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Dynamic Interrelations between Women's Educational Level, Educational Field and Fertility in Sweden

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Karin Tesching
December 2011

Swedish summary

Denna avhandling analyserar tre aspekter av sambandet mellan kvinnors utbildning och barnafödande. Särskild uppmärksamhet ägnas åt utbildningens *inriktning* som en dimension vid sidan av utbildnings*nivå* och rollen av att vara *studerande*. Denna dimension måste beaktas för att kunna förstå det komplexa samspelet mellan utbildning och fertilitet. De empiriska analyserna är baserade på svenska registerdata för perioden 1990-2004 som analyseras med hjälp av intensitetsregression.

Vad avser *effekter av utbildning på kvinnors fruktsamhet* bekräftar studien att pågående utbildningsaktivitet i allmänhet är negativt korrelerad med barnafödande. Vidare påvisar avhandlingen förutom skillnader i första-, andra- och tredjebarnsintensiteter för kvinnor med olika hög utbildningsnivå kraftiga skillnader i fruktsamhetsbeteende efter utbildningens inriktning.

För att undersöka *effekten av barnafödande på kvinnors utbildningskarriärer* analyseras hur barnafödande påverkar en kvinnas benägenhet att vidareutbilda sig inom ett annat utbildningsområde än det hon redan har en utbildning i. Effekten av barnafödande på en sådan händelse varierar kraftigt beroende på viket fält en kvinna tidigare utbildat sig inom. Kvinnor med examen inom områden där det är svårt att etablera sig på arbetsmarknaden visar sig ha en särskilt hög benägenhet till vidareutbildning inom ett annat område. För dessa kvinnor verkar barnafödande påverka dem att söka sig till ett utbildningsområde som erbjuder mer stabila och familjevänliga framtidsutsikter.

Slutligen undersöks *effekterna av icke-observerade faktorer på kvinnors utbildning och fruktsamhet*. Genom att skatta simultana intensitetsregressioner för en kvinnas fruktsamhetsbeteende och val av utbildningsområde visas att utbildningsbeslut och barnafödande är korrelerade via icke-observerade faktorer som samtidigt påverkar båda livsprocesserna.

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CHAPTER 1

Introduction

1.1 Educational trajectories and fertility decisions as interrelated processes

The life of an individual consists of several domains, such as education, employment, partnership, parenting, health or housing. These domains are dynamically linked; they interact with each other and with their common environment. Status changes in one life domain may preclude, delay, enable or accelerate status changes in other life domains. As a result critical decisions in life are probably not taken in isolation, but are part of general conceptions about future developments in different life domains (Willekens 1999). From a demographic point of view, the parts of the life course that appear to be especially interesting are those in which status changes in multiple domains take place in close sequence, typically the young adult years. In this study we focus on transitions in two domains of young women: education and childbearing. Both life domains are of special importance to women, as they have a strong and lasting impact on the roles women occupy over the course of their lives.

In the past decades, all Western societies have witnessed profound changes in the educational careers and in the childbearing behaviour of young women. On the one hand, there have been considerable improvements in women's educational qualifications. In comparison to previous generations, women today spend more time in the educational system, achieve higher levels of education, and are increasingly able to leverage their higher education to get better jobs (Blossfeld 1995). At the same time, there has been a pronounced postponement of entry into motherhood. Due to the simultaneous increase in women's educational participation and in women's ages at first birth, the interplay between the two life domains has been an important topic of discussion in the scientific literature.

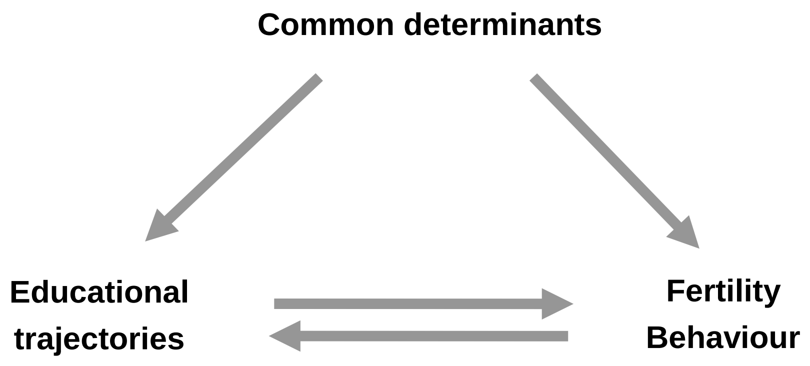
Among demographers, women's education is generally seen as one of the most important determinants of the timing of first births, as well as of overall fertility levels (Martín-García 2008). Consequently, a lot of attention has been paid to the effect of educational enrolment on women's risk of entering motherhood, and to the relationship between female educational level and fertility. In recent years researchers have increasingly emphasised that, in addition to educational level and educational activity, the field of study a woman is trained in might serve as an important indicator for her potential reproductive behaviour (e.g. Lappegård and Rønsen 2005; Hoem et al. 2006a; Martín-García and Baizán 2006). However, empirical studies on the relationship between educational field and fertility are still very limited.

Even though researchers have repeatedly argued that the relationship between education and fertility is exceedingly complex, comparatively little attention has been given to the possibility that causality might run not just from education to fertility; but that, conversely, events in the childbearing domain might also lead to changes in the educational domain. According to Hoem et al. (2006b), educational attainment cannot simply be viewed as a pre-set determinant of subsequent childbearing, and childbearing should not been studied simply as a consequence of the education a woman received in her early years. The authors point out that a particular education, in fact, may even be a consequence of previous childbearing. Empirical studies on the impact of childbearing on education have mostly concentrated on the effect of (early) motherhood on a woman's level of education. In the course of this study, we will argue that childbearing may influence not just a woman's educational level, but also the field of education she is trained in.

Research that seeks to understand the interplay between two life domains, such as educational trajectories and fertility transitions, has to take into account the possibility that, in addition to the mutual impact of events experienced in one life domain on events related to the other life domain, there might also be a correlation in the events due to common factors that simultaneously affect both life domains. In empirical investigations, it is important to control for such spurious factors (especially when they are not observed in the data), since they might lead to biased estimates of the effects of one life domain on the other.

In Figure 1.1, we summarise the outlined aspects of the link between a woman's educational career and her childbearing behaviour.

Figure 1.1: The interplay between education and fertility



1.2 Aim of the study

The overall aim of this study is to contribute to fertility research by investigating the dynamic interrelations between the educational trajectories and the fertility transitions of women. We explore these relationships by systematically analysing all three aspects of the link between education and fertility (see Figure 1.1). In line with Hoem et al. (2006b), we believe that, in studies on the relationship between education and fertility, the representation of education needs to reflect much more than just the activity status or the level attained. Therefore, we will incorporate field of education as a third dimension of a woman's educational trajectory. In our study, we will shed light on the interplay between the educational and the childbearing domain of women, both from a theoretical perspective and from an empirical point of view. By looking at theoretical frameworks and institutional aspects, we primarily intend to answer the following questions:

Which theoretical frameworks and institutional aspects are useful in explaining the impact of educational enrolment, educational level and educational field on women's childbearing behaviour in Western societies?
Through which mechanisms does childbearing have an impact on women's educational careers?
What are the factors that potentially affect the educational trajectories and the fertility transitions of women simultaneously?

A thorough elaboration of the theoretical frameworks and institutional aspects that are related to the different aspects of the linkage between education and fertility constitutes the basis for our empirical investigations. In the empirical chapters of this study we will focus on the following three main questions:

What is the effect of educational activity, educational level and educational field on women's transition rates to a first, second and third child? Does the consideration of unobserved characteristics lead to any changes in the observed effects?
Does childbearing affect a woman's educational career? More precisely, do women re-enter the educational system after becoming a mother to aim for an additional degree in a different field of study? Does the field of education a woman is trained in play a major role in her decision to pursue further training/re-training after childbirth?
Do we find empirical evidence to support the assumption that educational trajectories and fertility transitions are correlated due to unobserved determinants that simultaneously affect both life domains?

We will carry out our empirical analyses by means of event history methods, as these methods are the most suitable for analysing dynamically different domains of individual lives. The data we use emanate from a number of different Swedish population registers. The usage of register data is advantageous, as it allows us to work with comparatively large data sets and, thus to take a detailed look at different fields of education. However, the country of Sweden is of interest to us not only because of the availability of high quality register data, but also for a number of other reasons. For nearly all countries around the world, major challenges of the 21st century will include population ageing and the need to cope with the adverse consequences of this trend on the society's socio-economic conditions. By now, many policy makers have realised that there may be a shortage of labour in the near future, and are therefore aware of the importance of improving the integration of women into the labour market. It is also well known in all countries that higher levels of fertility might help to decelerate or even mitigate the trend of population ageing. Contemporary Sweden stands out as a country where cohort fertility levels, as well as female labour force participation rates are among the highest in the Western world. By adding to our understanding of the interplay between childbearing transitions and educational careers in Sweden[1], we also hope to generate information that may prove useful for countries that currently have low birth rates and/or that struggle with a poor compatibility of female productive and reproductive work.

1.3 Outline of the study

This study consists of eight chapters, including the present introduction. In **Chapter 2**, we provide an overview of the linkages between education and fertility from a theoretical perspective. We start by describing theoretical frameworks that are useful for explaining the impact of educational activity and educational level on women's childbearing behaviour. We pay special attention to the question of whether existing theories on fertility also allow us to draw conclusions regarding fertility differentials among women educated in different educational fields. We then discuss how events in the childbearing domain might have an impact on educational trajectories, and to what extent decisions about education and childbearing might be correlated due to common factors that simultaneously affect both domains.

Understanding the relationship between educational decisions and fertility transitions requires a careful consideration of the broader social and institutional context within which these events occur. In **Chapter 3**, we therefore incorporate three different institutional aspects - public policies, the educational system, and the linkage between education and the labour market - and explain how these aspects are related to women's educational trajectories and childbearing behaviour, and how they might mediate the

[1] We view educational careers as prerequisite for labour market careers that largely determine future employment prospects and the conditions under which this employment takes place.

relationship between events in both life domains. We also link the institutional aspects discussed to the specific Swedish context and provide an overview of demographic developments in Sweden in the areas of fertility, education and female labour force participation.

Chapter 4 serves as a link between the theoretical considerations presented in Chapters 2 and 3 and the empirical investigations that follow in Chapters 5 to 7. We describe how interrelated processes can be studied empirically, introduce the concept of event history analysis and provide some information on the statistical software packages used. In addition, we briefly specify the events that will be the focus of our empirical investigation and describe the data that we use for our analyses.

Chapter 5 is devoted to an empirical investigation of the multidimensional impact of women's education on childbearing patterns in Sweden. Unlike most other researchers, who have focused only on two dimensions of education - namely the effect of educational enrolment and the impact of educational level - we pay attention to the fact that there is also a third dimension - namely educational field - that might influence women's childbearing behaviour independently of the other two dimensions. Since female education is generally expected to have a different impact on births of different orders, we carry out separate analyses for the transition to a first, second and third child. However, we also present estimates from a simultaneous model of childbearing with a common factor for unobserved heterogeneity to account for the possibility that selection processes might play a role in the relationship between education and higher order fertility.

In **Chapter 6**, we look at the linkage between education and fertility from the opposite angle. We investigate empirically how events in the fertility domain affect women's educational trajectories. Unlike the majority of previous studies, we do not focus on the effect of (early) childbearing on the level of education a woman attains. Instead, we investigate empirically how childbearing influences a woman's risk to undergo a change in educational field. In particular, we are interested in the question of whether the field of education a woman initially was trained in plays a major role in her decision to pursue an additional degree in a different educational field after becoming a mother.

In **Chapter 7**, we explore the third dimension of the mutual relationship between education and fertility: namely, the simultaneous impact of unobserved characteristics (e.g. parental background, preferences) on women's childbearing behaviour and educational trajectories.

Chapter 8 concludes with a short summary of the most important findings. We briefly discuss some of the insights that this study has added, as well as the study's limitations. In addition, we provide an outlook to future challenges.

CHAPTER 2

Theoretical framework of educational trajectories and fertility decisions

2.1 Introduction

The interplay between education and fertility has been an important topic of discussion in the scientific literature. Typically, the aim of research is to explore how a woman's education affects her childbearing behaviour. In this context empirical investigations have focused not only on the impact of female education on the level of childlessness or the ultimate number of children, but also on educational differentials in the timing and spacing of births. Less attention has been paid to the possibility that it is not just the education of a woman that influences her childbearing behaviour: but, conversely, that the birth of a child might also lead to changes in her educational career. In line with Rindfuss et al. (1980), we view a woman's final educational outcome and the number of children realised as the cumulative outcome of a complex process that involves a multitude of considerations and decisions about both education and fertility. Moreover, we believe that education and fertility are processes which take time to complete, and which interact with each other in complex ways.

In the following discussion, we pay attention to the theoretical linkages between education and fertility. First, we review theoretical frameworks that are useful in explaining the influence of women's education on childbearing decisions (Chapter 2.2). Second, we discuss how events in the fertility domain can influence educational trajectories (Chapter 2.3). In a third step we focus on the correlation of educational trajectories and fertility decisions due to common factors that simultaneously affect both domains (Chapter 2.4).

2.2 The impact of education on fertility

In the past, most researchers who investigated the influence of women’s education on fertility focused on two dimensions of education: namely, the effect of educational enrolment and the impact of educational level. In recent studies, however, researchers increasingly have recognised the possibility that there is also a third dimension - namely, educational field - that might influence a woman’s childbearing behaviour independently of the other two dimensions (e.g. Lappegård and Rønsen 2005; Hoem et al. 2006a, 2006b; Martín-García and Baizán 2006). In the following, we briefly review theoretical approaches that are useful in explaining the impact of educational enrolment, educational level and educational field on women’s childbearing behaviour.[2]

2.2.1 The standard economic view

The economic approach on the impact of the educational career on fertility is based on the New Home Economics, pioneered by Gary S. Becker (1993, and earlier citations therein). At the foundation of this approach lies the assumption that actors have stable and homogenous preferences, and are rational in their decision-making. By allocating their limited resources (mainly income and time), they try to maximise total utility. Within this framework, children are seen as durable goods that provide consumption utility in terms of love, satisfaction or pleasure. Economists assume that, with increasing education, employment and wages women will have fewer children.[3] In order to explain this relationship, they refer to two important trade-offs households have

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2 We believe that the theories outlined below do not conflict with each other, but rather complement each other since they examine a complex phenomenon from different points of view.

3 The economic theory of fertility mainly focuses on the impact of employment and income on fertility. Within this framework education is seen as an investment in human capital; and, in line with the standard human capital theory, greater investments in education should lead to higher wages (Gustafsson 2001).

to deal with: the trade-off between the quantity and the quality of children, and the trade-off between home production and employment. In the following, we describe these two trade-offs in more detail.

The quality versus quantity trade-off

Models on the quantity and quality of children - developed by Willis (1973), Becker and Lewis (1973) and Becker (1993: 145-154) - imply that parents have preferences regarding the number of children they would like to have on the one hand, and the quality per child on the other. By quality, economists mean characteristics of children, such as their education, health or future income. Furthermore, it is assumed that parents want to have the same amount of quality for all of their children. Based on these assumptions, the shadow prices of child quantity (n) and child quality (q) are inextricably linked.

> *"Since an increase in q raises the amount spent on each child, it raises the relevant cost of each child. Similarly, an increase in n raises the cost of adding to the quality of each child because a larger number of children would be affected." (Becker 1993: 145)*

This interaction forces parents to make trade-offs between the quantity and the quality of their children. To explain the decrease in fertility with increasing income, Becker and Lewis (1973) assumed that the income elasticity of child quality (i.e. the change in the demand for child quality relative to the change in income) is substantially larger than the income elasticity of child quantity. Thus, with increasing income, parents invest more in the quality of their children. Since an increase in child quality is associated with greater costs for each additional child, couples with higher incomes have fewer children.

Aspects of status maintenance provide a further explanation for differences in investments in child quality. Esser (1999: 265-275) argued that highly educated parents want to protect their children against social relegation. Therefore they spend more money and effort on the education and upbringing of their offspring. Moreover, social class specific norms regarding housing, clothes, or recreational activities might codetermine parents' decisions about investments in child quality.

While traditional models on the quality-quantity trade-off focus on the role of income in fertility decisions, Lam and Duryea (1999) referred to a mechanism that links the costs of child quality directly to women's education. The authors pointed out that women's education, independent of the positive effect of enhanced wages, increases productivity at home. This leads to a decrease in the amount of time and goods required to produce a unit of child quality.[4] Since higher education thus lowers the relative price of child quality, highly educated women increase the average quality of their children and decrease the quantity of children.

The home production versus employment trade-off

In addition to income, raising children requires time, especially the time of mothers. Hence, a further dimension in which households are making trade-offs is the allocation of time between gainful employment and child care. By devoting their time to their children, mothers forgo the opportunity to earn additional income or undertake other activities. Economists have labelled this loss in income as the opportunity costs of children (Schultz 1969). For the better educated, the opportunity costs of childrearing are assumed to be higher, since education represents an investment in human capital that increases future labour market opportunities and income.

> *"One expects, therefore, to find in an environment where women can earn more income (per unit time) higher female labor participation rates, lower birth rates, and shorter intervals between births, other things being equal." (Schultz 1969: 155)*

When attempting to answer the question, of which of these trade-offs is decisive in causing the negative relationship between a woman's educational level (employment or wage) and fertility, Becker himself appeared to be uncertain. Initially he stated that, while opportunity costs might be an important cause of fertility decline, the interaction between the quantity and quality of children is the most important factor (Becker 1993: 144). However, in the last chapter of his book, Becker (1993: 350-352) declared the

[4] Highly educated women might, for example, be more able to help their children to master the curricula of schools (preparing for exams, writing school essays). They might also be more effective in managing their own and their children's daily routines, in creating temporal space for extracurricular activities, and in ensuring that their children use this time in a meaningful way (e.g. attending in music, dance, or theatre courses, doing sports).

growth in the earning power of women, which raises the relative costs of children by raising the forgone value of time spent on non-market activities, to be the major cause of fertility decline.

2.2.2 Economic theories of fertility timing

The standard economic theory of fertility (as outlined in Chapter 2.2.1) focuses on the role of employment and current income on family size decisions, without explicitly taking into account the timing of births. By contrast, economic theories of fertility timing (sometimes also called life-cycle models of fertility) attempt to determine the optimal timing of births. Following Happel et al. (1984), the timing of childbirth can be viewed as a problem of economic choice in terms of its impact on the life-cycle distribution of the household's consumption stream and the woman's lifetime earnings.

Models addressing the issue of *consumption smoothing* as a determinant for fertility timing (e.g. Happel et al. 1984) are based on the assumption that households want to smooth their life-cycle distribution of non-child consumption. Given that there is no opportunity to borrow against future incomes (assumption of a perfectly imperfect capital market with no option to borrow or save) the man's income profile determines the optimal timing of births.[5] The household smoothes its consumption profile and raises its economic welfare by delaying the periods of the woman's non-employment and the periods of child expenses to a time when the man's earnings are relatively high. If the husband's earnings increase over time, and if the utility derived from children depends only on completed family size, life-cycle utility is maximised when births are delayed to the biological limit (Happel et al. 1984). However, if the flow of utility from children depends not only on their number, but also on how much of their lifetime parents share with them, households derive more parental utility when children are born early. In this case, parenthood will not be postponed to the biological limit, but only until a moment when the costs of a child can be offset by the man's higher earnings (Hotz et al. 1997). Since highly educated people want to have highly educated children,

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[5] In reality, saving for the future is possible. Even borrowing against future incomes is sometimes allowed (e.g. state loans for financing higher education in Sweden or Germany), but usually it is associated with a penalty rate and available only for a fraction of tangible assets (Gustafsson 2001).

who tend to be costly, they have a stronger incentive to delay parenthood (Gustafsson 2001).

In models analysing the optimal time to give birth in view of its effects on *women's lifetime earnings*, the assumption of perfectly imperfect capital markets is substituted by the assumption of perfect capital markets that allow borrowing and saving across periods (Gustafsson 2001). In this scenario, the optimal timing of births is no longer affected by the man's income profile. By borrowing on their future income, a couple can start childbearing early and still enjoy a standard of living that approximates their life-cycle norm (Happel et al. 1984). Under the conditions of perfect capital markets, a household will try to maximise total life-cycle utility by timing births in a way that minimises the woman's career costs, and thereby maximises the woman's lifetime earnings.[6] Assuming that giving birth is accompanied by an interruption in employment, the costs a woman has to pay for becoming a mother are basically of two kinds: (i) her direct wage loss during labour force withdrawals, and (ii) her loss of future earning potential (Cigno and Ermisch 1989; Gustafsson 2001). As summarised by Kreyenfeld (2001: 66-67), the loss of future earning potential results from the fact that women do not accumulate work experience while they are at home caring for a child, and from the devaluation of human capital during times of non-employment. Having reviewed the existing econometric timing and spacing literature, Gustafsson (2001) asserted that the following five parameters determine women's career costs, and thus the optimal timing of births:

the amount of prematernal human capital,
the rate of depreciation of human capital due to non-use,
the rate of return to human capital investments,
the profile of human capital investments and
the length of time spent out of the labour force.

As it turns out, some of these parameters are closely connected, and changes in the assumptions about one parameter lead to changes in the effects of other parameters.

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6 The impact of parenthood on the husband's income is left out, as it is assumed that men's labour market careers are not influenced by birth timing.

If it is assumed that human capital does not depreciate with an absence from the labour market, and if the profile of human capital investments is assumed to be linear in labour force experience, fertility timing would have no impact on a woman's career costs, since the loss of lifetime earnings due to childbirth is the same at whatever age it occurs (Hotz et al. 1997; Gustafsson 2001; for a graphical representation see for example Zabel 2006a: 64). However, if the profile of human capital investments is assumed to be convex to the origin rather than linear, due to an investment motive that gets weaker as retirement approaches, fertility timing becomes relevant for a woman's lifetime earnings, even if there is no skill depreciation (Gustafsson 2001). Losses in lifetime income are then smaller for later than for earlier births, and the more so the stronger the rate of investments in human capital decreases with age and the longer the duration of leave. The effect of education on the relationship between fertility timing and women's lifetime earnings is not clear. While highly skilled women are more likely to experience significant changes from higher rates of human capital investments at young ages to lower rates at older ages (Zabel 2006b), less educated women tend to take longer periods of leave (e.g. Gustafsson et al. 1996; Brewster and Rindfuss 2000).

