Forestry	9,403	0.022	5,080	0.022
Engineering	9,403	0.191	5,080	0.194
Medicine	9,403	0.032	5,080	0.046
Education	9,403	0.119	5,080	0.140
Started studies during the new system	9,403	0.46	5,080	0.58
Entry year 87	9,403	0.106	5,080	0.141
Entry year 88	9,403	0.108	5,080	0.137
Entry year 89	9,403	0.110	5,080	0.145
Entry year 90	9,403	0.108	5,080	0.139
Entry year 91	9,403	0.111	5,080	0.123
Entry year 92	9,403	0.111	5,080	0.115
Entry year 93	9,403	0.114	5,080	0.101
Entry year 94	9,403	0.111	5,080	0.065
Entry year 95	9,403	0.121	5,080	0.034

Table 3b. Determinants of graduation hazard. Results from a Cox proportional hazard model.

	(1)	(2)	(3)	(4)
Age at the beginning of studies	0.97	0.97	0.97	1.00
	(5.44)**	(5.40)**	(5.47)**	(0.03)
Female	1.32	1.33	1.32	1.39
	(8.55)**	(8.63)**	(8.59)**	(6.19)**
Female*children	0.69	0.69	0.69	0.30
	(2.16)*	(2.13)*	(2.14)*	(1.86)
Children	1.18	1.17	1.12	1.75
	(1.05)	(1.02)	(0.75)	(0.97)
Married	1.23	1.22	1.26	1.37
	(2.59)**	(2.48)*	(2.90)**	(1.71)
Swedish speaking	0.85	0.85	0.89	0.84
	(3.02)**	(2.94)**	(2.15)*	(2.02)*
Student-teacher ratio	0.67	0.70	0.73	0.71
	(7.22)**	(6.67)**	(5.97)**	(3.91)**
Changed study field	0.73	0.73	0.73	0.59
	(6.38)**	(6.35)**	(6.32)**	(6.70)**
Entry year 88	1.01	-	-	-
	(0.11)			
Entry year 89	1.12	-	-	-
	(2.06)*			
Entry year 90	1.14	-	-	-
	(2.31)*			
Entry year 91	1.11	-	-	-
	(1.77)			
Entry year 92	1.26	-	-	-
	(3.84)**			
Entry year 93	1.34	-	-	-
	(4.52)**			
Entry year 94	1.42	-	-	-
	(4.72)**			
Entry year 95	1.45	-	-	-
	(3.94)**			
Post92	-	1.22	0.99	0.97
		(5.71)**	(0.28)	(0.42)
Local unemployment rate	-	-	1.04	1.05
			(7.82)**	(5.76)**
Unemployment rate of the study field	-	-	0.97	0.96
			(4.46)**	(2.17)*
Mean score in Matriculation Examination	-	-	-	1.14
				(3.95)**
Parents' income 2nd quartile	-	-	-	1.13
				(0.67)
Parents' income 3rd quartile	-	-	-	1.38
				(1.90)
Parents' income 4th quartile	-	-	-	1.19
				(1.04)
Log likelihood	-41390.07	-41396.70	-41365.23	-15139.48
Number of students	9350	9350	9350	4600
Number of graduates	5042	5042	5042	2038

Absolute value of z-statistics in parentheses. * significant at 5%; ** significant at 1%. All equations also include 20 dummy variables indicating the field of study. The models are identical to the models in table 3 but estimated with Cox proportional hazard model.

References

Blomster, Peter, 2000. Yliopisto-opiskelijoiden toimeentulo ja opintotuki 1900-luvun Suomessa, KELA sosiaali- ja terveysturvan tutkimuksia 56.

Booth, Alison L. and Satchell, Stephen E., 1995. The hazards of doing a PhD: an analysis of completion and withdrawal rates of British PhD students in the 1980s, Journal of the Royal Statistical Society, Series A (Statistics in Society) 158, 297-318.

Ehrenberg, Ronald G. and Mavros, Panagiotis G., 1995. Do doctoral students' financial support patterns affect their times-to-degree and completion probabilities, The Journal of Human Resources 30, 581-609.