Allowing for human capital depreciation, lifetime earnings are highest for women who begin childbearing either very early or at the limit of the fecund period. Which strategy is the more advantageous depends on the amount of pre-maternal human capital, the rate of depreciation of human capital during times of non-employment and the length of time spent out of the labour force. As long as only a fraction of the woman's job skills are lost during her periods of absence, postponement is advantageous. Higher rates of skill depreciation or longer durations of leave strengthen this positive effect. However, if an employment interruption leads to a total skill loss (due to a low initial skill level, a high rate of depreciation and/or a long duration of leave), it is better to have children as early as possible (Happel et al. 1984; Zabel 2006b). Again, postponing births is predicted to increase lifetime earnings for all women (as long as the interruption does not lead to a total skill loss), but the effect of educational level on birth timing is unclear. On the one hand, higher levels of qualifications usually come along with higher rates of skill depreciation during absence (Mincer and Polachek 1974, 1978; Zabel 2006b), which points to a stronger positive effect of postponing birth for highly educated women. On the other hand, these women normally take shorter periods of leave, which should lead to a weaker positive effect.

Finally, the effect of birth timing on women's career costs is influenced by the rate of return to human capital investments. According to Cigno and Ermisch (1989), a higher pay per unit of human capital accumulated results in a steeper earnings profile. Gustafsson (2001) showed graphically that, within occupations with steeper earnings profiles, getting children leads to a greater loss in lifetime income than in occupations with flatter earnings profiles. Assuming that skill depreciation occurs, a steep earnings profile additionally works in the direction of delaying parenthood. At the same time, the direct wage loss of late births relative to early births is greater for women educated for occupations with a steep earnings profile. This means that theory is ambiguous about whether a steep earnings profile leads to earlier or postponed births.

To summarise, based on the (rather hypothetical) assumption of a perfectly imperfect capital market with no option to borrow or save, the man's income profile determines the optimal timing of births. In order to smooth the life-cycle consumption children are postponed until their costs can be offset by the man's higher income. The incentive to postpone childbirth is assumed to be stronger for highly educated people, since for them the expenses related to children are supposed to be higher. However, under the (more realistic) assumption that borrowing and saving across periods is possible, women's career costs due to childbirth (that include direct losses in income and losses in future earning potential) are decisive for determining the optimal timing of births. If it is assumed that earning profiles are steeper at younger ages (due to lower investments in human capital with increasing age), or that skills depreciate (but do not lose their value completely) during periods outside the labour market, then the conclusion for the effect of birth timing is generally that losses in lifetime income are smaller the longer the birth is postponed. Regarding the question of whether the incentive to postpone births should be stronger for less educated or highly educated women, economic theories on fertility timing do not provide a clear answer. Highly educated women tend to have a steeper earning profile at younger ages, as well as higher rates of skill depreciation during absences, which points to a stronger positive effect of postponing births for women with high levels of qualification. At the same time, these women normally take shorter periods of leave, which leads to a weaker positive effect. Whether postponing births is more or less advantageous for those with higher than those with lower levels of education therefore depends upon how much the duration of parental leave varies compared to the profiles of human capital investments and the rates of skill depreciation among women at different educational levels.

Within life-cycle models of fertility, a lot of attention has been focused on the question of how education influences the optimal timing of birth. However, the scientific discussion has so far mainly concentrated on the effect of educational level. Meanwhile, researchers have largely ignored the possibility that differences in the factors that affect women’s career costs, and thus the optimal timing of childbirth (e.g. earning profile, length of interruption, skill depreciation during absence) might depend to a greater extent on the occupational field a women is trained for than on the educational level attained. Therefore, the optimal time to have a child and to take a break might be assessed differently by women with different types of education. A more detailed description of the link between educational field and the labour market, as well as its consequences on women’s fertility behaviour will be presented in Chapter 3.4.

In addition to determining the optimal timing of births, economic theories on fertility timing try to answer the question why, once the first birth occurs, couples do not choose to have all subsequent births as quickly as possible. Hotz et al. (1997) answered this question in the following way. Under the assumption of a perfectly imperfect capital market (no option to borrow or save), spacing arises as a compromise between the desire to have children early (as long as the utility parents gain from having children depends on the time they can spend with them), and the economic incentive to have children late when income is high. The more rapid the rise in household income (especially the fathers income), the more likely parents will use contraceptives in order to space their births.[7] Another factor that may play a role in the decision of parents to space out their children was posited by Willis (1973). He assumed that children take up less of their mother’s time as they age. By becoming less time-intensive, the opportunity costs, and thus the price of children decreases over time. On the basis of this

[7] Schultz (1969) expected that a high female income potential would lead to shorter births intervals (see Chapter 2.2.1). However, Schultz (1969) discussed the relationship between women’s employment prospects, opportunity costs and fertility in general; but did not take into account life-cycle variations in income, and the desire of individuals to smooth their consumption profile. Moreover, Schultz (1969) does not really explain the theoretical considerations that are behind his assumption.

assumption, Hotz et al. (1997) argued, that given this temporarily high price, parents have an incentive to postpone the next birth until this price declines.

2.2.3 Theories on social-structural or cultural changes

Differences in the impact of education on fertility presumably are not only the result of economic considerations. It can be assumed that social-structural and cultural changes also affect the fertility behaviour of women differently depending on their education and future earning opportunities. The idea that demographic developments - such as the emergence of below-replacement fertility, increasing divorce rates and the postponement of marriage and parenthood - are linked with social-structural changes and value changes has been developed within the framework of the second demographic transition (Lesthaeghe 1983, 1995; van de Kaa 1987, 1994, 2002). According to van de Kaa (1994), there are three broad types of factors which gave rise to the second demographic transition (SDT): namely, changes in the social structure of societies, cultural changes and technological innovations.

Changes in the social structure

Since the 1950s, the economy and social structure of Western societies have undergone various changes. One of these changes was the accelerated expansion of the educational system. This process was accompanied by an increase in the enrolment of women in education, which subsequently led to increases in women’s labour force participation. Since women still bear most of the responsibility for childrearing and child care, even in Western societies (Presser 1994; Maassen van den Brink and Groot 1997), many working women - especially those who are highly educated and are therefore at risk of losing a lot - postpone marriage and motherhood (Liefbroer 1999).

Further changes in the social structure were caused by economic developments. In the 1960s and early 1970s, Western economies experienced a boom which resulted in a sharp rise in income (Liefbroer 1999). While this improved financial situation enabled young adults to accelerate the process of family formation, it also presented them with a greater range of choices. In this context, having more education presumably opens people’s eyes to alternatives to childbearing, such as participating in various leisure activities or a enjoying a higher level of consumption.

Cultural changes

Social structural changes have coincided with important cultural changes that have influenced the values of young adults concerning family formation. These cultural changes include a decrease in normative controls exerted by parents, and especially by the church (process of secularisation), and an increased emphasis on individual choice (process of individualisation) that entitled adolescents to decide freely how to organise their lives (Lesthaeghe and Surkyn 1988; Liefbroer 1999). Referring to the classical theories of Tarde (1890), Sorokin (1947) and Bourdieu (1979)[8]; Lesthaeghe and Surkyn (1988) stressed the importance of education for the spread of post-materialist values. Several empirical studies have supported this view by showing that the values and behavioural patterns (e.g. cohabitation, voluntary childlessness) associated with the SDT spread first among the highly educated (e.g. de Feijter 1991; Sigle-Rushton 2008).[9]

An additional factor supporting this cultural change was the re-emergence of feminism during the 1960s, which resulted in a re-orientation of life priorities among women. A diminishing acceptance of traditional gender roles led women - especially highly educated women - to give greater priority to their own careers (Liefbroer 1999).

Technological innovations

In addition to these social-structural and cultural changes, the opportunities and values of young adults were influenced by technological innovations, such as the introduction and widespread distribution of reliable contraceptives, wider access to legal abortion and the diffusion of the mass media. While modern contraceptives and the legalisation of abortion enabled people to separate sex and reproduction, and thereby undermined the meaning of marriage as the only legitimate framework for sexual relationships, the media assisted in promoting the new ideas and behavioural patterns

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[8] While Tarde (1890) and Sorokin (1947) claimed that cultural change starts from the higher strata which are innovative as a result of wealth, power and privilege; Bourdieu (1979) stressed the role of an educational elite that is not necessarily wealthy and privileged in a material sense.

[9] However, in a number of countries some behaviour associated with the SDT (e.g. cohabitation, non-marital childbearing, lone motherhood) spread first among the less educated, presumably as a reaction to or an accommodation of economic and social disadvantages, rather than as an alternative lifestyle of highly educated individuals. For an overview on the role of education in the spread of SDT behaviour in different countries see, for example, Sobotka (2008).

(van de Kaa 1987; Liefbroer 1999). Empirical studies have shown that fertility control was evident first among urban dwellers, professionals and the literate or educated (Pollak and Watkins 1993).

2.2.4 The life course perspective

The emergence of the life course as a major research paradigm in the early 1960s led to major changes in how researchers thought about and studied human lives. According to the life course approach, people experience events at various moments in life that involve important changes in the structure of their lives. These events, or transitions in life, do not occur at random or in isolation, but have a certain structure. The fundamental concept underlying this structure is time. By extending Elder's (1994) considerations concerning the relationship between individual lives and times, Dykstra and van Wissen (1999) distinguished three different time dimensions. The first dimension is *biographical time*, which represents the chronological order in a person's life, and which acknowledges that experiences earlier in life influence the choices made later in life. It also points to the fact that a person's biography consists of various life domains, such as education, employment, partnership and parenting, which are dynamically linked. Willekens (1999) referred to this as interdependencies in the life course. He argued that each life domain is associated with a career, and that the domains interact with one another and with their common environment. Some interactions may lead to shifts in timing (e.g. the postponement of the realisation of an event) in order to solve incompatibility problems. A second dimension is *historical time*, which captures the effects of historical changes on individuals' lives (cohort effects). Finally, there is *social time*, which reflects the impact of age-graded institutional arrangements (e.g. regulations concerning a minimum age at leaving school or at marriage) or age-related norms on the timing and sequencing of events (e.g. having the first child before a certain age, getting married before starting childbearing). A further element that is fundamental to the life course approach is the notion of interaction between individuals (*linked lives*). According to Elder (1994), human lives are typically embedded in social relationships, which means that individual decisions are influenced by the opinions, behaviour and careers of significant others. Moreover, people are assumed to act goal-oriented within the constraints of historical and social time, and of their ties with significant others. This feature is referred to as *human agency*.

Viewing the impact of women's education on fertility from the life course perspective moves some aspects into focus that have been neglected by economic theories and theories on social-structural or cultural changes. In order to earn a degree, young men and women have to undergo education. Depending on the educational outcome, the time it takes to achieve the desired degree varies considerably (Kreyenfeld 2001: 65). In general, highly educated women spend more years in education than their less educated counterparts, and are therefore older on average when they leave the educational system. Since in most societies receiving education and childrearing is regarded as incompatible, either for practical reasons (monetary constraints, time constraints), or because of normative expectations that students should not become parents before they have finished their education (Rindfuss et al. 1988: 21; Blossfeld and Huinink 1991; Lappegård and Rønsen 2005), highly qualified women are on average also older at first birth. Some authors have argued that better educated women do not start childbearing at higher ages primarily because of their extended educational participation, but rather because of their ambition to transform their education into a successful career before starting a family. Highly educated women are assumed to postpone parenthood to a later stage in their employment career, when they consider themselves to be more established in a career track, and when taking a break may be less damaging to their future labour market career (Klein 1989; Kreyenfeld 2001: 68). By shifting first childbirth up to the mid-thirties, highly educated women increasingly come under pressure because of medical problems associated with late childbearing, as well as societal norms concerning the age range within which childbearing should occur (Blossfeld and Huinink 1991; Gustafsson 2001). As a result, some highly educated women might (voluntary or involuntary) change their childbearing plans, and end up childless or with fewer children than they originally wanted to have. Others - in the awareness of the shorter amount of time they have left to reach their desired number of children - might speed up their childbearing once they have started. Rindfuss et al. (1988: 26-27) mentioned another reason why women who initially only planned to postpone motherhood might end up childless. As women age and experience a diversity of roles, the demands of these roles increase, and the potential incompatibility of these responsibilities with parenthood becomes more apparent.

An aspect that is also neglected by standard theories on fertility is that the mechanisms which influence the decision about entering parenthood might differ from those mechanisms which are important when parents decide about having a second or a third child (Klein 1989). Within the economic framework, a standard assumption is that couples make deterministic plans for the rest of their lives, including decisions about education, labour force participation and the number of children, at the outset of their marriage.

> *"… a husband and a wife of given ages and characteristics are considered to adopt, at the outset of marriage, a utility-maximizing lifetime plan for childbearing, for expenditures of time and money on children, and for other sources of parental satisfaction not related to children." (Willis 1973: 17)*

However, Namboodiri (1983) argued that fertility should be seen and modelled as a sequential decision within the life course. According to the author, fertility plans and behaviour might be influenced differently by the same factor at different stages of life. Following this line of reasoning, it can be argued that the effect of individual factors - such as a woman's education, labour market status or income - on fertility might be different for women at different parities. In this context, Kreyenfeld (2001: 73) pointed out that couples who have decided to have a first child are already committed to a certain "life plan". They have already become parents, have experience in caring for a child and have adjusted their employment situation accordingly. Assuming that the institutional framework enables women to combine childrearing and employment, highly educated women may indeed be at higher risk of having an additional child, since they earn higher wages and are therefore able to afford a larger family. Klein (1989) assumed that the birth of a second child does not push women further into the role of housewife than having a first child did, which means that women do not have to fear an additional loss in income by having a second child. However, Kreyenfeld (2001: 73) disagreed, arguing, that even in societies where childrearing and employment is compatible due to extensive public day care, having a second child might be seen as a serious impediment for the full-time employment careers of both partners. Assuming this is the case, higher educated women may be expected to be less likely to have a second child.

The life course is a suitable framework for the analysis of population issues, but it cannot be seen as a theory in itself (van Wissen and Dykstra 1999). Nevertheless, we have reverted to the life course perspective, since it includes several aspects that are important for explaining the impact of women's education on fertility. In this chapter we have mainly focused on norms or shared expectations regarding the appropriate sequencing of events (the concept of social time), and on the question of whether education has a different impact on first births compared to higher order births. We will describe the interdependence of educational trajectories and fertility decisions from the opposite angle when we discuss how fertility might influence women's education (Chapter 2.3). In addition, we will pick up another element of the life course perspective - namely, the concept of linked lives - when we discuss the impact of the educational system on fertility decisions (Chapter 3.3).

2.2.5 Criticism and alternative explanations

The explanations of human fertility behaviour through economic motives at the household level, or through changes in the social structure and culture at the societal level, have attracted a lot of attention and support. Despite their popularity, both theoretical frameworks exhibit a number of substantial shortcomings which limit their usefulness.[10] The economic theory of fertility has been heavily criticised for its reliance on a set of unrealistic and restrictive assumptions. For example, by assuming that households act rationally and only aim at maximising utility, the possibility of both irrational behaviour (due to habit, anxiety, chance, etc.) and decision-making based on considerations other than utility maximisation, are precluded. A further assumption that has been questioned is that couples decide on the final number of their children at a single point in time: namely, at the outset of their marriage. In reality, fertility decision-making appears to be a rather dynamic process that is influenced by changing economic, childrearing and general life-cycle conditions (Bagozzi and van Loo 1978). Rindfuss et

[10] For a thorough critical examination of economic models of fertility see, for example, Bagozzi and van Loo (1978). Shortcomings of the Second Demographic Transition are discussed, for example, by Cliqet (1991: 72), de Bruijn (1999) and Coleman (2004).

al. (1988: 27, 198) have pointed out that a variety of events might make respondents alter their childbearing plans; and that, since individuals have imperfect forecasting abilities, it is inconceivable that they would not adjust their plans as events in their lives unfold. In addition to unrealistic and restrictive assumptions, Becker's economic theory of fertility has been criticised for neglecting individual tastes, and thus the psychological needs and motivations that influence fertility. Instead of explicitly modelling tastes, the assumption is made that all individuals have homogenous preferences (Bagozzi and van Loo 1978). An aspect that is also not taken into account by economists is the possibility of externalising childcare. Assuming that high quality child care is available and socially accepted, it is not the woman's loss in income that determines childbearing decisions, but rather the cost of external child care. Considering this, it becomes apparent that the impact of women's employment (or education) on fertility is strongly influenced by the institutional context in which children are born (Huinink and Konietzka 2007: 152). A final comment should be made about one of the main assumptions in economic models: namely, the supposition that a maximised utility can only be achieved by a traditional sex-specific division of labour within the household. Most industrialised countries have experienced not just a substantial increase in female educational attainment and employment over time, but also a fundamental decrease in the acceptance of traditional gender roles. Moreover, Oppenheimer (1997) stressed that, under real-world conditions, specialisation within the household might not always be a wise strategy. Indeed, it might turn out to be a quite risky and inflexible strategy when it comes to ensuring a family's economic well-being over time.

Compared to the criticisms of economic models, the objections that have been raised regarding the concept of a second demographic transition are more fundamental. Many critics have argued that the framework of a SDT is merely a description, not an explanation of recent demographic developments (de Bruijn 1999: 46-51). Some have even said they doubt that the changes were substantial enough to constitute a second demographic transition. Instead, they claim that the relational and reproductive shifts in behaviour, that have been observed in most industrialised countries since the mid-1960s, should rather be considered to be an accelerated continuation of the first demographic transition (Cliquet 1991: 72). Others have questioned that the term "transition" is appropriate for describing recent demographic developments. They have criticised that neither a starting point, nor any quantifiable endpoint of the SDT has ever been defined (Sobotka 2008). Moreover, they have pointed to the fact that a transition should be complete and irreversible. However, family patterns and living arrangements remained highly heterogeneous across countries (Kuijsten 1996), and within countries (Coleman 2004). Experiences from countries that are usually seen as the forerunners in the SDT process – namely, the Nordic and Western European countries - suggest that the second demographic transition does not necessarily lead to a long-lasting decline in fertility to sub-replacement levels, which originally was considered a SDT hallmark (Frejka et al. 2008). In addition, recent international studies have uncovered a positive association between the second demographic transition and fertility in contemporary Europe by showing that those counties that are most advanced in SDT values and behaviour (e.g. Sweden, Denmark and France) also exhibit the highest fertility levels in Europe, with a completed fertility close to replacement levels (Sobotka 2008). According to de Bruijn (1999: 46-51) another major drawback of the demographic transition theory is that it does not take into account the relevant social and cultural contexts in which reproductive behaviour takes place. Likewise, the transition framework does not specify in what way institutional factors (such as social policies or labour market policies) affect individual decision making.

Both theoretical frameworks discussed above predict a negative effect of female education (employment or wages) on fertility. Empirical investigations have clearly shown that educational enrolment delays motherhood (e.g. Marini 1984; Blossfeld and Huinink 1989; Klein and Lauterbach 1994; Kravdal 1994, 2007; Blossfeld 1995; Liefbroer and Corijn 1999; Hoem 2000; Lappegård and Rønsen 2005). However, existing research is less consistent when it comes to the impact of educational level on fertility. Many studies have confirmed a negative relationship between educational attainment and first-birth risk (e.g. Vermunt 1991; Brüderl and Klein 1991; Klein and Lauterbach 1994; de Jong Gierfeld and Liefbroer 1995; Liefbroer and Corijn 1999). In some studies, however, the negative effect of education on entering motherhood has been found to disappear with increasing age (Rindfuss et al. 1988: 91-119; Vermunt 1991; de Jong Gierfeld and Liefbroer 1995; Kravdal 1994, 2007; Liefbroer and Corijn 1999), suggesting that women postpone childbearing, rather than forgo it. Other studies, especially those in which educational level is operationalised as time-dependent, and separately for women who are enrolled and women who are not enrolled in education, found no or even a positive impact of educational level on first-birth risks (e.g. Blossfeld and Huinink 1991; Lappegård and Rønsen 2005; Kreyenfeld and Konietzka 2008).