Härkönen, Hanna, 2001. Opiskelijan rahapussilla. Selvitys Helsingin yliopiston opiskelijoiden toimeentulosta ja asumisesta keväällä 2001 (Helsingin yliopiston ylioppilaskunta, Helsinki).

Kalbfleisch, J. D. and Prentice, R. L., 1980. The statistical analysis of failure time data (John Wiley and Sons).

KELA, 2001. Student financial aid 2000-2001. http://www.kela.fi/opintotuki/esite.htm

Lancaster, Tony, 1990. The econometric analysis of transition data (Cambridge University Press).

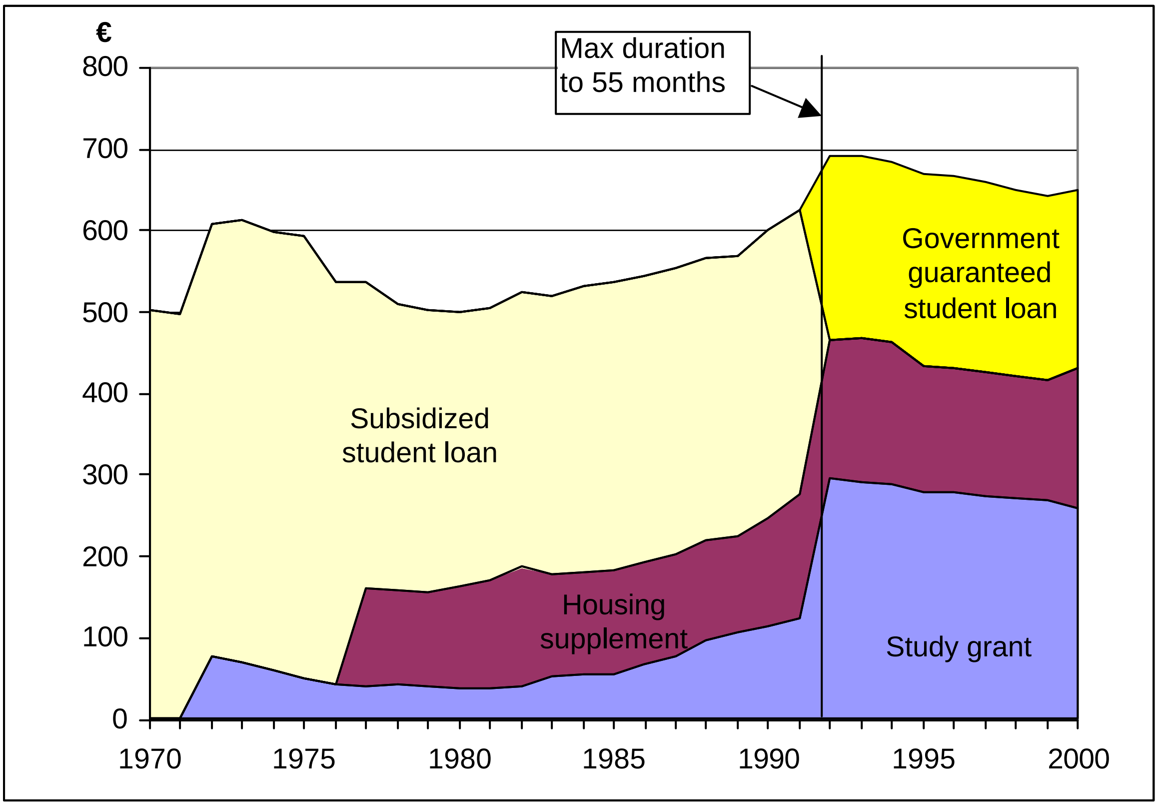
OECD, 1998. Education at a glance. OECD indicators 1998 (OECD, Paris).

van Ophem, Hans and Jonker, Nicole, 1999. The Duration of Higher Education: Semiparametric Estimation of a Dependent Risks Model, mimeo, University of Amsterdam.

Siegfried, John J. and Stock, Wendy A., 2001. So you want to earn a Ph.D. in economics? How long do you think it will take?, Journal of Human Resources 36, 364-378.

Raivola, Reijo, Zechner, Minna and Vehviläinen, Jukka, 2000. Opintotuki - opiskelijapalkka vai koulutusinvestointi, Ministry of Education 14/2000.

Figure 1. Maximum amount of student financial aid in Finland 1970-2000 (€).



In 2000 prices (euro) deflated by the cost of living index

Figure 2. Kaplan-Meier survival estimates by study field.

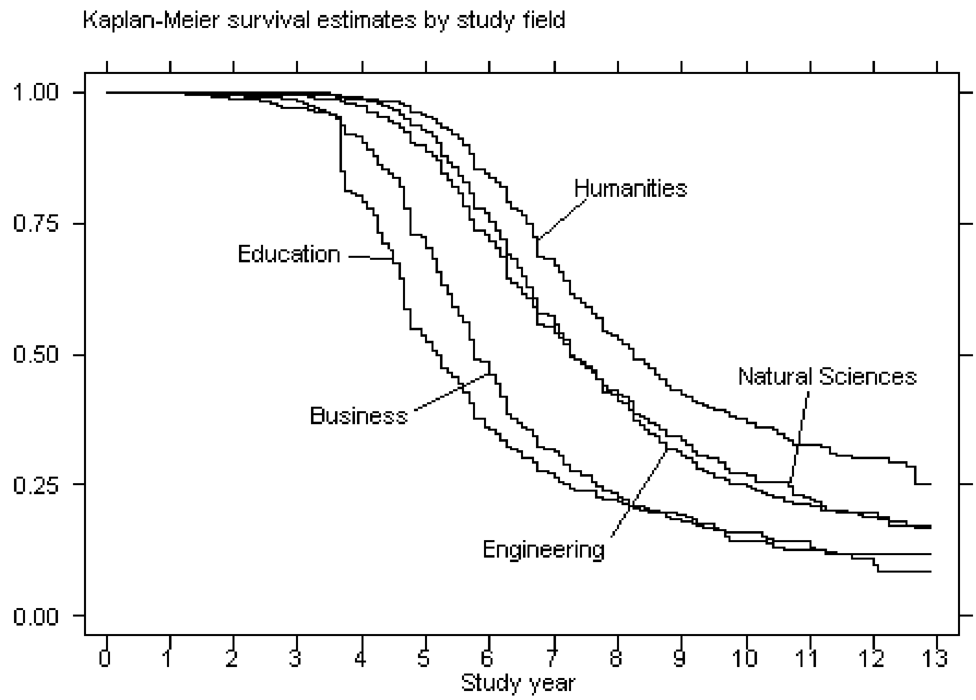
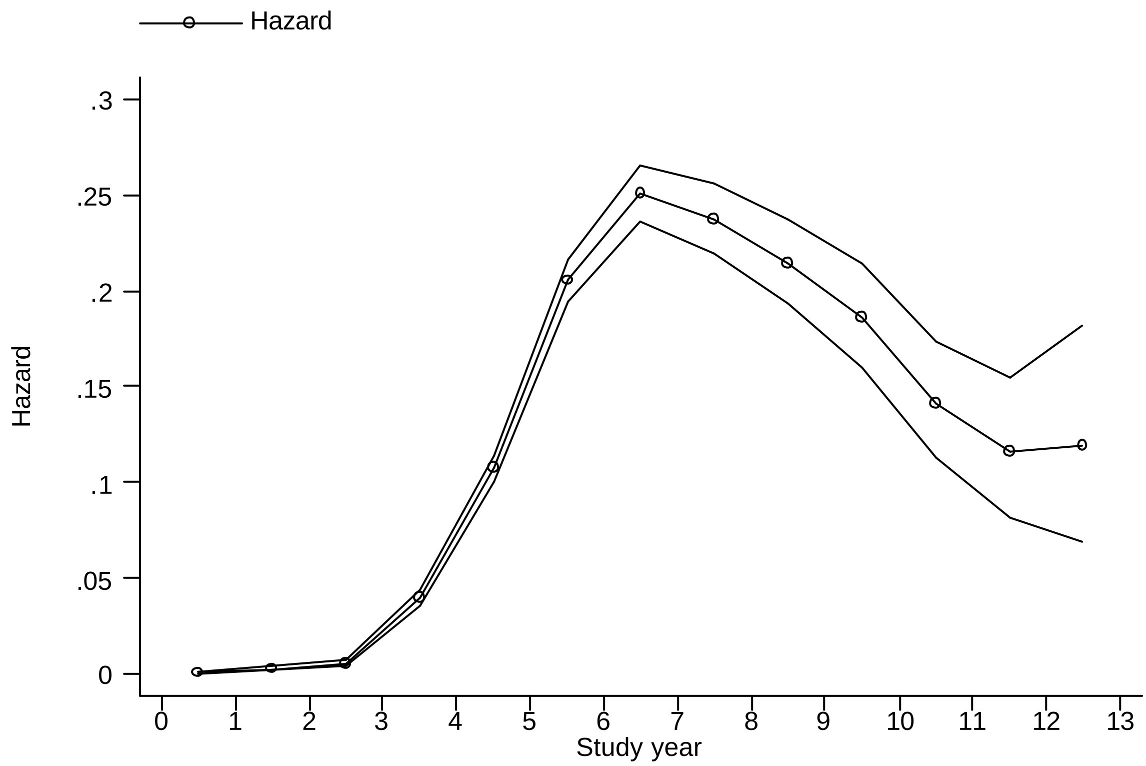