Studies on higher-order births (in particular studies for the Nordic and Western European countries) have shown a uniform, but unexpected pattern: namely, that transition rates to the second and third child do not decrease, but rather increase with women's educational level (e.g. Hoem 1996; Kravdal 2001, 2007; Oláh 2003; Gerster et al. 2007; Kreyenfeld and Konietzka 2008). Researchers have argued that this finding might be the result of three different effects (see for example Kreyenfeld 2002). First, due to their longer period of enrolment in the educational system, highly educated women have less time at their disposal to have the desired number of children. Consequently, they space births more closely together, which leads to an accelerated transition rate to subsequent children (*time-squeeze effect*). Second, due to positive assortative mating, better educated women tend to be married to or live with better educated men who have the earning potential to afford a large family (*partner effect*). Finally, women with high levels of education who are at risk of having a second or a third child constitute a selected group. By having children in spite of comparatively high opportunity costs, they have already manifested a strong preference for motherhood. This commitment to a family-oriented life plan makes them more prone to have an additional child (*selection effect*). Although these effects have attracted a lot of attention, empirical investigations were not able to confirm them conclusively.[11]

In search of alternative explanations for the observed positive effect of women's education on fertility, Kravdal (2007) has made several suggestions. In particular, he proposed that, in most modern societies, one of the main assumptions of economic

[11] For an investigation into the time-squeeze effect see, for example, Kreyenfeld (2002) and Gerster et al. (2007). The partner effect has been confirmed for West Germany (Kreyenfeld 2002; Köppen 2006), but positive assortative mating did not explain the positive effect of education on higher order births in studies for France (Köppen 2006), Norway (Kravdal 2007) and Denmark (Gerster et al. 2007). To control for self-selection, researchers usually estimate two or three birth transitions simultaneously by including a women specific unobserved heterogeneity term. However, the positive gradient of the educational variable only disappeared in those studies that used educational level as a time-independent variable measured at the time of interview or at the end of the reproductive age span (Kravdal 2001, 2007; Kreyenfeld 2002), but not in studies in which education was constructed as time-dependent (Martín-García 2006: 166-169, 189-193; Kravdal 2007).

theories - namely, the opportunity cost argument - might not hold anymore. Usually the opportunity cost effect is assumed to outweigh any income effect among better educated women. But, as childrearing and gainful employment became compatible for most women due to extensive public child care and other social policies, the depressing effect of women's education through opportunity costs may have gradually disappeared. Thus, today the sum of opportunity costs and child care costs might be independent of education. According to Kravdal (2007), this sum might be even smaller for the better educated, since they more often have jobs that make it easier to combine motherhood and employment. However, if a negative opportunity cost effect for highly educated women still exists, it must be offset by some factors that influence fertility decisions in a positive way. Kravdal (2007) has suggested that today the advantage of a higher purchasing power might not be completely outbalanced by an inclination among the rich to spend more on each child. Therefore, having a high level of education may tend to increase fertility along with income. A further potentially positive influence emerges if it is assumed that the better educated are more likely than the less educated to establish and maintain a reasonably stable relationship that encourages childbearing.[12, 13] To the extent that there is a difference in the efficiency of contraceptive use, the better educated might be expected to be the most advanced users. However, they are perhaps also more likely to make use of (or to be able to afford) medical assistance to become pregnant in case of fecundity problems. Moreover, the better educated might be more likely than others to feel free to deviate from any two-child norm, should it still exist; which does not necessarily mean that they will have fewer than two children.[14] Finally, Kravdal (2007) proposed that low birth rates among currently less educated women might also indicate that some of these women intend to reach a higher

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[12] Kravdal (2007) argued that this applies mainly to men, since they are still seen as the more important wage earners. However if it is assumed that the higher probability of being and remaining in a stable relationship for the better educated results not only from their ability to provide a high household income, but also from their ability to find an "appropriate" partner and to cope with couple-related problems that occur in everyday life, the effect should also apply to women.

[13] However, some studies have shown a positive relationship between union dissolution and continued childbearing, meaning that re-partnering leads to "extra" births that would not occur otherwise (e.g. Vikat et al. 1999; Thomson et al. 2002; Thomson 2005)

[14] In a similar vein, Hoem and Hoem (1989) argue that more highly educated women may be more ready to have a second or even a third child due to their greater confidence about their ability to control for non-familial opportunities even after the arrival of an additional child.

educational level at some point later in time. They refrain from having children so that a future educational upgrade will not be impeded.

Most theoretical frameworks mainly seek to identify the factors that influence the timing of entry into motherhood and the final number of children a couple will have. Less effort has been devoted to explaining by which criteria parents decide about when to have the second or third child (provided they want to have more than one child). As described in Chapter 2.2.2, economic theories of fertility timing suggest two reasons why, once the first birth occurred, couples do not try to have all subsequent children as quickly as possible. First, couples space their births to be able to enjoy the advantages of having children early, without being forced to give up too much utility from non-child consumption. Therefore, especially those couples who expect a rapid increase in income over time have an incentive to space their births. Second, since caring for children becomes less time-intensive as they age, the opportunity costs of having children decrease over time. Hence, parents may decide to postpone the birth of an additional child until the price they have to pay for the previous one has declined. In addition to economic reasons, there are probably also psychological motives that deter parents from having all of their desired children at once. For example, there might be couples who love having a small child in the house, but who do not want to have more than a certain number of children. Consequently, they space their children to avoid having too many children. Others might want to spend as much time as possible with each child, and therefore space the second (third) child so that it is born when the first (second) one no longer requires as much care. However, under certain circumstances, it might also be advantageous for a couple to have all of the subsequent children they want as quickly as possible. For example, in cases in which with increasing child age (and therefore decreasing time needed for child care) external child care costs would still exceed the woman's wage. This can occur because the woman earns very little, but also because of certain characteristics of the couple's occupations (such as shift work, travelling etc.) that would require very expensive external child care.[15] Taking this into account, it might be advantageous for some couples to space their children close

[15] If only one parent is doing shift work or has to travel a lot, the partner might be able to take care of the children during his absence. However, the situation is different if both partners have working times that are in conflict with their responsibilities as a parent (e.g. both work in the health care sector).

together in order to minimise the time span with very small children in the house, and to use the mother's time at home efficiently. In some countries (e.g. Sweden, Germany) the parental leave system provides an additional incentive for short birth intervals by offering a kind of premium to parents who space a subsequent birth close to the previous one.[16] Moreover, a couple's decision about when to have the next child might be influenced by normative expectations regarding an appropriate age difference between siblings. In this context, a commonly shared opinion is that siblings should be close to each other in age, since this means, they will have similar needs and interests, and that they will be able to benefit from each other.

In most industrialised countries, there has been an intensive postponement of fertility. Today, especially the better educated tend to start childbearing at much higher ages. Under these conditions, it seems unlikely that intervals between births would be longer for highly educated women. In contrast, women with high levels of education are certainly aware of the shorter amount of time they have left before they reach the biological or socially sanctioned limit of fertility. Therefore (as described by the time-squeeze effect), they presumably proceed faster to having a second or subsequent child. However, as outlined above, it is probably not just the educational level that determines whether it is beneficial to have all of the desired children as quickly as possible, or spaced over a number of years; but also the specific characteristics of the occupation a women is trained for, and the institutional setting within which employment and childbearing takes place. Moreover, fertility decisions should not be seen as the result of a pure cost-benefit analysis, but as a process that is also co-determined by social, psychological and normative factors.

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16 In Sweden, benefits received during parental leave are closely connected to previous labour market activity and income. A reduction in working hours, which is common among Swedish mothers with small children, would normally lead to lower benefits for subsequent parental leave periods. To protect parents from losing too much money, the Swedish parental leave system guarantees that there will be no reduction in the allowance from one parental leave period to another, as long as parents space their births sufficiently close together. Currently, the maximum interval between two births that makes parents eligible for the "speed premium" is 30 months (Andersson et al. 2006b). Several studies have shown that, after the formal introduction of this rule in 1980, a shortening of birth spacing occurred (e.g. Hoem 1993c; Andersson 1999, 2002; Andersson et al. 2006b). In Germany, where parental leave benefits have been income-related since 2007, there is also a form of compensation for a reduction in working hours after childbirth. Parental leave benefits are increased by 10 percent (at least 75 € per month) if a subsequent child is born before the previous one reaches age three.

2.3 The impact of fertility on education

In the chapters above, we reviewed existing explanations for the impact of women's education on fertility. However, researchers have repeatedly argued that the possible causal connection between fertility and education is exceedingly complex, and that fertility might affect education as well (e.g. Rindfuss et al. 1980; Billari and Philipov 2004; Kravdal 2007). Only a few scientists from the U.S. have investigated whether causality really runs in both directions. Rindfuss et al. (1980) analysed the reciprocal relationship between education and age at first birth, and came to the conclusion that it is dominated by the effect from education to age at first birth, with only a trivial effect in the other direction. In contrast, Hofferth and Moore (1979) found a reciprocal causal relationship between educational attainment and age at first birth. Moreover, their findings indicated that the effect of age at entering motherhood on education is even stronger than the effect of educational attainment on age at first birth. Marini (1984) examined these studies critically, and discussed several factors that may account for the discrepant findings (e.g. differences in the samples used, methodological factors). She came to the conclusion that both studies exhibited substantial shortcomings, which probably biased the results. In her own empirical investigation, Marini (1984) demonstrated that education and age at entering parenthood causally affect each other. Her findings indicated that the dominant direction of causality is from educational attainment to age at first birth. Nevertheless, Marini (1984) also showed that the causal effect of age at entering motherhood on education is of significant magnitude, and that it operates independently of the effect of age at first marriage.[17]

Studies on the impact of fertility on education have primarily concentrated on the situation in the U.S., and have mainly sought to investigate the consequences of an early first birth on a young woman's educational attainment. The general finding was that entering motherhood is detrimental to a young woman, since it drastically reduces the probability that she will continue her schooling. As a result, women who become mothers at an early age accumulate less education on average than those who delay

[17] Since the timing of entry into parenthood is highly related to the timing of entry into marriage, it is also possible that the effect observed for the timing of one of these familial role transitions on educational attainment can in fact be attributed to the timing of the other.

entry into parenthood (e.g. Waite and Moore 1978; Hofferth and Moore 1979; Marini 1984; Anderson 1993; Klepinger et al. 1995, 1999; Hofferth et al. 2001). Most of the studies cited above focused on the socio-economic consequences of motherhood during adolescent years. However, it has been shown that in the U.S. early childbearing in general, and not just teenage motherhood, reduces the educational attainment of young women (McElroy 1996). The explanations for this association have mainly focused on the barriers to further schooling raised by pregnancy and motherhood. In the past, the main barriers have been created by school system practices and policies that typically forced pregnant women to withdraw from regular classes (Ewer and Gibbs 1976). Today, however, most industrialised societies give special support to women who become pregnant at school age. Nevertheless, the difficulty of managing school attendance and child care, the burden of household tasks, and pressure from her parents, peers or partner to spend as much time as possible with the child decrease the likelihood that an adolescent who has a child will continue in school. An alternative explanation for lower educational attainments among early childbearers was mentioned by Bacon (1974). He argued that role transitions that are accelerated - that is, transitions that take place too early in a woman’s life cycle - tend to cause stress and conflict, which can result in social pathologies, such as marital instability, poverty and truncated educational careers. Presser (1971) stressed the importance of the timing of the acquisition of the mother role for the development of a young woman’s aspirations and goals. She pointed to the fact that early childbearing often closes other role options available to young women. As a consequence, those who move directly from the role of a daughter to the role of a mother (and wife) have few opportunities to try non-traditional roles, and to experience satisfaction from non-familial activities. In this context, Waite and Moore (1978) concluded that the lack of exposure to non-traditional roles before motherhood might lead to larger families and less labour force activity, as well as less schooling, among women who entered parenthood at an early age.

Some researchers have argued that the effects of early childbearing are exaggerated because young mothers differ substantially from young women who delay motherhood. Adolescent childbearers might, for example, have lower educational aspirations and academic aptitude (Card and Wise 1978). Hoffman (1998) emphasised that teenage mothers often have a multitude of other disadvantages that also contribute to their poorer educational achievements, like having grown up in poor families or tough neighbourhoods. Given the substantial disadvantages and reduced opportunities with which early childbearers started, they might not have done better in school if they had delayed family formation. For the U.S. Hofferth et al. (2001) showed that unobserved differences between young mothers and their childless peers reduce, but do not eliminate, the effect of early births. In the same study, the authors investigated whether the effect of early childbearing changed over time. Since institutional barriers, the lack of community support and social pressures have decreased over time, it is likely that the negative effect of early childbearing on women's educational outcomes has also diminished. Hofferth et al. (2001) found that in the U.S. in recent periods more young women have completed high school, regardless of the timing of their first birth. However, the gap between early and later childbearers in postsecondary school attendance has widened considerably. Given the increased importance of higher education for labour market and income opportunities, Hofferth et al. (2001) concluded that young mothers today are at least as disadvantaged as those of past generations.

Berthoud and Robson (2001) compared the educational attainment of women who became mothers before their 20th birthday with the educational attainment of those who became mothers later in life for 13 European countries. Although the observed countries differ greatly in their social and educational systems, the authors showed that the finding of lower educational attainments among early mothers is consistent across countries. Apparently relatively few women who drop out of education due to an early childbirth manage to reach a higher educational level later in life. However, this does not necessarily mean that women in general do not experience changes in education after entering motherhood. Kravdal (2007) showed that at least in Norway - a country with a highly flexible educational system and generous policies towards families with children - a remarkable number of women achieved improvements in education after the birth of their first or even a higher order child.

A possibility, that has been totally neglected so far, is that childbearing may not only influence a woman's educational level, but also the educational field she is trained in. Indeed, there are several plausible explanations for why women might want to change their field of education once they have entered motherhood. For example, some women might realise that the working conditions of the occupation they were originally trained for are incompatible with caring for a small child (e.g. due to shift work, business trips, frequent overtime). Others might find that their skills have depreciated during their time off work due to rapid changes in the required level of knowledge or in the application of methods and technical skills, such as computer programs. In both cases, women who are highly motivated to work will probably enrol in further education or participate in re-education courses to improve their earning opportunities. Some of them might choose a course of study in a different field because they expect it will lead to jobs with more stable and family-friendly working conditions.

When examining the impact of fertility on education, researchers have mainly focused on the detrimental effects of an early first birth on a woman's educational level. Kravdal (2007) mentioned another way in which fertility – or, more precisely, the non-occurrence of an event in the fertility domain - might influence education. Women who realise that they will never become a mother or have the second child that they wished to have might decide to pursue more education than they had originally intended. A further mechanism proposed in this study is that students who want to have a child may work very eagerly to complete their education. The desire to have a child leads them to reach their educational goals faster than they otherwise would have done.

2.4 The impact of common and usually unobserved factors on educational trajectories and fertility decisions

Aside from the potential influence of education on women's decisions about whether and when to have children; and, conversely, the impact of childbearing on a woman's educational trajectory; it has to be taken into account that events in both life domains are influenced by several other factors. In recent years, researchers have increasingly emphasised that some of these factors may affect educational trajectories and fertility decisions simultaneously (e.g. Upchurch et al. 2002; Billari and Philipov 2004; Kravdal 2007; Baizán and Martín-García 2007; Martín-García 2008). We will discuss two groups of factors that are of particular importance in this context. The first group is related to the parental family and the social origin of individuals, while the second group concerns individual-level characteristics, such as aspirations, expectations and preferences regarding children and education.

The simultaneous impact of social origin on education and fertility

There is a large body of research showing that the family of origin plays a crucial role in shaping an individual's educational career (Mare 1980; Shavit and Blossfeld 1993; Erikson and Jonsson 1996a, 1996b; De Graaf et al. 2000; Breen et al. 2009, 2010).[18] Explanations for the association between family background and children's educational success generally refer to the importance of the parental economic, cultural and social capital. Due to their better financial resources, high-income families are able to offer their children access to better schools and extracurricular activities. They are also more able to afford the opportunity costs that are involved in extended educational careers (De Graaf et al. 2000). At the same time, children raised in more advantaged classes benefit from greater cultural resources. They are socialised into the values, manners and expectations that dominate the educational system; and they are more familiar with highbrow activities, like art, theatre or classical literature, which help them to master the curricula of schools, especially those of higher education (Bourdieu 1973; De Graaf et al. 2000). Offspring of high-status parents might also receive more parental stimulation and support for schoolwork than working-class children do. In addition, higher class children are on average more capable of navigating through the educational system, because in many cases their parents, older siblings, relatives and friends achieved higher education, and can serve as accurate advisors at crucial decision points in the school career. However, different performance levels at school probably also derive to some extent from genetic differences between individuals from different class

[18] A variety of studies have investigated whether the long-term process of educational expansion, which that has been observed for all economically advanced societies during the 20th century, was accompanied by a decline in class inequalities in educational attainment. In their seminal study, Shavit and Blossfeld (1993) reported a remarkable stability of socio-economic inequalities of educational opportunities over time for all but two (Sweden and the Netherlands) of the 13 countries studied in their project. For quite a few countries, Shavit and Blossfeld's (1993) finding of persistent inequality has been challenged by more recent analyses (e.g. Germany: Henz and Maas 1995; Mayer et al. 2007; France: Vallet 2004; Italy: Shavit and Westerbeek 1998; for a comparative study see for example Breen et al. 2009; Breen et al. 2010). However, these newer studies also show that, even in countries that experienced a decline in the impact of social origin over time, the family of origin still has an effect on variation in educational attainment.

backgrounds. Moreover, differences in nutrition and health may play a role, as well as social class differences in sibship size (Erikson and Jonsson 1996a; Breen et al. 2009).[19]

As indicated above, social class and parental resources not only influence the educational career of individuals; they also contribute to a large degree to choices in the domain of household and family formation. Various studies have shown that social background influences fertility-relevant behaviour, such as the age at marriage or the age at entering parenthood (e.g. Michael and Tuma 1985; Axinn and Thornton 1992; Kahn and Anderson 1992; Barber 2000; Dahlberg 2011). In a study on West Germany, Blossfeld and Huinink (1991) found that women from lower social classes are younger at first marriage and at entering parenthood than women from higher social classes. Moreover, the authors asserted that women who grew up in large families are more strongly socialised to take on the roles of housewife and mother. As a result, these women are more inclined to have many children and to have them early. By contrast, highly educated parents are more likely to encourage their children to postpone fertility during their teen years as well as during their early twenties, due to the high educational and occupational aspirations that they have for their children (Rindfuss et al. 2007).

Aspirations, expectations and preferences towards children and education

In addition to factors related to the social and parental background, individual-level characteristics - such as preferences, values and attitudes - may simultaneously affect women's decisions about education and fertility.[20] Preference theorists maintain that differences in women's occupational choices are basically the result of heterogeneous preferences and priorities regarding work-lifestyles and family models.[21] According to Hakim (2000: 157-192; 2003), women can be divided into three distinctive groups. On the one side there are home-centred women, who give priority to

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19 One of the most significant developments in the study of educational attainment has been Boudon's (1974: 28-31) distinction between primary and secondary effects of social origin. Primary effects result from differences in academic ability and school performance between children from different social backgrounds, while secondary effects refer to different propensities prevailing in different social classes to progress to the next educational step, even at the same level of performance (Breen et al. 2009). For a detailed discussion of primary and secondary effects see, for example, Erikson and Jonsson (1996a).

20 Kravdal (2007) mentioned health as a further individual-level characteristic that potentially influences women's fertility behaviour as well as her educational career.

21 This view corresponds to the demographers' age-old concept of self-selection (Goldmann 2001).

family and children throughout their lives; while on the other side there are work-centred women, who are committed to work or equivalent activities. Between these two groups there is a larger group of adaptive women, who prefer to combine employment and family work without giving a fixed priority to either.[22] In line with preference theories, Martín-García and Baizán (2006) assumed that women's choices concerning the direction of study are tied to their future aims regarding employment and family, and are influenced by the perceived conditions under which specific professions are performed. Women with a strong preference for both children and gainful employment are more likely to enrol in fields of study that lead to occupations with family-friendly working conditions, such as school teaching. Hoem et al. (2006a) pointed out that also personal traits and interests might affect educational decisions and fertility simultaneously. The authors argued that those traits and interests that make some women more prone to choose a specific educational line might also be associated with their proneness to have children.

> *"For example, women who are interested in social relationships and in other people should be more likely to opt for an education in which they can work closely with people, such as educations for teaching, health care, social work, anthropology, and so on. At the same time they may be more inclined to have children than women who are less interested in personal relationships and in other people." (Hoem et al. 2006a: 340)*

Due to their preferences and personal traits, women with favourable values and attitudes towards family and fertility are likely to be over-represented in certain educational fields; and, accordingly, under-represented in other fields of study (Martín-García and Baizán 2006). Thus, differences in fertility behaviour between women educated in different educational fields might be the result of selection effects.

Most quantitative datasets include no or only insufficient information on determinants such as social class, parental resources, preferences or personal traits.

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[22] Hakim's preference theory has been criticised for assuming that preferences are constant over the life course. Researchers have argued that it might be more plausible that women adjust their preferences in response to factual constraints and opportunities (Leahy and Doughney 2006; Hoem et al. 2006a). However, another possibility is that preferences indeed remain constant throughout the life, but that women's actual behaviour deviates from their preferences since they have to adjust it to the institutional and social context in which they live.

However, when analysing the effects that educational trajectories and childbearing decisions have on each other, it is important to control for spurious factors that simultaneously have an impact on both processes, and may therefore bias the results.

2.5 Concluding remarks on the theoretical framework

In the previous sections, we described the theoretical linkages between education and fertility. Unlike most other researchers, who mainly focused on the causal effect of education on women’s childbearing behaviour, we also discussed how childbearing might lead to changes in a woman’s educational career. In addition, we addressed the possibility that common and usually unobserved factors - such as social origin, preferences or personal traits - might simultaneously have an impact on fertility decisions and educational trajectories. Following the life course perspective, we view education and fertility as two (out of several) parallel domains in a woman’s life that dynamically interact with each other and with their common environment. Therefore, an important aim of this study is to investigate empirically to what extent decisions about education and fertility are interrelated.

In the introductory part of this chapter, we pointed out that it might not be sufficient to take into account only the effect of women’s educational level and educational activity in explaining fertility differentials. In line with other researchers, we argued that the field of education might also have a strong impact on women’s childbearing behaviour. The link between educational field and fertility has been emphasised only in recent years. Therefore, existing theories on fertility do not contribute greatly the explanation of fertility differentials among women educated in different educational fields. Nevertheless, we outlined some possible mechanisms. First, *women educated in different educational fields might assess the optimal time to have a (first) child and to take a break differently* (Chapter 2.2.2). This is because different fields of education lead to different occupations and employment sectors. The corresponding jobs probably differ, for example, in terms of earning profile, skill depreciation during absences or the compatibility of caring for a small child and maintaining gainful employment (and thus the time a woman has to stay at home after childbirth). Since these factors influence the optimal timing of birth, it is likely that there are field-specific differences in the timing of entry into motherhood. Second, *women educated in different educational fields might assess the optimal spacing of births differently* (Chapter 2.2.5). We argued that, for some women, it might be advantageous to have their children close together. This applies, for example, to situations in which both partners have occupations that are characterised by shift work, frequent business trips or long hours. Since a complete return of both parents to such occupations is only possible when all of their children have reached a certain age, women might seek to minimise the time span with small children in the house. Some educational fields are more likely to lead to such occupations than others. For that reason, it is likely that there are field-specific differences in how women space their births. Third, *women's choices of educational fields might be related to their social origin, to personal traits and to preferences and future aims regarding family and employment* (Chapter 2.4.). The reasoning behind this assumption is that, in addition to the accumulation of human capital, educational choices also express individual interests, preferences and orientations concerning future roles that might be positively or negatively associated with childbearing.

Economic theories of fertility, as well as theories on social-structural or cultural changes, have been criticised for not taking into account the institutional context in which reproductive behaviour occurs. However, within research on life course patterns, a connection is being assumed between certain institutional conditions on the macro level of societies on the one hand, and specific life course patterns on the other (Mayer 1997). In the following chapters, we will therefore investigate how the institutional framework affects educational choices and fertility decisions. Moreover, we will examine whether the consideration of institutional aspects allows us to make more detailed assumptions about the impact of educational field on fertility decisions.

CHAPTER 3

Institutional framework and demographic patterns

3.1 Introduction

Understanding the relationship between educational decisions and fertility transitions requires a careful consideration of the broader social and institutional context within which these events occur. In the following chapters, we address three institutional aspects that have been emphasised by Hoem et al. (2006a, 2006b) in their studies on the influence of educational attainment on childlessness and ultimate fertility. First, investigations into the dynamics of childbearing and education should take into account the fact that both processes, as well as the relationship between them, are mediated through public policies (Chapter 3.2.) Second, explanations of the relationship between female education and fertility should consider the institutional context within which young women are educated, and in which they make decisions about the type and the duration of their education (Chapter 3.3). Third, researchers must recognise that the relationship between educational attainment and childbearing might be affected by the link between education and the labour market (Chapter 3.4).

In the following, we discuss these issues in greater detail. In addition, we will link the institutional aspects to the Swedish context, and we will briefly summarise demographic developments in Sweden in the areas of fertility, education and female labour force participation.

3.2 Public policies and fertility decisions

Parents’ childbearing decisions, as well as the relationship between women’s education and fertility, are shaped by the configuration of the welfare state. These policies determine how easy or difficult it is to raise children and to combine gainful employment and caring for a family. In addition, social policies can mitigate employment risks, as well as the opportunity costs that accompany childbirth (Hoem et al. 2006b). Comparative research has shown that the influence of educational attainment on fertility varies across countries (e.g. Blossfeld 1995; Neyer and Hoem 2008). The negative effects of educational attainment on entering motherhood seem to be stronger in societies in which the degree of incompatibility between female employment and family life is more pronounced than in societies in which the degree of incompatibility is small. Liefbroer and Corijn (1999) emphasised that the compatibility of female productive and reproductive work has both a cultural and a structural dimension, and that the cultural dimension is related to ideology, values and norms concerning the role of women in a society; while the structural dimension is related to actual societal opportunities and constraints on the role of women. These two dimensions are often related. However, in some societies, relatively favourable opportunities for the labour force participation of women may co-exist with relatively traditional cultural values; whereas in other societies, relatively liberal values may co-exist with relatively unfavourable opportunities for labour force participation.

3.2.1 The Swedish family and gender equality policies

Since the 1960s, Sweden has geared its public policies towards securing the labour force participation of women, relieving parents from care obligations and reducing the adverse economic and social consequences that may result from having children (Hoem et al. 2006b). Swedish policies and reforms reflect a strong commitment to gender equality based on the ideal of women and men sharing equally in paid work and family responsibilities (Oláh and Bernhardt 2008). In line with the general goal of supporting women’s labour force participation and promoting gender equality, Sweden introduced individual taxation in 1971. In addition, social security entitlements have been gradually uncoupled from marital and/or partnership status

(Hoem et al. 2006b). Today, the main principle of social security in Sweden is that every adult is responsible for his/her maintenance through his/her own earnings, unless he/she is unable to work because of sickness, disability or old age. Consequently, there is no spousal alimony in case of divorce (Oláh and Bernhardt 2008).

A very important component of the Swedish family policy system is the highly flexible parental leave programme. In 1974, existing maternity leave regulations were replaced by a formally gender-neutral parental insurance. Sweden thus became the first county in the world that acknowledged fathers as caring parents on a par with mothers (Oláh and Bernhardt 2008). Employed parents were entitled to six months of job-protected leave with 90 per cent of their previous gross earnings, up to a fairly high benefit ceiling. The parental leave could be taken over a continuous period, piecemeal or part-time any time before the child’s eighth birthday, and it could be shared by the parents as they wished. Benefits also became taxable and pensionable, and entitled employed recipients to paid vacation. The entitlement period for parental benefits has been extended over time: to seven months in 1975, to nine months in 1978, to 12 months in 1980, to 15 months in 1989 and to 16 months in 2002. Since 1980, benefits during the last three months of leave have been paid at a low flat rate that is the same for all recipients. Moreover, fathers became entitled to 10 days of additional leave following the birth of a child that was compensated at the same level as parental leave. In 1980, Sweden also formalised the so-called “speed premium”, a regulation that allowed parents to retain the level of their leave benefit if they had their second or subsequent child within 24 months of the previous birth (see also footnote 16, p.29). The eligibility interval was extended to 30 months in 1986 (Albrecht et al. 1999; Hoem et al. 2006b; Oláh and Bernhardt 2008).

In the mid-1990s, high unemployment and a large state budget deficit created pressure for benefit cutbacks in all major social insurance programmes. During this period, the replacement level in parental insurance was lowered in steps to 80 and 75 per cent; but in the late 1990s, the level was partially restored to the present level of 80 per cent (Duvander et al. 2005). To be entitled to receive earnings-related parental insurance benefits, a parent must have continuously worked for a certain period before the birth.[23] Those with no or insufficient previous employment receive a flat rate during the whole leave period. This feature of the Swedish parental insurance programme gives parents, and especially women, a strong incentive to be employed prior to birth, and even to postpone childbirth until earnings are stable and sufficiently high (Hoem 1995a; Albrecht et al. 1999). In order to promote a more gender-equal uptake of parental leave, the Swedish government earmarked one month of parental insurance for each parent individually. This regulation came into effect in 1995, and was extended to two months in 2002 (Oláh and Bernhardt 2008). Men’s uptake of earnings-related parental insurance increased from approximately 10 per cent in 1995 to around 20 per cent in 2005. Although this level is unmatched elsewhere in the European Union, the distribution of care work between Swedish women and men is still quite uneven (Duvander et al. 2008).

Along with the parental insurance system, child care, in the form of pre-school activities and school-age child care, is one of the mainstays of Swedish family welfare policy. In Sweden, day care is regarded as a pedagogical opportunity (Hoem 2005). The extensive provision of high-quality public child care is intended to guarantee equality in terms of the provision of care and education, and to redistribute resources among children of various social classes and ethnic origins (Oláh and Bernhardt 2008). Public child care is available for parents who are enrolled in education or who are gainfully employed for at least 20 hours a week. After several reforms in 2001 and 2003, even children whose parents were unemployed or on parental leave became entitled to at least 15 hours of pre-school activities per week (Skolverket 2007). Due to the political desire to provide child care facilities for all children in need of care services, pre-school activities and school-age child care expanded rapidly in Sweden. In 1975, about 17 per cent of children aged one to six were enrolled in public child care (including day care centres and family day care). By 1985, the share had risen to 51 per cent, and had increased to 63 per cent by 1995. Since 1998, six-year-olds have had the opportunity to attend pre-school. Today, nearly all six-year-olds are enrolled in pre-school, and the share of children aged one to five attending public child care has increased to more than

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[23] Regulations concerning the length of employment before childbirth that qualifies for earnings-related leave benefits changed over time. Currently a parent has to work for a minimum of 240 consecutive days (eight months) before the expected delivery date (Försäkringskassan 2008a)

80 per cent (Skolverket 2006a: 15-18). In Sweden, public child care is provided mainly by the municipalities and financed by state grants, local tax revenue and - to a minor extent - by parents' fees. In the 1990s, fees became more expensive and were increasingly linked to income and the child's hours of attendance. As a result, an increase in family income due to longer working hours or a better paid job was often of little financial advantage. This endangered the willingness of parents, particularly mothers, to increase their working hours. To remedy this problem, a system of maximum child care fees was introduced in 2002. This new system includes a ceiling on the amount parents can be required to pay for child care (Swedish Institute 2004a).[24] For most families with children, the maximum fee system led to a substantial reduction in their child care costs (Brink et al. 2007).

In addition to the generous and flexible parental leave programme and the extensive provision of heavily subsidised public child care, the Swedish welfare state has implemented a number of other policies to facilitate the combination of employment and parenthood. Parents have, for example, the right to work part-time, if they wish, until their youngest child is eight years old (Oláh and Bernhardt 2008). Moreover, parents of children under age 12 are entitled to 120 days of paid care leave per year and per child to care for a sick child. The first 60 days can even be used if the person who usually looks after the child is ill (Försäkringskassan 2008b).

To sum up, during the last decades Sweden has gradually extended its dual earner model of family policy, and has succeeded to a large extent in promoting the compatibility of female productive and reproductive work in both the cultural and the structural dimension. The result is a society in which egalitarian family ideals are more prominent than in most other European countries. Likewise, cohort fertility levels, as well as female employment rates, are among the highest in Europe. In the next subchapter, we give an overview of Swedish fertility patterns. A description of women's participation in the Swedish labour market will be provided in chapter 3.4.2.

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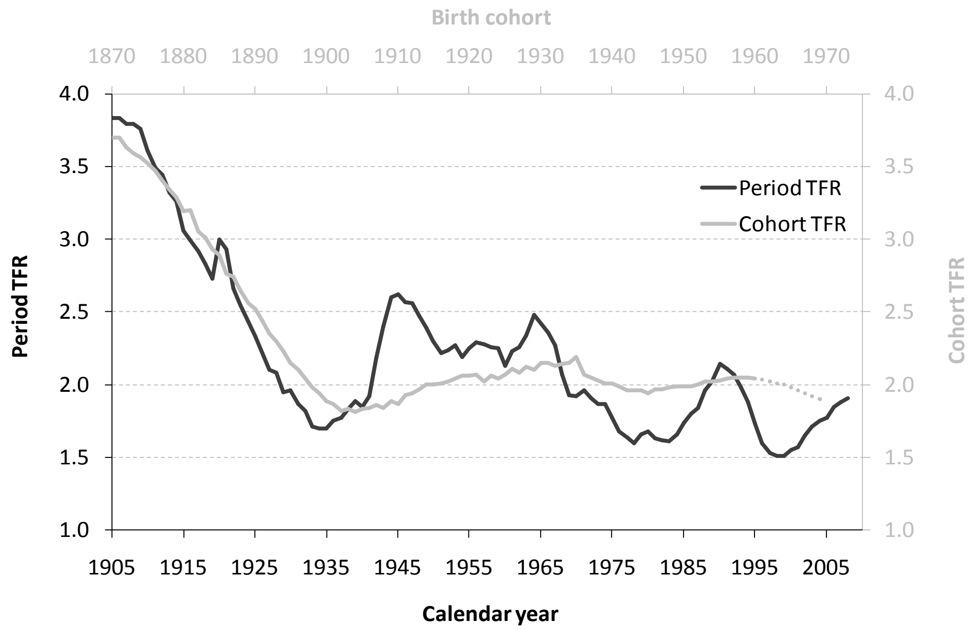
[24] At pre-school facilities, for example, the fee charged may be no more than one to three per cent of the family's income, depending on how many children the couple has. The fee may not, however, exceed SEK 1,260 per month for the family's youngest child, SEK 840 for the second youngest and SEK 420 for the third youngest. No fees are charged for further children (Skolverket 2007: 12).

3.2.2 Demographic patterns of fertility

During the first four decades of the 20th century, fertility in Sweden declined nearly continuously (see Figure 3.1). The period total fertility rate (TFR) reached a low point of 1.70 children per women in 1935, which was among the lowest levels in the world at that time (Hoem and Hoem 1996). After a baby boom during the 1940s, and somewhat lower but stable fertility levels in the 1950s, Swedish period TFR values changed from the 1960s onwards in what Hoem and Hoem (1996) have described as a roller-coaster pattern of fertility. In a development that has often been attributed to the introduction of modern contraceptives and women’s rapidly increasing labour force participation (Hoem and Hoem 1996; Oláh and Bernhardt 2008), the period TFR decreased from a high of 2.48 children per women in 1964 to a low of 1.60 in 1978. In the 1980s, economic trends became very favourable, and the massive investments directed towards families with children bore fruit (Hoem and Hoem 1996). During the second half of the 1980s, the period TFR increased sharply. It went up to and even exceeded the replacement level at the beginning of the 1990s, a level much higher than those seen in almost all of the other Western European countries at that time (Andersson 1999). However, during the economic crisis of the 1990s, Swedish fertility declined markedly, and in 1998 and 1999 the lowest period TFR (1.51) ever in Sweden was recorded. Since then, the period fertility level has increased and reached a value of 1.91 children per women in 2008.

Figure 3.1: Period total fertility rates for the period 1905-2008 vs. cohort total fertility rates for women born 1870-1970

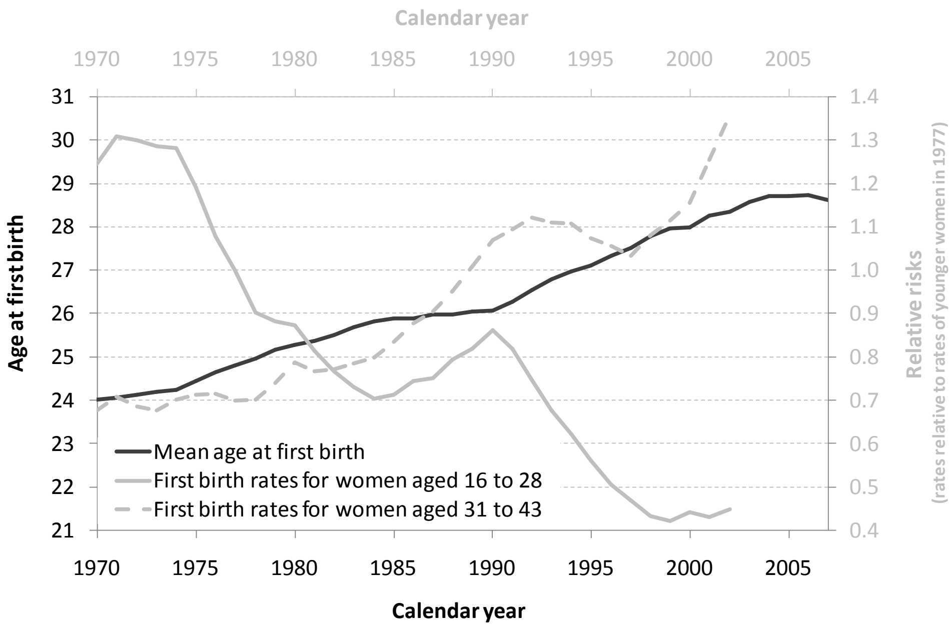


Source: Council of Europe (2001: 82-83; 2005: 88-89); Statistics Sweden (2002: 95-96; 2009f)
Notes: (1) The time lag between the period TFR and the cohort TFR constitutes 35 years. (2) Cohorts born after 1960 were younger than age 45 in 2005, and may therefore not have fully completed their childbearing.

In line with period fertility trends, completed cohort fertility also declined from an average of more than three children for women born in the 1870s to less than two children for those born at the turn of the 20th century. Unlike the period trends, completed cohort fertility showed only moderate fluctuations. Most cohorts born in the 20th century had a fertility level of around two children per woman. For younger cohorts, especially those born in the 1970s or later, fertility is expected to remain below two children per women (Statistics Sweden 2002, quoted by Olàh and Bernhardt 2008).

Sweden's fluctuating period total fertility rate, but rather stable cohort fertility level, can be explained by shifts in the age at entering parenthood and changes in the speed of subsequent childbearing. Within a period of 37 years, the age at entering motherhood increased in Sweden by 4.6 years, from a mean age of 24.0 years in 1970 to a mean age of 28.6 years in 2007 (see Figure 3.2). This increase in the mean age of first childbearing over time is the result of a dramatic drop in the propensity to enter motherhood among younger women, and a nearly constant increase in first birth fertility among women beyond age 30.

Figure 3.2: Women's mean age at first birth for the period 1970-2007 vs. standardised annual indices of first birth rates by age groups for the period 1970-2002



Source: Statistics Sweden (2008c); Andersson (2004)
Note: Annual indices of first birth rates are standardised for age in single years. For a thorough description of the estimation procedure for annual indices of first birth rates see Andersson (1999, 2001).

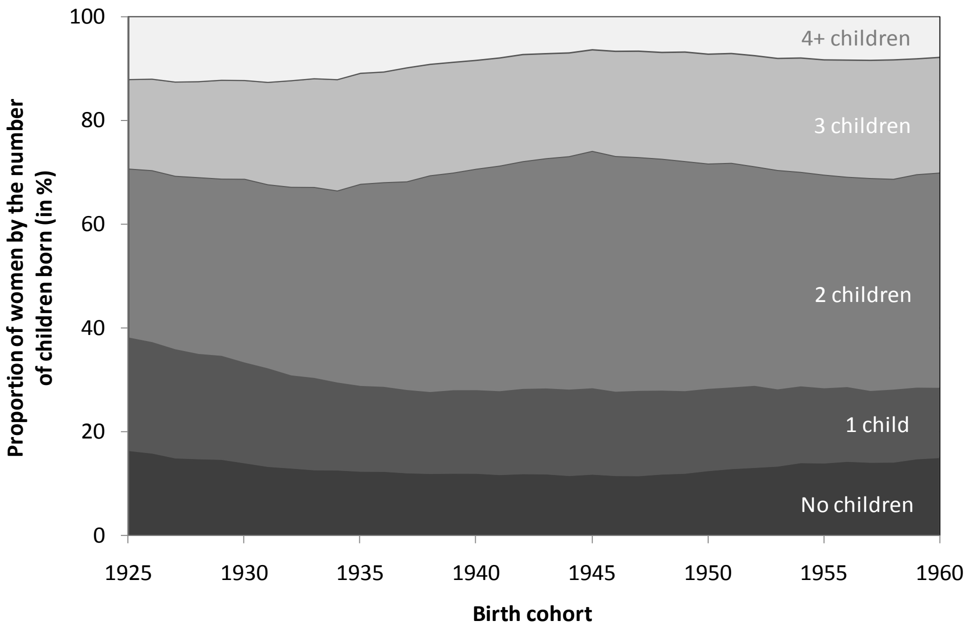
From the early 1970s to the mid-1980s, first birth intensities for younger women fell by almost 50 per cent, but remained more or less stable for women at higher ages. In the mid-1980s, first birth intensities for older women started to increase markedly, and went up by around 40 per cent in less than 10 years. During the baby boom period of the late 1980s, younger women also experienced an increase in the propensity to enter motherhood. However, after 1990, the general downward trend in first birth fertility among younger women continued, and first birth rates for these women stabilised only from 1998 onwards at a very low level. During the Swedish economic crisis of the 1990s, first birth intensities also declined for women above age 30 for a couple of years, but then increased sharply from 1998 onwards, reaching a level that was three times as high as that of younger women in 2002 (see Figure 3.2).

The childbearing boom of the 1980s stemmed not only from higher birth intensities among childless women, but also from an elevated propensity among Swedish mothers (regardless of parity) to continue their childbearing (Andersson 1999). Several studies have shown that a large part of this increase in higher order births can be attributed to the introduction of the so-called "speed premium" at the beginning of the

1980s (see Chapter 3.2.1), which led to a permanent shortening of birth intervals among women at all educational levels (e.g. Andersson et al. 2006b). Currently, almost half of all second births occur in Sweden before the first child turns 2.5 years old (Oláh and Bernhardt 2008).

Figure 3.3 shows that the two-child norm is well established in Sweden. The share of women with two children increased from one-third for those born in the mid-1920s to more than 45 per cent for those born in the mid-1940s, and declined only slightly for later cohorts. Having three children is also quite a common pattern, and it was chosen by about every fifth women born between 1930 and 1960. The share of one-child families and large families (four or more children) decreased over cohorts. At the same time, the proportion of childless women remained more or less stable (12 to 16 per cent) with the lowest share found among those born in the mid-1940s. On the whole, the share of families with more than two children has been quite stable across cohorts. This trend, in combination with the strong prevalence of two-child families and a moderate level of childlessness, explain the rather high cohort fertility in Sweden.

Figure 3.3: Cohort parity distribution for women born 1925-1960



Source: Oláh and Bernhardt (2008); data were kindly provided by the authors on request

In the mid-1970s, childbearing increasingly started to precede marriage in Sweden (Hoem and Hoem 1996; Thomson 2005). Today, nearly 60 per cent of all children and two-thirds of all first children are born in non-marital relationships. However, the share of births to single mothers (i.e. to women that did not live with the child's father at the time of birth) is only around 10 per cent (Oláh and Bernhardt 2008).

Table 3.1 provides some initial insights into the role of education in fertility behaviour in Sweden. The data presented show that the postponement of the first birth to higher ages applies to women at all educational levels. However, increases in the mean age at entering parenthood across birth cohorts have been strongest for the highly educated. Women born in 1945 who attained a post-secondary education had their first child an average of 3.7 years later than those with only primary or lower secondary education. For women born 15 years later, the difference in the mean age at first birth increased to five years.

Table 3.1: Mean age at first birth, proportion childless, and cohort total fertility rate, by educational level for women born in 1945 and 1960

	Educational level		
	Primary/lower sec.	Upper secondary	Post-secondary
Mean age at first birth			
Birth cohort 1945	22.5	23.6	26.2
Birth cohort 1960	23.4	25.6	28.4
Proportion childless (in %)			
Birth cohort 1945	10.9	10.2	14.0
Birth cohort 1960	14.2	13.3	16.1
Cohort total fertility rate			
Birth cohort 1945	2.02	1.97	1.88
Birth cohort 1960	2.20	2.05	1.91

Source: Statistics Sweden (2002: 105-106)

Although highly educated Swedish women start childbearing at much higher ages, the association between educational attainment and the level of childlessness or ultimate fertility is relatively weak in Sweden. The differences in the proportion of women who remain childless among women with the lowest and women with the highest educational levels even declined from 3.1 per cent for those born in 1945 to 1.9 per cent for those born in 1960 (see Table 3.1). Andersson et al. (2009) have argued that the weak role of educational attainment on the level of childlessness and ultimate fertility (a pattern more or less common to all Nordic countries) can be attributed to the impact of

Nordic social policies that facilitate the recuperation of fertility at older ages, and make social differences in behaviour small.