Figure3. Empirical hazard rate.



Note: To estimate the empirical hazard the data have been split into 12 month intervals. The estimated hazard rate is the number of graduates during the year divided by the population at risk at the beginning of the year. The lines around the hazard indicate the 95% confidence intervals.

Table 1. Times-to-degree.

Median and average duration of completed degrees 1987-2000

Graduation year	1987	1988	1989	1990	1991	1992	1993
Median duration (months)	79	75	77	77	74	74	74
Average duration (months)	86	93	84	89	79	81	81

Graduation year	1994	1995	1996	1997	1998	1999	2000
Median duration (months)	74	74	73	74	74	74	71
Average duration (months)	80	77	81	82	83	85	83

Median duration of completed degrees by the year of entry

Entry year	1987	1988	1989	1990	1991	1992	1993
Median duration (months)	90	92	87	89	92	87	86

Table 2. Life table.

Study Year	Population at risk	Censored	Graduates	Hazard	Cumulative Graduation
0-1	9,403	110	5	0.0005	0.0005
1-2	9,288	130	25	0.0027	0.0032
2-3	9,133	277	52	0.0057	0.0089
3-4	8,804	153	351	0.0399	0.0484
4-5	8,300	973	889	0.1071	0.1503
5-6	6,438	732	1,321	0.2052	0.3247
6-7	4,385	531	1,099	0.2506	0.4939
7-8	2,755	418	654	0.2374	0.6141
8-9	1,683	327	361	0.2145	0.6968
9-10	995	222	185	0.1859	0.7532
10-11	588	176	83	0.1412	0.7880
11-12	329	148	38	0.1155	0.8125
12-13	143	126	17	0.1189	0.8348

Table3. Determinants of the graduation hazard.

	(1)	(2)	(3)	(4)
Age at the beginning of studies	1.08	1.08	1.08	1.13
	(5.89)**	(5.91)**	(5.82)**	(2.43)*
Female	1.50	1.51	1.51	1.60
	(5.68)**	(5.73)**	(5.73)**	(4.46)**
Female*children	0.50	0.48	0.51	0.15
	(1.54)	(1.62)	(1.49)	(1.58)
Children	1.14	1.17	1.09	1.78
	(0.31)	(0.38)	(0.21)	(0.54)
Married	3.25	3.20	3.20	3.93
	(5.61)**	(5.55)**	(5.58)**	(3.56)**
Swedish speaking	0.67	0.68	0.71	0.80
	(3.32)**	(3.22)**	(2.80)**	(1.31)
Student-teacher ratio	0.36	0.50	0.51	0.53
	(9.25)**	(6.35)**	(6.10)**	(3.64)**
Changed study field	0.36	0.36	0.37	0.31
	(9.25)**	(9.24)**	(9.12)**	(7.67)**
Entry year 88	0.82	-	-	-
	(1.50)			
Entry year 89	0.93	-	-	-
	(0.52)			
Entry year 90	0.94	-	-	-
	(0.49)			
Entry year 91	1.04	-	-	-
	(0.32)			
Entry year 92	1.33	-	-	-
	(2.06)*			
Entry year 93	1.43	-	-	-
	(2.55)*			
Entry year 94	1.61	-	-	-
	(3.22)**			
Entry year 95	1.49	-	-	-
	(2.42)*			
Post92	-	1.52	1.14	0.96
		(5.72)**	(1.16)	(0.28)