3.3 Educational systems, educational trajectories and fertility decisions

The structure of the educational system is decisive for an individual's educational career. It influences the level of education that a person finally attains, as well as the choice of the educational field. Hoem et al. (2006a) pointed out that some aspects of the structure of an educational system might also have an impact on fertility. For that reason, investigations into the relationship between education and fertility should take into account the institutional context in which young people are educated.

Education and training systems vary, for example, in their organisational structure. In some countries, the educational system is strongly oriented towards providing general qualifications with little consideration of the labour market relevance of the skills taught (e.g. the United States). Others have established vocational training programmes that are either directly integrated into the general school system (e.g. the Netherlands), or are provided through large-scale apprenticeship programmes (e.g. Germany, Austria). In between, there are countries like France or Sweden, which rely on a mix of general and vocational school tracks in conjunction with a small apprenticeship programme, if any. (Müller and Gangl 2003). Since these systems involve different environments during instruction, different transition patterns into the labour market and variations in the portability of skills across employers, they may also influence individual fertility behaviour (Hoem et al. 2006a).

A further difference between educational systems is related to the age at which important decisions about the educational career have to be made. In some countries, pupils are separated into different tracks relatively early in their school career, such as in Germany. Other countries, like the Nordic ones, avoid early track differentiation (Müller and Wolbers 2003; Hoem et al. 2006a). Given that some pupils (or their parents and teachers) become aware of their abilities only after some years of schooling, the age at differentiation probably has an impact on the final educational outcome. Differences in educational choices between those students who have to choose between different options comparatively early during their formative years, and those who can postpone crucial decisions to a higher age, might also arise from the fact that individual interests and ideas about the future are probably more developed among older children.

Educational systems also differ in the flexibility of pathways, and thus in the opportunity to correct earlier educational decisions (Müller and Gangl 2003). Some educational systems are highly permeable, allowing young people to change their educational tracks relatively easily, and to exit from and re-enter post-compulsory education at all stages in their lives. Others, however, are more rigid, and offer pupils and students only limited opportunities to alter their educational choices or to resume education after an interruption. Hoem et al. (2006a) have argued that these differences in the flexibility of educational systems must have an impact on fertility. Flexible educational systems offer young women better opportunities to adjust their education to changes in their interests and abilities and to developments in their family lives. Women who recognise that the occupation they are trained for is not very compatible with childrearing can re-enter the educational system and train in a field that is better suited to their actual needs or future childbearing plans.

> *“A flexible educational system should therefore make it easier for a woman to have children because she does not need to see childbearing as having an irrevocable impact on all other aspects of her life course.”(Hoem et al. 2006a: 335)*

The degree of sex segregation in the educational system is an additional factor that may influence educational trajectories, as well as fertility behaviour. Although in most countries gender differences in the level of educational attainment have diminished over recent decades, the gender division in the types of education chosen has remained remarkably persistent.[25] Women are more likely to earn degrees in teaching, health and social care, personal services and arts or humanities; while men

[25] According to Jacobs (1989: 37-63), gender differences in educational choices can be attributed to a sex-specific socialisation that influences young peoples’ perceptions of what life goals (e.g. family, career) they should pursue. As children mature into adolescents and start to make educational decisions, sex-specific socialisation in conjunction with gender inequality in the educational system leads young women and men into divergent educational trajectories. Further explanations for sex-specific educational choices and cross-national variability in sex segregation can be found in Charles and Bradley (2009) and Estévez-Abe et al. (2003).

prefer to study crafts, industry, engineering, computer science and mathematics (e.g. Bradley 2000; OECD 2001: 173; Smyth 2003; European Comission 2004; Charles and Bradley 2009).[26] Martín-García and Baizán (2006) have argued that enrolment in different fields might involve different socialisation effects, which in turn may influence childbearing attitudes. This corresponds to Elder's notion of linked lives, which emphasises the impact of opinions, behaviour and careers of significant others - such as friends, classmates or teachers - on individual decisions and actions (see Chapter 2.2.4, p. 20). A female-dominated educational environment provides young girls with more opportunities to socialise with other girls and women who have the same educational background (Hoem et al. 2006a). They have better options of "doing gender"[27], and thus are probably more likely to develop a life course ideal that includes marriage and motherhood. Hoem et al. (2006a) have emphasised that, in addition, female-dominated educational fields often provide a more supportive environment for women than male-dominated fields of education. Being enrolled in a female-dominated educational field may therefore support the development of a life course orientation that encompasses both a professional career and parenthood.

We now turn to the institutional context within which young Swedes are educated. In Chapter 3.3.1 we briefly outline the main elements of the Swedish educational system and highlight those aspects that are relevant for our analysis. An overview of the changes in educational attainment over time and a description of gender differences in educational choices in contemporary Sweden will follow in Chapter 3.3.2.

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[26] Buchmann and Charles (1995) proposed that educational choices are more likely to be gender-typical when they have to be made at an early age, since knowledge about the practical disadvantages of female-typed occupations is likely to be quite limited early in life. This feature, coupled with a strong education-labour market linkage, means that occupational segregation is likely to be more pronounced in countries with highly differentiated, vocationally oriented systems.

[27] Some scientists claim that gender is socially and culturally constructed rather than a straightforward statement of biological facts. Individuals do not act manly or womanly due to biological reasons, but in accordance with what is socially determined as typical male or female behaviour (West and Zimmermann 1987; Gildemeister and Wetterer 1992; West and Fenstermaker 1995).

3.3.1 The Swedish educational system

From around 1950 onwards, the school system in Sweden was restructured from a fairly traditional European system - characterised by early selection, parallel school forms and a small and exclusive secondary and tertiary sector - to a system reminiscent of the American one, with a non-selective compulsory school and mass education at the secondary level. However, Sweden has maintained or even strengthened the focus on vocational training, and the tertiary sector has not expanded to the same degree as the demand for higher education (Erikson and Jonsson 1996a, 1996b). In the following, we briefly describe the main features of Sweden's current educational system (for a graphical representation see Figure 3.4). To account for the fact that not all birth cohorts on whom our empirical analyses will focus were educated under the current system, we also refer to some important changes in the educational structure in recent decades.

In Sweden, primary and lower secondary education takes place in the form of nine years of comprehensive schooling, which are mandatory for all children. Compulsory schooling generally starts at age seven; however, children are also allowed to begin at age six or eight. In addition to regular compulsory schools, there are Sami schools for Sami-speaking children[28], special schools for the deaf and hearing impaired, and schools for children with intellectual disabilities(Skolverket 2009b).[29] About 98 per cent of compulsory school leavers go on to upper secondary school (Swedish Institute 2000).

Upper secondary education in Sweden aims at providing a broad platform of knowledge for the labour market and for further studies (Skolverket 2009b). Vocational education is integrated into the general school system, and designed with the goal of keeping the gap between general and vocational tracks as small as possible (Müller and Wolbers 2003). There are 17 national programmes, 14 of which have a more vocational orientation and require at least 15 per cent of the time to be spent in a workplace environment (e.g. health care programme, vehicle engineering programme). The remaining three programmes primarily prepare pupils for further studies (e.g. social science programme). In addition, municipalities may choose to set up local profiles

[28] The Sami school covers the first six school years. Afterwards, Sami children attend regular compulsory schools (Skolverket 2009b).

[29] Education for individuals with intellectual disabilities is also provided at the upper secondary level and within the system of adult education (Skolverket 2009b).

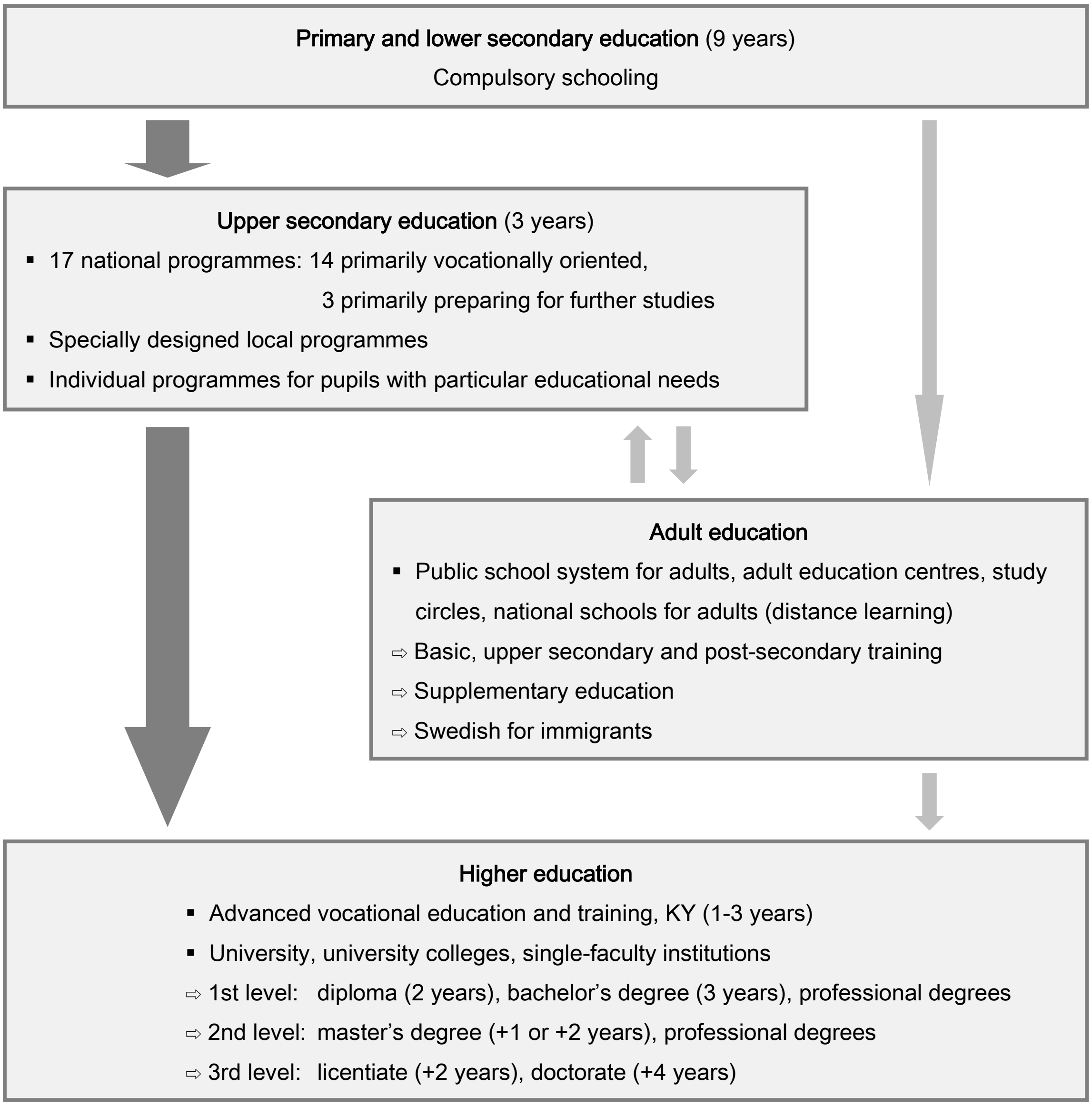
adapted to the local needs and conditions, or students may be permitted to follow individual programmes of varying length and content. The latter, however, tend to be used to help pupils make up for deficiencies in subjects from compulsory school, and most students in individual programmes transfer to one of the national programmes or a local programme later on. Since the school year 1995/1996, all national and local programmes have been three years in length, and grant successful graduates in principle direct access to higher education.[30] However, for most tertiary courses and study programmes, there are specific entry requirements that vary depending on the subject area and the type of course (Swedish Institute 2000; Salerno 2002). Today, approximately 45 per cent of all upper secondary school leavers have started higher education by the age of 25 (Högskoleverket and SCB 2009: 82). Transitional frequencies are, however, characterised by a significant regional dispersion and by a higher proportion of women continuing to higher education (Skolverket 2006b: 76).

Higher education in Sweden is divided into three levels. Within the first level two general degrees are awarded: diplomas after two years and bachelor's degrees after three years of full-time study. At the second level, students can attain either one-year or two-year master's degrees. Educational subjects in which these general degrees are awarded are, for example, social sciences, natural sciences, humanities and arts. In addition to these general degrees, students can pursue a professional degree which, depending on its length, may be awarded at either the first or the second level. Professional degrees can bet earned, for example, in the fields of engineering, health care, agriculture, law and education. At the third level, two degrees are offered: licentiate degrees and doctoral degrees. They are designed to take two and four years, respectively, to complete and correspond in principle to an American PhD or to a continental European research doctorate (Hoem et al. 2006a; Högskoleverket 2007a; 2008: 46-48; 2009). Since 1996, Swedish students also have the option of obtaining higher education by participating in Advanced Vocational Education and Training

30 The new system was introduced in the 1992/1993 school year and implemented fully by all municipalities in the school year 1995/1996 (Swedish Institute 2000). Before the reform, the primarily vocationally oriented programmes included only two years of schooling and permitted no direct access to higher education. However, by passing through one of the various extensions and specialisations after a two-year programme individuals were able to upgrade their secondary education and to achieve eligibility for higher education (Hoem et al. 2006a).

(KY). KY is designed as a complement to traditional colleges and universities. The education period varies between one to three years, and includes significant elements of workplace training (Swedish Agency for Advanced Vocational Education 2006).

Figure 3.4: Map of the Swedish educational system



Source: Swedish Institute (2000); Salerno (2002); Swedish Agency for Advanced Vocational Education (2006); Skolverket (2009b)

In Sweden, admission to higher education is restricted. If the number of qualified applicants for a certain course or programme exceeds the number of places available, a selection is made. At least one-third of all places are allocated on the basis of final school grades, and at least one-third on the basis of scores from the Swedish Scholastic Aptitude Test, which measures knowledge and skills that are considered important for success in higher education. In addition, a maximum of one-third of places can be allocated based on other criteria, such as previous training, vocational experience or interviews (Högskoleverket 2008: 46). Between 1970 and 2008, even people who did not complete any form of upper secondary education were able to apply for higher education if they were age 25 or older and had at least four years of work experience. This regulation was intended to improve the educational opportunities of those generations who had not been able to profit from the expansion of the upper secondary school system (Salerno 2002; Swedish Institute 2004c; Eurydice 2008).

Social equality in educational advancement is also supported through an extensive system of adult education. In Sweden, education for adults is offered within the public school system, at some 150 adult education centres, through study circles organised by voluntary educational associations, and through two national schools for adults in which instruction is partly or entirely provided by distance learning (Swedish Institute 2000). By participating in adult education, students can obtain qualifications in individual subjects or complete a leaving certificate for compulsory school and/or upper secondary school. At the post-secondary level, adult education offers the option to achieve higher professional qualifications or qualifications within a new profession. In addition, adult education includes language instruction for immigrants and supplementary training programmes in, for example, music, art, dance or handicrafts (Skolverket 2009b). In general, adult education is arranged to allow students to combine their studies and employment. However, employees also have the right to interrupt their employment in order to enrol in further education, with a guarantee of return to employment (Swedish Institute 2000; Hoem et al. 2006a).

To level social differences in educational opportunities, tuition in all public institutions is free of charge. In addition, various financial assistance schemes are provided for students in upper secondary, adult and higher education. Study assistance at the upper secondary level comprises a study grant, which represents a continuation of the child allowance and is paid to all students between 16 and 20 years of age. In addition, students can apply for a needs-tested grant to help cover the costs of study and daily travel (Swedish Institute 2000). For those enrolled in adult or higher education, financial assistance includes both a non-repayable grant and a loan that has to be repaid at a later date. The entitlement to financial assistance is an individual right, which means that the total amount awarded does not take into account the economic circumstances of the student's parents or spouse (Swedish Institute 2004c).[31]

A special feature of the Swedish educational system is its high degree of flexibility, which ensures that early educational choices do not rule out other educational opportunities later in life. Hoem et al. (2006a) observed that Swedes have numerous options for resuming their education, either to complement or upgrade their existing knowledge, or to change their field of study. Thus, they can easily adapt their education to their interests, abilities and desires, as well as to the demands of work or family life. A considerable number of Swedes do not simply leave the educational system upon completion of a degree, never again to return to the classroom. Instead, alternating education and employment, and combining part-time work with part-time education, are widespread life strategies (Marklund 1981; Hoem et al. 2006a). As a consequence, unordered educational careers have become a common feature within the Swedish society (Breen and Jonsson 2000).

3.3.2 Educational attainment - changes and gender differences

In recent decades, Sweden's educational system has changed fundamentally. As a result of the expansion of the upper secondary and tertiary sectors, there have been large increases in educational attainment over time. In 2005, more than 80 per cent of the 25-to-64-year-olds had at least an upper secondary education. In the same year, 30 per cent of Swedes had a tertiary degree (see Table 3.2). In general, educational attainment is higher among the younger age groups. In 2005, the proportion of individuals holding at least an upper secondary degree was 19 percentage points higher among the 25-to-34-year-olds than among the 55-to-64-year-olds. The proportion of individuals with a tertiary degree differed between the youngest and the oldest age group by 12 percentage points.

[31] However, the amount of financial assistance may be reduced in cases where a student's own income is too substantial (Swedish Institute 2004c). Furthermore, students can receive financial assistance only until the year that they turn 54, and the right to take out a loan is limited from age 45 onwards (CSN 2009).

Table 3.2: Proportion of the Swedish population who have attained (at least) upper secondary education and tertiary education in 2005

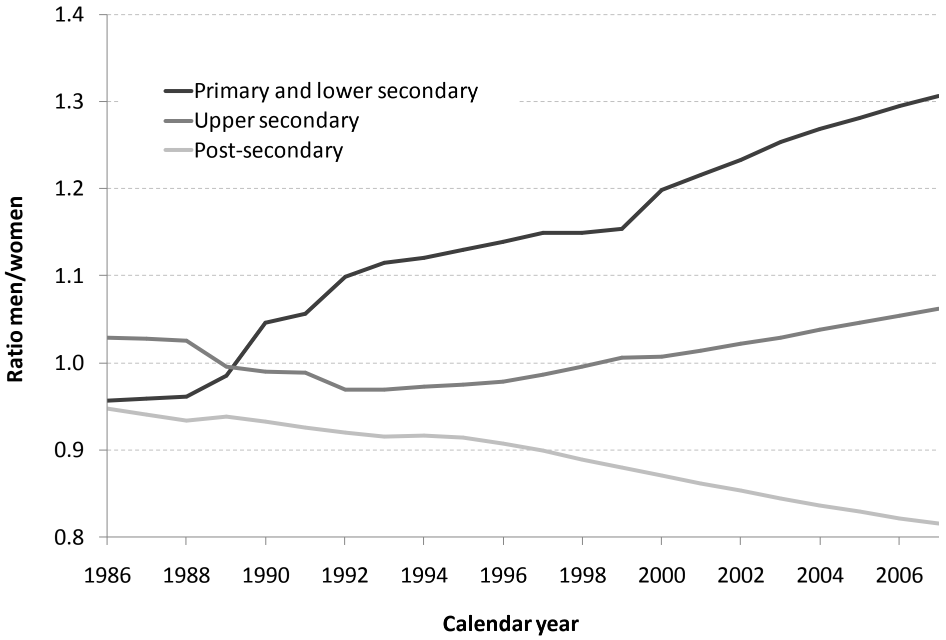
Age group	Proportion of population (in %) who have attained …	
	… at least upper secondary education	… tertiary education
25-64	84	30
25-34	91	37
35-44	90	28
45-54	82	28
55-64	72	25

Source: OECD (2007: 37-38)

In Sweden, probably more than in other Western countries, school reforms have been carried out with the explicit aim of reducing social inequalities in educational attainment. By analysing the association between class of origin and transition to higher education, Erikson and Jonsson (1996a, 1996b) found that class-related educational inequalities decreased in Sweden during the period of 1930 to 1970. However, from the 1970s onwards, the level of educational inequality remained stable, despite several reforms that aimed at equalisation, decreasing class differences in the standard of living and changing economic circumstances and political regimes. In comparison to most other countries, the level of class inequality might be somewhat lower in Sweden, but the pattern of inequality is very much the same. The offspring of the upper service class are more likely to go on to upper secondary and higher education, while the children of farmers, workers and lower-grade white-collar workers lag behind.

In addition to equalising educational opportunities for individuals from different social classes, ethnic groups or countries of origin, educational reforms also aimed at promoting equality between women and men (Elgqvist-Saltzman 1988). Sweden has been very successful in incorporating women into higher education. As a result, gender differences in educational levels have not decreased, but have instead increased over the past 20 years. As can be seen in Figure 3.5, the number of women and men whose highest educational level is upper secondary schooling was quite balanced during the 1990s. At the turn of the 20th century, men started to outnumber women at this medium educational level, and that tendency has increased in recent years. There are far more men than women who have only compulsory schooling, and differences at the lowest educational level have increased, especially since the mid-1990s. With respect to post-secondary education, a contrary development can be observed. The gender distribution in higher education changed from an equal balance at the end of the 1980s to a clear numerical advantage for women in 2007.[32] Today, Swedish women are on average more highly educated than their male counterparts. Nevertheless, men still outnumber women at the most advanced educational levels, meaning that they more often hold licentiate or doctoral degrees (Skolverket 2009a).

Figure 3.5: Gender differences in educational level for the period 1986-2007, population aged 25 to 64 (ratio between the number of men and the number of women according to the highest educational level attained)



Source: Skolverket (2009a)

Despite the enormous increase in the share of women in higher education, gender segregation by field of education persists. Figure 3.6 shows that, in 2007, only two out of the 17 national upper secondary school programmes had an almost equal gender balance (the proportion of female students was between 40 to 60 per cent): namely, the social science and the natural science programmes. Approximately 40 per cent of the students who enrolled in an upper secondary national programme in 2007 chose one of these two academically oriented programmes (Skolverket 2008: 154, own estimations).

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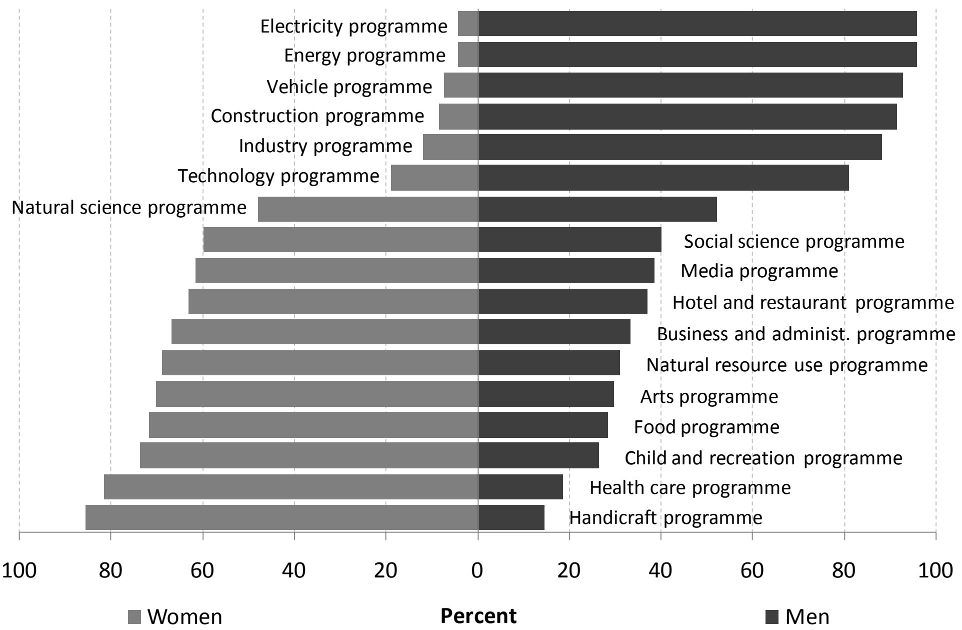
[32] The strong increase in the proportion of women with post-secondary education is to some extent also the result of the incorporation of colleges for nursing and teaching, which are traditionally dominated by women, into higher education in 1977 (Elgqvist-Saltzman 1988).

The technology programme, which is the third academically oriented programme, was clearly male-dominated. However, in comparison to the male-dominated vocational lines (e.g. electricity programme, vehicle programme), the share of women in the technology programme was relatively high.

Most of the 14 vocationally oriented programmes were clearly gender marked. Men were over-represented in five programmes that prepare students for typical male-dominated occupations, such as mechanical engineering, vehicle engineering, electrical engineering or construction; while women dominated in nine vocational programmes, especially in those that provide training in handicraft professions (e.g. florist, hairdresser and tailor), health services or child care.

Figure 3.6: Gender differences in educational field at the upper secondary school level in 2007 (proportion of women and men enrolled in different upper secondary national programmes for students who have proceeded directly from compulsory school in the same year)



Source: Skolverket (2008: 154), own estimations
Note: Students enrolled in individual or specially designed programmes with a connection to a certain national programme are included in the corresponding national programme.

It is striking that, within the vocational programmes, all of the male-dominated fields had a more uneven gender distribution than any of the female-dominated ones. This means, that at the upper secondary school level, there was a higher proportion of men in typically female programmes, while there was a lower proportion of women in typically male programmes. Generally, the degree of gender segregation within the Swedish upper secondary school system decreased between the mid-1970s and the mid-1990s, and has remained more or less constant since then. The main reason for this decline in segregation is that, due to the reform of the upper secondary school organisation at the beginning of the 1990s, many programmes disappeared that had primarily attracted women (e.g. the social programme, the social service programme). Since then, growing numbers of students have been enrolling in one of the academically oriented programmes, which are more gender-balanced. The gender division in vocational programmes has remained quite stable over time. This especially applies to those vocational programmes that lead to the traditionally male labour market. Among the female-dominated courses, only the health care programme[33] became less gender-segregated (Skolverket 2006b: 48-51). However, with a proportion of more than 80 per cent in 2007, women still substantially outnumber men in this educational field. Lidegran et al. (2006) showed that, in Swedish upper secondary schools, gender differences in the choice of educational field are more pronounced among children from lower social classes, since they more frequently choose vocationally oriented programmes. Children from higher social classes are more likely to enter into the academically oriented upper secondary programmes that have more gender-equal distributions, and the division does not take place until university.

Due to a higher female transition rate from upper secondary to tertiary education, Swedish women constitute the majority of graduates in nearly all sectors of higher education. In the academic year 2007/2008, the dominance of women was especially strong within the area of health care and welfare, as well as teaching. Only within the field of engineering and manufacturing did male graduates outnumber female graduates (see Figure 3.7). Thus, the traditional choices that Swedish women and men make at upper secondary school continue into higher education. However, in comparison to the highly gender-segregated upper secondary school system, gender differences within higher education are less pronounced. In quite a number of educational fields, the proportion of male graduates in 2007/2008 was between 30 and 40 per cent.

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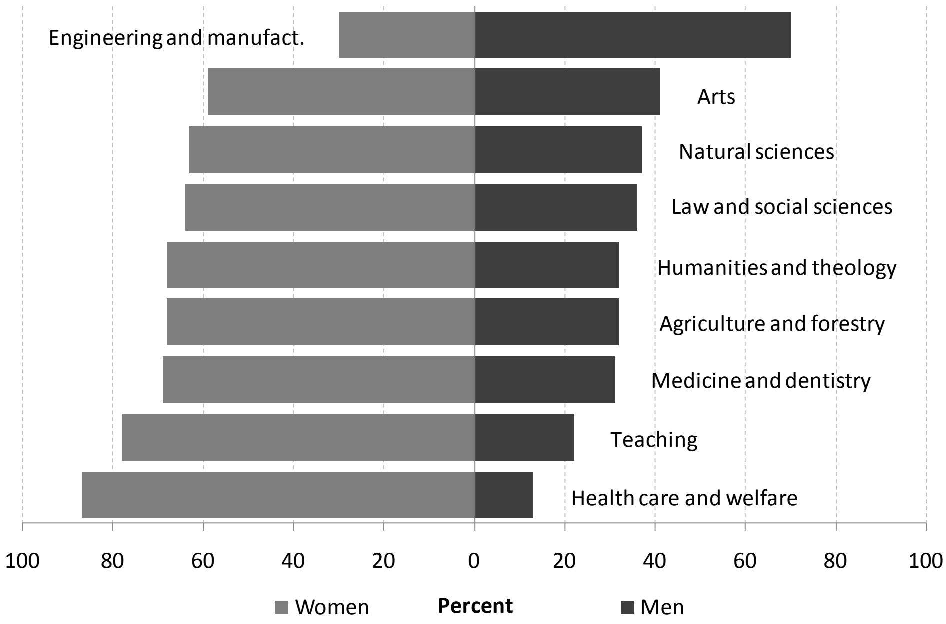
[33] The health care programme was implemented in course of the reform of the upper secondary programme in 1992/1993. It is more or less a combination of the nursing programme and the social service programme, both of which have been strongly female-dominated.

Figure 3.7: Gender differences in educational field at the post secondary school level in the academic year 2007/2008 (proportion of women and men graduating from different sectors of higher education)



Source: Högskoleverket and SCB (2009: 72-78)

The gender composition within higher education has changed considerably over the last 30 years, primarily because women have increasingly entered traditionally male fields of education. Between the academic years 1977/1978 and 2007/2008, the proportion of women who had earned a degree in the area of engineering and manufacturing increased from approximately seven to 30 per cent. Likewise, the proportion of female graduates in agriculture and forestry increased from 17 to 68 per cent, and in medicine and dentistry from 39 to 69 per cent (Skolverket 2006b: 80; Högskoleverket and SCB 2009: 72-78). However, it should be noted that all of the educational fields displayed in Figure 3.7 are quite broad, and that the gender distribution between the sub-areas of each of these fields varies greatly. In engineering and manufacturing, for example, women cluster in the “soft” courses, like industrial science, architecture or textile engineering; while the “hard” technology (e.g. electrical engineering, mechanical engineering) is still strongly dominated by men. Within the natural sciences, women crowd into subjects like pharmacy or biology, but they less often choose physics or mathematics. In teaching, women heavily dominate in the area of pre-school and primary school teaching, education for children with special needs and child or youth pedagogy. However, among those being educated for teaching the upper years of compulsory schooling, the gender distribution is less uneven, and graduates from courses for upper secondary school teaching are almost gender balanced (Elgqvist-Saltzman 1988; Högskoleverket and SCB 2009: 72-78). In her analysis of educational segregation in Sweden, Stanfors (2003: 184) concluded that "…even though women make up the majority at universities and even though they are increasingly represented in prestigious fields and in general do better than men, men still dominate the fields and subject areas that lead to high positions and well-paid jobs".

3.4 Education, labour market options and fertility decisions

The choice of a particular type of education not only has a decisive impact on a woman's social environment during her formative years; it also largely determines her future employment prospects and the conditions in which this employment takes place. Hoem et al. (2006a) have suggested that some aspects of the link between education and the labour market might also have an important bearing on women's decisions about whether and when to have children. In the following, we will briefly outline these aspects.

First, fields of education vary in the prospects of finding an appropriate job after graduation. Some educational fields lead to occupations that are marked by a considerable mismatch with vacant positions. Others, such as the field of humanities or fine arts, do not lead to an obvious set of occupations at all (Hoem et al. 2006a). Young people with these educational backgrounds face a much more difficult school-to-work transition than graduates from other disciplines. Their transition to work not only takes longer; they are also more likely to wind up in atypical employment, which quite often results in a lower occupational status, a lower income, a high risk of unemployment and a continuous search for a more suitable job (Konietzka 2002; Erikson and Jonsson 2003; Smyth 2003; Wolbers 2003; Haak and Rasner 2009). However, for most (especially highly educated) women, being successfully established in the labour market is an important prerequisite for fertility decision-making (Kreyenfeld 2001: 68; Zabel

2006b).[34] This especially applies to a country like Sweden, where social benefits, such as the amount of the parental leave benefit, strongly depend on a woman's previous labour market status and income (see Chapter 3.2.1). Graduates from educational fields with poor employment prospects may therefore feel impelled to prolong the postponement of motherhood, and permanent childlessness might be more likely among them.

The choice of a particular field of education not only influences the time that is needed to find a suitable job; it also largely determines other aspects of a woman's future employment that are relevant for fertility decision-making. Most educations lead to a certain occupational sector, some even prepare students for a specific profession, and these sectors or professions differ in terms of employment security and the opportunities to combine work and family life (Hoem et al. 2006a). In many countries, the public sector offers much better job stability than the private sector. In addition, the public sector is often more likely to provide family-friendly work arrangements, such as part-time jobs, flexible work schedules or additional maternity leave arrangements (Ellingsæter and Rønsen 1996; Evans 2001). Being employed in the public sector should therefore increase the likelihood of childbearing (Hoem et al. 2006a, 2006b). However, the chances of getting a position in the public sector strongly depend on an individual's educational background. In Sweden, the share of publicly employed women is especially high in the areas of health and child care, social services, education, public administration and police work (Alestalo et al. 1991; Pierre 2008). Women who graduated with degrees that lead to one of these occupational areas might therefore have more children on average than women who graduated with degrees that primarily lead to occupations in the private sector.

A further difference between educational fields is related to the consequences that an interruption in employment due to childbirth has for future career opportunities. By staying at home to care for a small child, women not only miss the opportunity to

[34] This view is also supported by a qualitative study of Ranson (1998), who investigated the effect of educational and occupational choices on the transition to motherhood among university-educated women in Canada. The respondents in this study regularly cited the achievement of job security as an important factor that had influenced their considerations about when to become mothers. Women whose career paths were less straightforward, who experienced difficulties in establishing their careers or who needed to accommodate further education or career shifts were generally the ones who were most likely to postpone motherhood (Ranson 1998).

accumulate work experience, they also face the risk of skill depreciation due to the advancement in knowledge and working methods during their absence (see Chapter 2.2.2). Especially in occupational sectors that require technological skills, such as science and engineering, change progresses rapidly and skills become outdated quickly (Blau et al. 2002: 170).[35] Women educated in fields in which the risk of skill depreciation is high might therefore be more likely to remain childless than women whose educational qualifications do not deteriorate during employment interruptions (Hoem et al. 2006a).

Moreover, the probability of ending up in a male- or female-dominated occupational sector differs depending on the educational field a person has chosen. In most countries, the skewed distribution in the educational system is mirrored in the labour market. Thus, a high share of female employees is usually found in areas like health and social care, child care, teaching, personal services or clerical activities; while men dominate most occupations related to technology, construction, engineering or industrial production (e.g. Anker 1998a: 250-296; Melkas and Anker 2001; Blau et al. 2002: 133-144).[36] According to Hoem et al. (2006a, 2006b), childbearing should be more likely among women educated in fields that lead to female-dominated occupations than among women educated in fields that primarily lead to male-dominated occupations. The authors give several explanations for their assumption. First, employment areas with a high share of women provide an environment in which pregnancy and motherhood are quite common. Having the opportunity to talk with other women - and especially mothers - about issues and problems related to childbearing, childrearing and employment might have a positive influence on a woman's own

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[35] Skill depreciation may be mitigated through social policies that discourage long employment interruptions, as well as through educational policies that provide opportunities for recurrent education and retraining (Hoem et al. 2006a). Also firms can protect their employees against skill depreciation by establishing mechanisms that keep those that are on parental leave up-to-date (e.g. newsletters about important developments, evening or weekend courses that impart firm-specific knowledge, option to voluntarily participate in scheduled meetings).

[36] In occupations typically held by women, the degree of feminisation often decreases with increasing occupational status. In the health sector, for example, women dominate nursing, but they are less likely than men to be doctors. Women also outnumber men in the area of child care and primary school teaching, but they are underrepresented among the university teachers. In the area of personal services and clerical work, women predominate at lower status positions, such as shop assistant, waiter, hairdresser, telephone operator or secretary; but they are less likely than men to hold managerial or supervisory positions (Anker 1998a: 250-296; Melkas and Anker 2001).

childbearing behaviour (see also our corresponding argument in Chapter 3.3). Second, occupational sectors with a high share of female employees frequently offer better opportunities for combining work and family life. Employers in female-dominated sectors are more likely to be familiar with the needs of childrearing parents, and are probably more willing to offer family-friendly work arrangements, like part-time jobs or unpaid leave. Moreover, female-dominated areas are less likely to have time-intensive work norms, such as regular overtime. And, finally, occupational fields with a high share of women offer on average more exit and re-entry options with comparatively small consequences of job discontinuity on future career development (Lappegård 2002; Hoem et al. 2006a). A higher level of fertility in female-dominated occupations might, however, result not only from the availability of a fertility-promoting network, better opportunities for combining work and family, and a lower wage penalty for employment interruptions; but also from the fact that women with a strong preference for children might deliberately choose occupations with these characteristics (see our corresponding argument in Chapter 2.4).[37]

In sum, by choosing a particular field of education, women are already determining the basic characteristics of their future employment, which might in turn have an important influence on their childbearing behaviour. In the following chapters, we will provide more detailed information on the link between education and the labour market in the Swedish context.

3.4.1 The transition from school to work in Sweden

There are several pathways that Swedish adolescents can take when entering the labour market. They can leave school and enter the workforce at age 16, or continue to upper secondary school (although today almost all Swedes take the latter course). After three years of upper secondary school - either general or vocationally oriented - they can join the workforce or enrol in one of the numerous tertiary study programmes. Either at the beginning of upper secondary school or at the beginning of post-secondary studies, young Swedes have to choose a specific field of education, and all of these decisions

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[37] This line of argumentation can also be found in theories on occupational segregation by sex (see, for example, Anker 1998b; Estévez-Abe 2005).

about educational level and field will have a huge impact on how easy or difficult it will be for them to get established on the labour market.

In Sweden, as in many other countries, young people who are trying to gain a foothold in the labour market face a more competitive situation than older people who already have some work experience. As a consequence, unemployment levels are generally highest among those who have recently finished their education (see Table 3.3). During the economic crisis of the 1990s, when the Swedish labour market became tight, unemployment increased dramatically, especially among people under age 25. Between 1993 and 1997, more than 15 per cent of the 16- to 24-year-olds experienced unemployment, while the unemployment rate for the working population as a whole rose to only eight per cent.

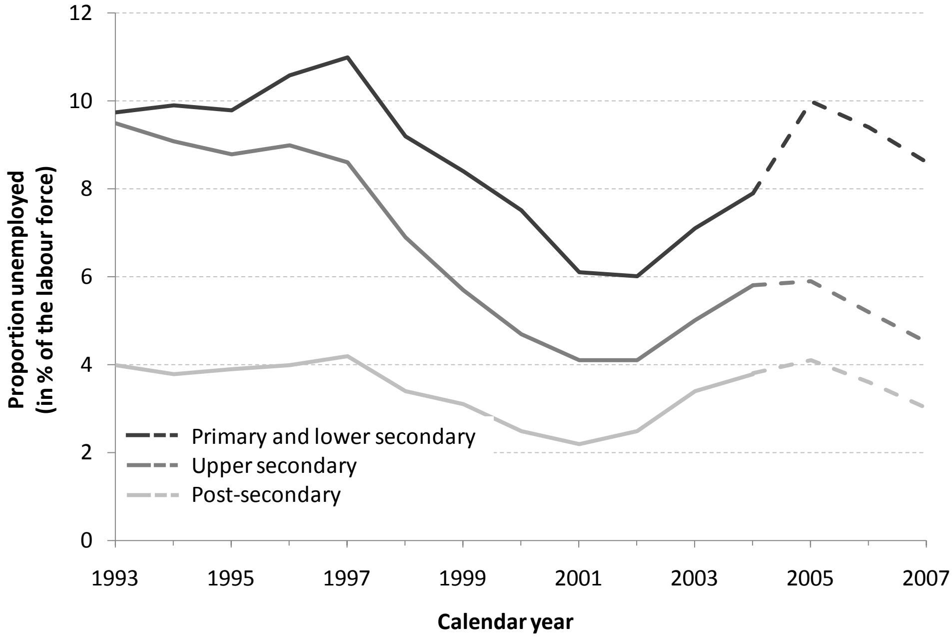
Table 3.3: Unemployment in Sweden by age in selected calendar years

Age group	Proportion unemployed (in % of the labor force)					
	1980	1990	1993	1997	2003	2007
16-64	2.0	1.6	8.2	8.0	4.9	4.6
16-24	5.0	3.7	18.4	15.4	10.2	11.7
25-54	1.3	1.2	7.1	7.1	4.3	3.7
55-64	1.6	1.5	5.5	7.4	4.1	3.5

Source: Statistics Sweden (2009d), own estimations
Note: Data are not strictly comparable over time due to changes in the registration of unemployment in 2005.

In addition to the association between unemployment and age, there is also an obvious connection between unemployment and educational level. Figure 3.8 shows that, irrespective of the state of the economy, unemployment is highest for those who only have qualifications from compulsory schooling. Unemployment is lower for those with an upper secondary school degree, and lowest for those with qualifications from higher education. During 2007, 8.6 per cent of Swedes with primary or lower secondary schooling were unemployed, compared to only 4.5 per cent of people with upper secondary qualifications, and 3.0 per cent of people with post-secondary training

Figure 3.8: Unemployment in Sweden by educational level for the period 1993-2007 (population aged 16 to 64)



Source: Högskoleverket (2007b: 29); Statistics Sweden (2009c)
Note: Data are not strictly comparable over time due to changes in the registration of unemployment in 2005.

With respect to educational field, unemployment in Sweden is highest among those who only have a general educational degree and those who completed their education in the field of humanities and arts: both had an unemployment rate of 7.4 per cent in 2007 (see Table 3.4).[38] People who were educated in teaching methods or teaching had the lowest levels of unemployment (1.8 per cent), followed by people with qualifications in health care, nursing or social care (2.5 per cent).

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[38] A high rate of unemployment among those with a general educational degree can be attributed to at least two factors. First, general educational degrees impart no labour-market specific knowledge. As a consequence, graduates with such a background often have more difficulties in entering the labour market than graduates with a specific educational qualification. Second, in Sweden only those who left school after compulsory school and those who graduated from an academically oriented upper secondary program (and did not continue to post-secondary studies) are listed as people with a general education. Thus, quite a number of people with a general educational field have only a low level of education, which increases their probability of experiencing unemployment.