Table continues on the next page

Table continues from the previous page

	(1)	(2)	(3)	(4)
Local unemployment rate	-	-	1.04 (3.66)**	1.09 (5.45)**
Unemployment rate of the study field	-	-	0.98 (1.28)	0.95 (1.56)
Mean score in Matriculation Examination	-	-	-	1.31 (4.10)**
Parents' income 2nd quartile	-	-	-	1.22 (0.78)
Parents' income 3rd quartile	-	-	-	1.47 (1.54)
Parents' income 4th quartile	-	-	-	1.25 (0.90)
Duration dependence (p)	8.52 (84.81)**	8.50 (85.56)**	8.45 (85.11)**	9.68 (57.49)**
Variance of unobs. heterogeneity (σ^2)	3.72 (30.66)**	3.71 (30.80)**	3.66 (30.26)**	3.14 (14.40)**
Log likelihood	-3959.08	-3961.97	-3954.38	-1338.41
Number of students	9350	9350	9350	4600
Number of graduates	5042	5042	5042	2038

The reported coefficients are hazard ratios. Absolute value of z-statistics in parentheses. * indicates statistical significance at the 5% level; ** significance at 1% level. All models are based on the Weibull distribution and are estimated with the Gamma frailty. All equations also include 20 dummy variables indicating the field of study.

Table 4. Determinants of the graduation hazard with interaction terms.

	(1)	(2)	(3)
Age at the beginning of studies	1.03	1.02	1.14
	(1.39)	(1.28)	(2.66)**
Female	1.44	1.44	1.60
	(5.03)**	(5.06)**	(4.46)**
Female*children	0.25	0.27	0.15
	(2.76)**	(2.58)**	(1.57)
Children	1.97	1.80	1.72
	(1.46)	(1.27)	(0.51)
Married	3.01	2.98	3.97
	(4.98)**	(4.96)**	(3.60)**
Swedish speaking	0.67	0.72	0.81
	(3.22)**	(2.66)**	(1.30)
Student-teacher ratio	0.49	0.51	0.55
	(6.18)**	(5.79)**	(3.45)**
Changed study field	0.32	0.33	0.31
	(9.96)**	(9.87)**	(7.75)**
Post92	1.15	0.76	0.78
	(1.19)	(1.90)	(1.16)
Long study-times*post92	1.55	1.77	1.59
	(3.20)**	(3.98)**	(1.96)
Poor parents	0.89	0.86	1.17
	(1.17)	(1.51)	(0.71)
Poor parents*Post92	1.10	1.12	0.79
	(0.62)	(0.74)	(0.93)
Local unemployment rate	-	1.05	1.09
		(4.78)**	(5.50)**
Unemployment rate of the study field	-	0.96	0.91
		(2.51)*	(2.68)**
Mean score in Matriculation Examination	-	-	1.30
			(4.03)**
Duration dependence (p)	8.83	8.78	9.62
	(85.64)**	(85.38)**	(58.08)**
Variance of unobs. heterogeneity (σ^2)	3.69	3.64	3.10
	(30.25)**	(29.70)**	(14.32)**
Log likelihood	-40102.58	-40074.52	-15140.60
Number of students	9044	9044	4600
Number of graduates	4910	4910	2038

The reported coefficients are hazard ratios. Absolute value of z-statistics in parentheses. * indicates statistical significance at 5% level; ** significance at 1% level. All models are based on the Weibull distribution and estimated with the Gamma frailty. All equations also include 20 dummy variables indicating the field of study.