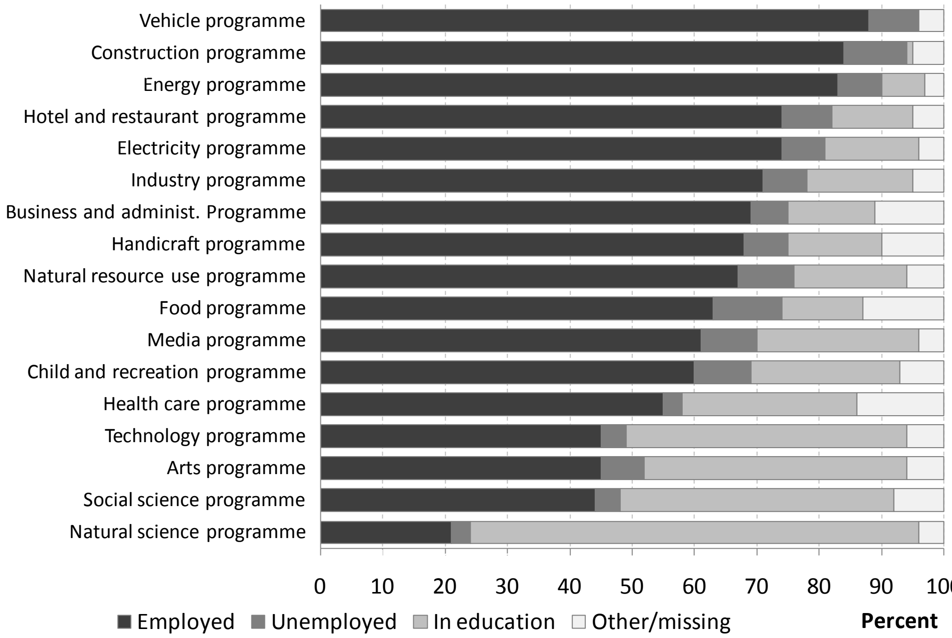
Table 3.4: Unemployment in Sweden by educational field in 2007 (population aged 16 to 64)

Educational field	Proportion unemployed in 2007 (in % of the labour force)
Total	4.6
General education	7.4
Teaching methods and teacher education	1.8
Humanities and arts	7.4
Social sciences, law, commerce, administration	3.5
Natural sciences, mathematics and computing	5.1
Engineering and manufacturing	3.7
Agriculture and forestry, veterinary medicine	3.7
Health care and nursing, social care	2.5
Services	4.2

Source: Statistics Sweden (2009b)

However, looking at differences in the levels of unemployment between people with different educational backgrounds offers only a glimpse at the effect that educational choices might have on young people's transitions from school to work. A more detailed picture can be drawn by analysing the path that students of different educational fields take after graduation. In spring 2008, Statistics Sweden conducted a survey of people who had completed upper secondary education in 2005. In total, for 52 per cent of the upper secondary school leavers of 2005, gainful employment was the main activity three years after graduation, while 37 per cent were in further education, and six per cent were unemployed or taking part in employment policy initiatives (Statistics Sweden 2008a: 19). As can be seen from Figure 3.9, the activity status three years after graduation from upper secondary school strongly depends on the programme a student has completed. Employment rates were highest among graduates of the vehicle, the construction and the energy programmes. At the same time, students with a degree in one of these fields had the lowest probability of taking up further studies. At 72 per cent, graduates of the natural science programme had the highest probability of continuing education. Graduates of the social science, the arts and the technology programmes were roughly equally likely to be in employment or in education three years after finishing upper secondary school. The proportion of unemployed people ranged from three to 11 per cent, with the lowest levels reported by graduates of the natural science, the social science and the health care programmes; and the highest levels reported by those who completed the food and the construction programmes. Unemployment was also fairly high among graduates of the media, the natural resource use and the child and recreation programmes.

Figure 3.9: Transition from upper secondary education to work - Main activity during the week of 31 March-6 April 2008 for those who left upper secondary national school programmes in 2005



Source: Statistics Sweden (2008a: 19-20)
Note: Employed also includes those who are self-employed; unemployed includes those without work as well as those who are in employment policy initiatives.

The survey conducted by Statistics Sweden also revealed that quite a high proportion of graduates of the arts, the media, the natural resource use and the child and recreation programmes felt impelled to continue their education for at least a certain amount of time after graduating from upper secondary school because they were not able to find a job (Statistics Sweden 2008a: 101-102).[39] Among those who were working in 2008, the probability of being employed within the appropriate vocational field was highest for those who had completed the construction or the energy

[39] Quite a number of occupations that required only an upper secondary school degree in the past (e.g. pre-school and after-school teaching) have been upgraded to the tertiary level in recent decades. High proportions of unemployed and of “involuntary” tertiary-level students among graduates from certain upper secondary school programmes - such as the child and recreation programme - probably indicate a shortage of available low- and medium-level jobs in these fields.

programmes, while very few graduates of the arts or the media programmes had a job appropriate to their education (Statistics Sweden 2008a: 39-40).

Differences in the transition from school to work were also found among graduates from different sectors of higher education (see Table 3.5). On average, 71 per cent of the students who graduated from higher education during the academic year 2003/04 had established themselves in the labour market in 2005, i.e. 12 to 18 months after receiving their degrees. Establishment rates were highest for physicians and nurses. Graduates with degrees in engineering, theology, economics, teaching, social work and social care also had relatively high rates of establishment in the labour market in 2005. Most groups of degree holders had between 60 to 90 per cent of their members established in the labour market within 12 to 18 months after graduation. Educational groups that deviated clearly from this pattern were holders of degrees in the fine arts and humanities, with only 29 to 40 per cent of graduates established in the labour market in 2005. Social scientists and natural scientists also had relatively low labour market establishment rates (49 to 58 per cent).[40] Higher establishment rates were reported for graduates with a master's degree than for graduates with a bachelor's degree, which indicates that, even within the tertiary sector, more time spent in education provided an advantage for a successful school to work transition.

Graduates from higher education who experience difficulties in entering the labour market due to their field of education often end up in jobs that do not really match their educational background. In Sweden, tertiary students with a degree in the area of humanities (with the exception of theology) or arts have an especially high risk of holding a job that does not correspond to their education. By contrast, only a very small proportion of graduates with a university degree in medicine, health care, dentistry, midwifery or architecture face this problem (Statistics Sweden 2008b: 61-63).

[40] Low establishment rates among graduates from social sciences, natural sciences and humanities might at least partly result from a relatively high number of graduates within these fields who enrol in postgraduate programmes to attain a licentiate or doctoral degree. The majority of them are funded by stipends. Postgraduate studies are also common within the fields of medicine and technology. However, in these fields it is more common to pursue postgraduate studies within the framework of employment, or parallel to it (Högskoleverket 2007b: 20-24)

Table 3.5: Transition from post-secondary education to work - Proportion of students graduating from post-secondary training in the academic year 2003/2004 who were established in the labour market by 2005 (in total and for selected fields of education)

Post-secondary educational field	**Proportion of those awarded degrees in 2003/04 who were established in the labour market by 2005 (in %)**
Total	71
Medicine	95
Specialist nursing	92
Dentistry	89
Pharmacy and pharmacology	85
Nursing	82
Dental hygiene	76
Engineering (master's degree)	76
Theology	75
Economics (magisterexamen)	73
Social work	72
Teaching	71
Social care	70
Engineering (diploma and bachelor's degree)	70
Economics (bachelor's degree)	68
Agricultural sciences, rural management, horticulture	67
Technology (master's degree)	66
Architecture	63
Technology (bachelor's degree)	61
Social sciences (master's degree)	58
Natural sciences (bachelor's degree)	53
Natural sciences (master's degree)	52
Social sciences (bachelor's degree)	49
Humanities (master's degree)	40
Humanities (bachelor's degree)	39
Fine arts	29

Source: Högskoleverket (2007b: 30)

3.4.2 Labour force participation - changes and gender differences

In the 1950s and 1960s, Sweden had a permanent shortage of labour that was filled by immigrant labour. In the mid-1960s, policy makers and trade unions became increasingly aware of the costs of immigration.[41] At the same time, there was a growing awareness that women should be treated as equal partners in society, and should be enabled to engage in paid employment on a par with men. Women were encouraged to seek employment in private industry, and especially in the quickly expanding public sector (Hoem and Hoem 1996). During the 1970s, the Swedish government intensified its efforts to increase the supply of female labour and to facilitate entry into the labour market for all women, regardless of their marital or motherhood status. In 1971, the system of joint taxation was replaced by individual taxation, which implied a considerable reduction in the marginal tax rate of married women. Other policy measures, that were instrumental in increasing women's employment, were the rapid expansion of highly subsidised childcare facilities, and the introduction of a six-month paid parental leave in 1974 that was extended several times in the following years (Sundström 1999) (see also Chapter 3.2.1).

As a result of both the government's efforts to combat the shortage of labour by increasing the supply of female labour, and the quest for economic independence and equality among Swedish women, female employment rates increased in Sweden continuously from the late 1960s until the beginning of the 1990s. Since the 1970s, women's labour force participation rates have been among the highest in the developed world, nearly catching up to those of men from the late 1980s onwards (Oláh and Bernhardt 2008). During the economic crisis of the 1990s, labour force participation rates decreased for both sexes, since a considerable number of men and women reacted to the unfavourable situation on the labour market by prolonging their educational career or by re-entering the educational system. In addition, unemployment rates increased for both sexes, and for the first time unemployment was higher among men than among women (see Figure 3.10, notice note 2).

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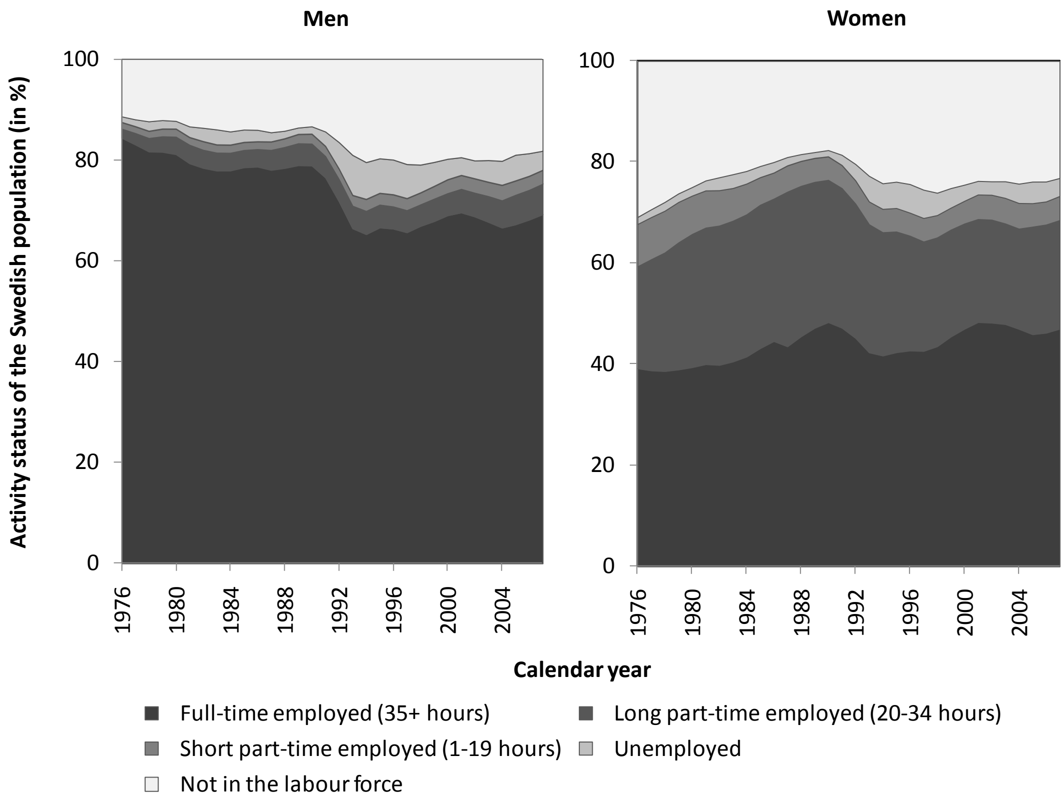
[41] In Sweden, the social costs for immigrant labour were comparatively high, since Sweden permitted family immigration relatively early, and made strong efforts to integrate foreign citizens into Swedish society (e.g. monetary support to learn Swedish, granting of social security and other benefits) (Hoem and Hoem 1996).

Figure 3.10: Activity status of the Swedish population for the period 1976-2007 (Swedish men and women aged 16 to 64)



Source: Statistics Sweden (2009d), own calculations

Notes: (1) Data are not strictly comparable over time due to changes in the survey method in 1986, 1993 and 2005. (2) The labour force participation rate (in per cent) for a certain year results from 100 per cent reduced by the percentage of those who are not in the labour force in the respective year.

When referring to Sweden as one of the most egalitarian countries with respect to the integration of women into the labour market, it is important to keep in mind that the high figures for female labour force participation hide a substantial degree of part-time work and absence, especially due to child care (see Figure 3.10 and Table 3.6).[42] At the beginning of the 1980s, more than 46 per cent of employed women were registered as working part-time. Since then, the proportion of part-timers among Swedish women had decreased to 35.9 per cent in 2007; a level that was still three times as high as that of men (11.4 per cent in 2007). However, as can be seen in Figure 3.10, most Swedish part-time workers have rather long weekly hours. In 2007, roughly 82 per cent of all

[42] In this context, it is important to note that women who are on parental leave are counted as in the labour force.

female part-time employees worked 20-34 hours per week.[43] A comparison of labour force participation rates and at-work rates for Swedish women reveals that the rise in female labour market participation in Sweden was not accompanied by an equally large increase in the proportion of women who were actually at work (see Table 3.6). Especially among mothers of pre-school children, there are large differences between labour market participation and presence in the workplace.[44]

Table 3.6: Labour force participation rates and at-work rates for Swedish women aged 16 to 64 in selected calendar years

Calendar year	All women		Women with children (0 to 6 years old)	
	Labour force participation rate (in %)	At-work rate (in %)	Labour force participation rate (in %)	At-work rate (in %)
1976	69.1	56.1	62.9	45.6
1980	75.0	58.6	75.2	50.5
1985	79.2	62.1	84.1	55.2
1990	82.3	63.0	86.3	52.1
1995	76.1	58.0	79.3	51.1
2000	75.5	58.3	79.7	53.1
2004	75.7	57.5	80.3	49.9
2007	76.8	60.1	82.8	-

Source: Statistics Sweden (2009d, 2009e), own calculations
Note: In addition to absences due to child care, extended holidays or illness; unemployment is also responsible for differences between labour force participation rates and at-work rates. However, the effect of unemployment is rather small, especially in times when unemployment is low. To account for the increase in unemployment in the 1990s, we also estimated the development of at-work rates under the assumption that unemployment has remained at the level of 1976 (results not shown). In this case, at-work rates for all women would have been 2.2 percentage points higher in 1995 and between 1.0 and 1.4 percentage points higher in 2000, 2004 and 2007.

In addition, vertical as well as horizontal sex segregation persists in Sweden, despite the strong emphasis on gender equality in the labour market and in society (Stanfors 2003: 94). In any given type of occupation, women usually have lower

[43] All numbers in this paragraph are calculated on the basis of the Swedish Labour Force Surveys (Statistics Sweden 2009d).

[44] In 2007, the labour force participation rate for Swedish men was 81.7 per cent and the at-work rate was 67.9 per cent. Unfortunately, Statistics Sweden does not provide these data separately for men with children.

positions than men. This underrepresentation of women at higher status positions is especially strong in the private sector. Although pay differentials between men and women are small in Sweden compared to most other industrialised countries, women still receive substantially less pay than men (Melkas and Anker 2001).[45] There have been some reductions in occupational segregation since 1970, as better educated and more career-oriented women have started to move into traditionally male-dominated areas of study and work (Stanfors 2003: 95). However, horizontal occupational segregation in particular has remained comparatively high in Sweden (Erikson and Jonsson 2003; Charles and Grusky 2004). According to Melkas and Anker (2001), this can be attributed to the fact that Sweden not only has a high percentage of men working in male-dominated occupations (which also applies to many other OECD countries), but also a high percentage of women working in female-dominated occupations. In Sweden, approximately half of the employed non-agricultural female workforce is in “female” occupations that are predominantly associated with social care and welfare, child care, pre- and primary school teaching, nursing, service or office work. The public sector has been, and continues to be, a very important employer for Swedish women, since typically female areas of work like education, health care, child care and social services are virtually monopolised by the state (Melkas and Anker 2001). In 2007, approximately half of all female employment was in the public sector, compared to 18 per cent of male employment (Statistics Sweden 2009a).

3.5 Concluding remarks on the institutional framework and demographic patterns

In the previous sections, we described how certain aspects of the institutional framework might affect educational choices and fertility decisions. In a first step, we argued that parents’ childbearing decisions, as well as the relationship between

[45] According to the Swedish Institute (2004b), most of the income gap between men and women can be explained by the high incidence of part-time work among women. Women also earn a smaller share of overtime pay and shift-work bonuses. Much of the remaining gap is attributable to differences in the distribution of men and women according to age, occupation and education. However, pay differentials of between one and eight per cent can not be explained by any factor other than gender.

women’s education and fertility, are mediated through public policies. They determine how easy or difficult it is to combine gainful employment and childrearing. Moreover, they can mitigate employment risks, as well as opportunity costs that are connected to childbirth.

In Chapter 3.2.1 we showed that the Swedish welfare state had been quite successful in promoting the compatibility of female productive and reproductive work. As a result, contemporary Sweden stands out as a society in which egalitarian family ideals are more prominent than in most other industrialised countries. Likewise, cohort fertility levels, as well as female labour force participation, are among the highest in the Western world (see Chapters 3.2.2 and 3.4.2). Keeping the Swedish welfare model in mind, there are two aspects of the relationship between education and fertility that should be taken into account. The first pertains to the optimal timing of entering motherhood for women with different educational levels. According to economic models of fertility timing, there is no clear answer to the question of whether postponing births is more or less advantageous for those with higher than for those with lower qualification levels. On the one hand, highly educated women are more likely to have a steeper earnings profile at younger ages and higher rates of skill depreciation, which points to a stronger positive effect of postponing births for those with high levels of qualifications. On the other hand, highly educated women normally take shorter periods of leave, which leads to a weaker positive effect. We concluded that the answer to the question of whether the incentive to postpone births is stronger for less educated or highly educated women therefore depends on how much the duration of parental leave varies relative to the profile of human capital investments and the rate of skill depreciation between women with different educational levels (see Chapter 2.2.2). However, due to its structure, we believe that the Swedish parental leave system is likely to diminish differences in the length of parental leave taken by women with different educational qualifications. This view is supported by Duvander et al. (2005), who noted that the introduction of parental leave in Sweden led to a homogenisation of child care and to strong norms in how to care for small children. Today, all Swedish children, regardless of their parents’ education, income or labour market status, are likely to stay at home with a parent for at least one year before other forms of child care

are initiated.[46] Against this background, highly educated Swedish women should have a stronger incentive to postpone births than their less educated counterparts, since in Sweden educational differences in work interruption due to childbirth are presumably negligible compared to educational differences in the profile of human capital investments and in the rate of skill depreciation. The second aspect that should be considered is related to differences in the childbearing behaviour of women trained in different educational fields. In modern welfare states like Sweden, social policies directed at working mothers are often designed to make family life and female labour market participation more compatible. However, as indicated by Lappegård and Rønsen (2005), social policies may generate different responses from women with different educational backgrounds. Long parental leaves and generous family benefits may fit better with a career track in certain types of occupations, and may thus be perceived as reducing the opportunity costs of childbearing for some women more than for others.

In Chapter 3.3, we argued that the relationship between female education and fertility may be influenced not only by social policies, but also by the institutional context in which young women are educated, and in which they make decisions about the field and the duration of their education. Important aspects are, for example, the organisational structure of an educational system (general vs. vocational); the age at which crucial decisions about the educational career have to be made; the degree of flexibility in the system, which encourages or hampers changes in education at a later point in life; and the degree of gender segregation within the educational system. We argued that all of these factors not only have a decisive impact on a woman's educational career, but also influence (i) the social environment in which young women grow up, and in which attitudes and future aims regarding childbearing and employment are formed; and (ii) the actual conditions under which individual fertility behaviour takes place.

Finally, we pointed out that the relationship between educational attainment and childbearing might be affected through the link between education and the labour

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[46] Further support is given by a study by Berggren (2004), who analysed how Swedish mothers and fathers use parental insurance and how long they are on parental leave. The study showed that, in Sweden, the average amount of time spent in parental leave was lowest among women with only primary or lower secondary education, while there is nearly no difference between those with upper secondary education and those with higher qualifications.

market (see Chapter 3.4). By choosing a particular field of education, women largely determine their future labour market options (e.g. how easy it becomes to find a suitable job, employment stability, income opportunities), their employment conditions (e.g. shift work, option to work part-time) and the consequences that an interruption due to childbirth will have for their future employment career (degree of skill depreciation). These features are very likely to have an important bearing on women's decisions about whether and when to have children. We argued that women, who graduate from educational fields characterised by a tight link between education and the labour market, secure employment prospects and a high propensity to become established in a female-dominated area (with family-friendly working conditions and a low wage penalty for employment interruptions), probably are faster in their transition to motherhood, and are more likely to continue childbearing. We also explained why rates of childbearing tend to be lower among women educated in fields that lack an obvious set of occupations, that do not lead to a reliable employment career, and that primarily prepare for male-dominated occupations (with time-intensive work norms, a male-dominated work environment and a high wage penalty for employment interruptions).

At the end of CHAPTER 2, we concluded that classical theoretical frameworks do not contribute a lot to the explanation of fertility differentials among women educated in different fields of education. However, CHAPTER 3 has shown that by taking into account institutional aspects it is possible to deduce quite concrete assumptions about the impact of educational field on fertility decisions. Nevertheless, we are well aware of the possibility that higher levels of fertility for women with certain educational qualifications might result not only from a causal impact of education on fertility, but also from the fact that events in the fertility domain might affect women's educational decisions, and thus their educational outcomes (see Chapter 2.3). In addition, we have to keep in mind that there might be factors - such as the parental background, or individual preferences, values and attitudes - that simultaneously affect educational trajectories and fertility decisions of women (see Chapter 2.4).

In the previous chapters, we have elaborated theoretical frameworks (CHAPTER 2) and institutional aspects (CHAPTER 3) that are related to the various aspects of the linkage between female education and fertility. Using these considerations as a basis, we now proceed to the empirical part of this study. In CHAPTER 5, CHAPTER 6 and

CHAPTER 7, we present empirical investigations on three different aspects of the link between a woman's educational career and her childbearing behaviour. First, however, we describe how interrelated processes can be studied empirically, and we provide some information on the data that we use for our analyses.

CHAPTER 4

Methodological aspects: How to study interrelated processes empirically

4.1 Description of methods

We use *event history techniques* to examine the dynamic interrelations between educational trajectories and fertility transitions of women. Since the 1980s, event history analysis - also known as survival analysis, hazard regression analysis, intensity regression analysis, failure-time analysis, duration analysis or transition analysis - has become one of the principal toolkits of demography and life course research in general (Billari 2005). As indicated by Hoem (1993b), this method can be viewed as an extension of the cluster of methods connected to life table and standardisation techniques that have been used extensively by demographers in the past.[47]

Event history analysis models a hazard function (also referred to as hazard rate or transition rate). The hazard function describes the probability that an event (e.g. first birth) occurs to an individual during a specified time interval (t, t+ Δt), given that the individual has not experienced the event before the start of that interval (Yamaguchi 1991: 9-10; Blossfeld and Rohwer 2002: 32). Event history analysis thus focuses on the

[47] Event history modelling is, nowadays a well-known and frequently used approach in demography, as well as in other social sciences. We therefore do not describe in detail every statistical aspect of the underlying concept, but rather give a short overview of the general idea of event history analysis, and highlight some aspects that are of importance for our study. For a thorough description of the event history approach, as well as its statistical foundation see, for example, Yamaguchi (1991), Blossfeld and Rohwer (2002), Courgeau and Lelievre (2002) or Box-Steffensmeier and Jones (2004).

time-to-event as the dependent variable. Time-to-event is linked to explanatory variables (covariates) that can be grouped into time-constant covariates (e.g. gender, race) or time-varying covariates (e.g. education, civil status), either at the individual level or at an aggregate level (e.g. macro-level indicators, such as the unemployment rate). Event history techniques allow scientists to explain events in one life domain (e.g. first birth in the fertility domain) by taking into account relevant aspects of the past history of other life domains (e.g. educational domain, employment domain, union status domain), and thus to study the complex interdependencies between life course trajectories. In addition, event history analysis may take into account unobserved factors underlying these complex interdependencies (Billari 2005).

For our empirical investigations, we use a *multiplicative intensity regression model* (or proportional hazard model). In such a model, the coefficients of the covariates affect the hazard function in a multiplicative manner, which means that they shift the baseline hazard proportionally without altering its shape. The proportionality assumption can be partially relaxed by including interactions between the baseline function and the covariates. A general mathematical representation of the hazard function in the form that we use it is:

$$\ln \mu_i(t) = y(t) + \sum_m \alpha_m x_{im} + \sum_n \beta_n w_{in}(t)$$

where $\ln \mu_i(t)$ is the logarithm of the risk of occurrence of the event for individual i at process time t, $y(t)$ represents the baseline hazard duration dependence, x_{im} the time–constant categorical covariates, w_{im} the time–varying categorical covariates, and α and β the respective regression parameters. In our analyses, the baseline hazard duration dependence is always modelled as a piecewise linear spline (also known as generalised Gompertz or piecewise linear Gompertz).

In addition to including categorical covariates, some software packages (e.g. aML) also make it possible to incorporate time-constant and time-varying variables in a continuous form. We will make use of this option in our empirical investigations. The formula then reads:

$$\ln \mu_i(t) = y(t) + z_k(u_{ik} + t) + v_l(u_{il}) + \sum_m \alpha_m x_{im} + \sum_n \beta_n w_{in}(t)$$

where $z_k(u_{ik}+t)$ denotes a piecewise linear spline representation of the effect of a covariate that is a continuous function of process time t (e.g. calendar time), while $v_l(u_{il})$ symbolizes a piecewise linear spline representation of the effect of a continuous variable that is constant in time (e.g. woman's age at previous birth).

Scientists are often confronted with the problem that the data they have at their disposal do not contain all the information that are relevant for the process under study. To capture variation resulting from the omission of key explanatory variables (e.g. attitudes, preferences) event history techniques provide the opportunity to include an extra term for *unobserved heterogeneity* in the model.

$$\ln \mu_i(t) = y(t) + z_k(u_{ik} + t) + v_l(u_{il}) + \sum_m \alpha_m x_{im} + \sum_n \beta_n w_{in}(t) + \varepsilon_i$$

The heterogeneity component, denoted with ε_i in the equation above, controls for unobserved person-specific factors that are constant over time, and it is usually assumed to be normally distributed with zero mean and a standard deviation to be estimated.[48]

$$\varepsilon_i \sim N(0, \sigma^2)$$

Sometimes unobserved determinants not only affect the event under study, but also some individual-level characteristics that are supposed to serve as explanatory covariates in the model. To give an example, the risk of first birth might be influenced by a woman's level and field of education, and by unobserved factors, such as the parental background or attitudes and preferences concerning children.[49] As we argued in Chapter 2.4, these unobserved factors probably also influence a woman's outcome in the educational domain. Women's childbearing behaviour and women's educational trajectories might therefore be jointly determined by the same unobserved woman-specific characteristics. Models that do not take this aspect into account might lead to biased results for the impact of educational level and educational field on childbearing.[50] A common procedure for dealing with unobserved, and presumably

48 Other possibilities exist, but we will not make use of them here.

49 In addition to educational level and educational field, there certainly are other observed factors that influence women's risk of first birth. However, we neglect them in order to keep the example as simple as possible.

50 Likewise, studies interested in the effect of childbearing on women's educational trajectories might lead to biased results if the joint determination of events in both life domains due to unobserved characteristics is neglected.

correlated, heterogeneity is the *simultaneous equation approach* (multiprocess modelling) proposed by Lillard (Lillard 1993; Lillard and Panis 2003). This technique allows unobserved heterogeneity to be correlated across two or more processes, and thus enables scientists to control for unmeasured factors that simultaneously influence the processes under study. The hazard rate equations then read:

$$\ln \mu_i^A(t) = y^A(t) + z_k^A(u_{ik} + t) + v_l^A(u_{il}) + \sum_m \alpha_m^A x_{im} + \sum_n \beta_n^A w_{in}(t) + \varepsilon_i^A$$
$$\ln \mu_i^B(t) = y^B(t) + z_k^B(u_{ik} + t) + v_l^B(u_{il}) + \sum_m \alpha_m^B x_{im} + \sum_n \beta_n^B w_{in}(t) + \varepsilon_i^B$$

where ε_i^A and ε_i^B represent unobserved heterogeneity components capturing all unobserved person-specific factors that are constant over time and relevant to process *A* and process *B*, respectively. The heterogeneity components are usually assumed to follow a joint bivariate normal distribution:

$$\begin{pmatrix} \varepsilon_i^A \\ \varepsilon_i^B \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{\varepsilon^A}^2 & \rho_{\varepsilon^A \varepsilon^B} \\ \rho_{\varepsilon^A \varepsilon^B} & \sigma_{\varepsilon^B}^2 \end{pmatrix}\right)$$

where $\sigma_{\varepsilon^A}^2$ and $\sigma_{\varepsilon^B}^2$ denote the standard deviations of the person-specific residuals and $\rho_{\varepsilon^A \varepsilon^B}$ is the correlation between the residuals. In our empirical analyses of the link between education and fertility, we repeatedly control for unobserved characteristics affecting our results (e.g. in Section 5.6, CHAPTER 5 and in Section 6.4, CHAPTER 6). In addition, we apply the simultaneous hazard equation approach when we examine whether educational trajectories and fertility transitions are correlated due to common determinants that simultaneously affect both life domains (CHAPTER 7).

We performed the event history analyses with the help of the statistical software package aML, version 2.09, developed by Lillard and Panis (2003). For data management, data preparation and the production of descriptive statistics we used STATA, version 11.0.

4.2 Events under study

In the theoretical part of this study, we argued that the relationship between education and fertility is exceedingly complex, and we outlined three possibilities for how a woman's educational trajectory might be linked to her childbearing behaviour. We first argued that a woman's educational background might influence her decisions about whether and when to have children, as well as the number of children she finally has. However, we also pointed to the fact that childbearing might lead to changes in a woman's educational career. Finally, we addressed the possibility that common and usually unobserved factors - such as the parental background, preferences or personal traits - might simultaneously affect a woman's fertility behaviour and educational trajectory. In the empirical part of this study, we carry out investigations on all three aspects of the link between education and fertility. In the following, we give some first information on the events that we concentrate on (for an overview, see also Table 4.1).

To explore the *impact of education on women's childbearing behaviour*, we estimate event history models for the transition to a first, second and third conception (CHAPTER 5). Contrary to most previous research, which mainly concentrated on the effect of educational enrolment and the impact of educational level on fertility, we also include educational field as a third dimension of education. In addition, we pay attention to the role of unobserved heterogeneity as a potential source of biased estimates for the effect of education on women's reproductive behaviour.

Subsequently, we investigate *how childbearing affects women's educational trajectories* (CHAPTER 6). We are interested in the question of whether women re-enter the educational system after becoming a mother to pursue a further degree in a different field of education. In particular, we want to find out whether the field a woman is trained in plays a decisive role in her decision to pursue further training/re-training after childbirth. To analyse this aspect, we estimate an event history model for women's risk of undergoing a change in educational field after becoming a mother (Section 6.3). To be able to draw more general conclusions, we additionally carry out an event history analysis for the impact of motherhood status on women's risk of educational change (Section 6.4).

Finally, we analyse *whether educational trajectories and fertility transitions are correlated due to unobserved determinants that simultaneously affect both life domains* (CHAPTER 7). We estimate a simultaneous hazard equation model for women's risk of conceiving a first, second and third child, and women's choices of educational fields. With the help of this model, we want to find out whether unobserved characteristics (e.g. parental background, preferences) simultaneously affect women's risk of childbearing and women's risk of choosing a particular field of education.

We explain our motivation for the choice of these particular events and specify the processes that we study in greater detail in each empirical chapter.

Table 4.1: Summarising overview of the events under study

Chapter	Event in a woman's life	Explanatory focus
5	• First conception • Second conception • Third conception	• Educational enrolment • Educational level • Educational field
6	• First change in field after entering motherhood (mothers)	• Educational field at entering motherhood
	• Changes in educational field (childless women and mothers)	• Motherhood status • Previous educational field
7	• Joint model of first, second and third conceptions & educational choices (educational choice: first attainment of a degree in teacher training, health care and welfare or agriculture, forestry and animal health)	• Simultaneous impact of unobserved factors (e.g. parental background, preferences)

4.3 Choice of data

To analyse the relationship between a women's educational trajectory and her childbearing behaviour, detailed information on both life domains are required. In this study, we use Swedish register data that were compiled by Statistics Sweden from a number of different databases. In 2005, Statistics Sweden extracted a 25 per cent sample of people born between 1950 and 1985 from the *Historiska befolkningsregistret* (HBR).[51] The HBR provided a personal identification number (which is necessary for

[51] Since 1968, Statistics Sweden has recorded a large amount of data on the population and population changes within the framework of the *Register över totalbefolkningen* (RTB). Each year, a register on the situation at the end of the year and a register on the demographic events that happened during the year are produced, in both cases with data at the individual level. In order to improve the availability of that data, and for ease of use, Statistics Sweden constructed a historical database. At the beginning of each year, the *Historiska befolkningsregistret* (HBR) is adjusted for demographic events that occurred during the previous year. Thus, the HBR provides longitudinal information on all persons registered in Sweden for the period from 1969 onwards (Statistics Sweden 2006a). Individuals born between 1950 and 1969 are only registered in the HBR (and included in my data) if they survived until 1969.

combining information from different registers), as well as information on migration, civil status changes and mortality. These data have been extended by information about individuals' birth date, sex and fertility history from the *Flergenerationsregistret* of 2005.[52] In addition, the *Longitudinell Integrationsdatabas för Sjukförsäkrings- och Arbetsmarknadsstudier* (LISA) has been used to obtain individual information on various educational variables and labour market characteristics.[53] Upon checking the data, we discovered that the information provided on individuals' civil status histories and municipality histories were incomplete. For both variables, there was only information for individuals who changed their civil status or municipality at least once in their life. On request, Statistics Sweden additionally extracted yearly information on civil status and community from the *Register över totalbefolkningen* for the years 1968 to 2005 for all individuals in the sample. Table 4.2 gives an overview of the data provided by Statistics Sweden.

The data that we have at our disposal include complete retrospective histories of childbearing, national and international migration, marriage formation and marriage dissolution to the accuracy of a month. However, individual information on education and participation in the labour market are only available for the period 1990 to 2004, and the data are on a yearly basis.

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52 The *Flergenerationsregistret* contains information about the biological or adoptive parents of all persons who have been registered in Sweden at some point in time since 1961, and who were born in 1932 or later (Statistics Sweden 2006b).

53 The longitudinal database LISA integrates existing data from the labour market, educational and social sectors. The database consists of annual registers since 1990 and includes all individuals aged 16 and older who were registered in Sweden as of 31 December for each year.

Table 4.2: Overview of the data provided by Statistics Sweden and the registers used

Information	Source
• Personal identification number	Historiska befolkningsregistret (2005)
• Sex	Flergenerationsregistret (2005)
• Birth country	Flergenerationsregistret (2005)
Monthly information on:	
• Birth date	Flergenerationsregistret (2005)
• Death date	Historiska befolkningsregistret (2005)
• Immigration(s) to Sweden	Historiska befolkningsregistret (2005)
• Emigration(s) from Sweden	Historiska befolkningsregistret (2005)
• Municipality changes and municipality before and after change	Historiska befolkningsregistret (2005)
• Civil status changes and civil status before and after change	Historiska befolkningsregistret (2005)
• Birth dates and sex of children	Flergenerationsregistret (2005)
For the years 1990 to 2004 yearly information on:	
• Educational level	LISA (2004)
• Educational field	LISA (2004)
• Receipt of financial aid for students (yes/no)	LISA (2004)
• Employment status	LISA (2004)
• Employment sector	LISA (2004)
• Employment branch	LISA (2004)
• Income	LISA (2004)
• Receipt of unemployment benefits (yes/ no)	LISA (2004)
For the years 1968 to 2005 yearly information on:	
• Civil status	Register över totalbefolkningen (1968-2005)
• Community	Register över totalbefolkningen (1968-2005)

The extracted register data were stored as various SQL-data files on a server in Sweden. We accessed the data via MONA, the Swedish system for external access to micro data. Since the data we use were newly compiled, extensive data editing and testing of data quality was necessary. A detailed report on all the steps carried out can be found in Appendix A. In the following, we only briefly describe an important change in the registration of educational qualifications in Sweden that took place in 2000, as well as its consequences for our empirical investigations.

In the year 2000, the Swedish system of educational classification underwent a revision in order to adapt the Swedish standard to the international standard for classification of education (ISCED 1997).[54] In addition to adapting the classification of educational qualifications to the international standard, Statistics Sweden also added information from a number of new data sources to the register. These new data sources contained, for example, information on the total number of approved points from adult education attained in 1988 or later (not necessarily completed upper secondary education) and the total number of approved points from higher education attained in 1993 or later (not necessarily completed tertiary education). We have to take into account the “delayed” incorporation of this information into the Swedish educational register for two reasons. First, for a number of individuals, our data probably report changes in educational level and educational field in the year 2000, although the reported educational qualifications might have been attained previously. Second, from 2000 onwards, the Swedish educational register (and thus also our data) allows us to distinguish very clearly between complete and incomplete educational qualifications at a given level. Unfortunately, this clear distinction is not possible for the years before the revision of the Swedish system of educational classification.[55] Thus, we are not able to differentiate between complete and incomplete educational qualifications at a given level for the years 1990 to 1999. We will describe how we handle these two items in our analyses at the beginning of each empirical chapter, when we discuss in detail the method used, the sample selection and the construction of our variables.

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[54] In Appendix A we described how we adjusted the data on educational qualifications for the years 1990 to 1999 to the data for the years 2000 to 2004.

[55] According to Hans Odelholm from Statistics Sweden educational qualifications registered within the old Swedish system of educational classification cannot be separated at all into complete and incomplete educations at the upper secondary level. For tertiary educations, the old classification comprised some codes that indicated incomplete educations. However, in order to figure out the respective codes, it would be necessary to go through all the codes of the old classification (more than 4,000), and to consider all the changes that the old classification went through between the years 1990 to 1999. We refrained from carrying out this work.

CHAPTER 5

The multidimensional impact of women's education on fertility

5.1 Introduction

In the first empirical part of this dissertation, we investigate the role of women's education in childbearing patterns in Sweden. Unlike most other researchers, who have focused only on two dimensions of education – namely, the effect of educational enrolment and the impact of educational level - we acknowledge that there is also a third dimension – namely, educational field - that might influence women's childbearing behaviour independently of the other two dimensions. We have structured our analysis in the following way. In Section 5.2, we briefly review previous research findings and formulate specific hypotheses based on theoretical concepts, institutional aspects and previous empirical findings. Section 5.3, deals with the sample selection, the choice of variables and the method used for the analysis of first, second and third birth risks. Since women's education is generally expected to have a different impact on births of different orders, we analyse the transition to a first, second, and third child separately in Sections 5.4 and 5.5. In Section 5.6, we take into account selection by modelling first, second and third birth risks jointly, with a common factor for unobserved heterogeneity. We conclude this first empirical part with a short discussion of our main findings in Section 5.7.

5.2 Previous empirical findings and research hypothesis

In most societies, **enrolment in education** and childrearing are regarded as incompatible, either for practical reasons (monetary constraints, time constraints), or because of normative expectations that students should not become parents before they have finished education (Rindfuss et al. 1988: 21; Blossfeld and Huinink 1991; Lappegård and Rønsen 2005). Consequently, educational activity is generally assumed to be associated with a low childbearing risk. Empirical investigations have consistently supported this assumption by showing that educational enrolment reduces the risk of entering motherhood (e.g. Marini 1984; Blossfeld and Huinink 1989; Kravdal 1994, 2007; Blossfeld 1995; Hoem 2000; Santow and Bracher 2001; Andersson and Scott 2005; Kreyenfeld and Konietzka 2008). In a study on the impact of education on the transition to a first child in Norway, Lappegård and Rønsen (2005) additionally distinguished between various types of educational activity. The authors found a negative effect of being enrolled for all types of educational activity. However, they also showed that there are significant differences in how inhibiting the student role is for starting a family. According to the study by Lappegård and Rønsen, the negative effect of educational enrolment is strongest during compulsory schooling. At the upper secondary school level the negative effect was found to be much less pronounced within vocational than within academic fields. The authors suggested that this finding might be attributed to higher aspirations for further education among women in academic upper secondary programmes. At the university level, Lappegård and Rønsen detected a much stronger negative effect of being enrolled in education among those in male-dominated fields of study than among those in female-dominated fields. According to the authors, this finding might be related to greater difficulties in combining studies and motherhood in male-dominated fields, and to higher career aspirations among women enrolled in these fields. However, selection effects might also be an explanation; i.e. women with a strong preference for children may be more likely to be enrolled in a typical female field of study (see Chapter 2.4). Likewise, socialisation effects or bandwagon effects might play a role. Being surrounded by women offers more opportunities to exchange opinions about the compatibility of studying and childrearing, and increases the likelihood of experiencing how other women become mothers (see Chapter 3.3). As was previously suggested by Hoem (1993a), even childbearing can be "contagious". Being surrounded by women who are about to start a family or who already have entered motherhood might therefore encourage a woman to start childbearing, even if she is still in education.

Studies on the impact of women's education on higher order births have shown that educational activity not only reduces women's risk of entering parenthood, but also of continuing with childbearing (e.g. Berinde 1999; Oláh 2003; Lappegård 2006; Gerster et al. 2007; Kravdal 2007; Andersson and Scott 2007). Only a few studies compare the strength of the negative effect of educational activity for women at different parities. For Sweden, Andersson and Scott (2005, 2007) and Thalberg (2009) reported a fairly similar negative effect for mothers (regardless of their parity), which was, however, much lower than the effect for childless women. Studies on Norway carried out by Lappegard (2006) and Kravdal (2007) revealed a weaker negative effect of educational activity on further childbearing for two-child mothers compared to one-child mothers. We also expect to find that educational enrolment impedes motherhood most strongly among childless women. For mothers, the negative effect of being in education on further childbearing should be less strong, since they already have experience in raising a child while being in education, and might have found an effective way to handle this situation. In addition, mothers who still participate in education often do so at a higher level where the negative effects of school enrolment have been found to be less strong. Thus, our hypothesis regarding the effect of educational activity reads as follows:

H5-I: Women who are still enrolled in education will have lower birth rates than women who are no longer enrolled. The negative effect of educational enrolment on fertility will be strongest for the transition to a first child.

The results of studies concerning the effect of **educational level** on the risk of entering motherhood are highly inconsistent, reaching from negative (e.g. Martín-García and Baizán 2006); or negative, but disappearing with women's increasing age (e.g. Liefbroer and Corijn 1999); up to no major impact (e.g. Kreyenfeld and Konietzka 2008); or even a positive one (e.g. Lappegård and Rønsen 2005).[56] For Sweden, Santow and Bracher (2001) reported a u-shaped relationship between educational attainment

[56] See also Chapter 2.2.5.

and first birth rate, with the lowest risk of starting a family found for those with a medium educational level.[57] Lappegård and Rønsen (2005) concluded that the size and the direction of the effect of women's educational attainment on the risk of entering parenthood is quite sensitive to the specification of the model (e.g. educational level as a fixed vs. time-varying covariate, the effect of educational level estimated jointly vs. separately for those who are in education and those who are out of education), which has been confirmed empirically by Kravdal (2007).

Recent studies on higher order births in Nordic and Western European countries have shown a uniform pattern; namely, that transition rates to a second and a third child increase with women's educational level (e.g. Hoem 1996; Kravdal 2001, 2007; Oláh 2003; Lappegård 2006; Gerster et al. 2007; Kreyenfeld and Konietzka 2008). Since these findings contradict traditional economic theories and theories on social-structural or cultural changes that predict lower levels of fertility for highly educated women (see Chapter 2.2.1 and Chapter 2.2.3), a number of alternative explanations have been proposed (time-squeeze effect, partner effect, selection effect, invalidity of the opportunity cost argument in modern societies, etc.).[58] We base our hypothesis regarding the impact of educational level on fertility on previous empirical research results, and expect to find the following linkage in our Swedish data:

H5-II: After women have finished school, those with higher levels of education will have higher transition rates to a second and third child. For the risk of entering motherhood, we expect to find a u-shaped relationship, with the lowest first birth rates for those with a medium educational level.

While researchers have paid a lot of attention to the detrimental effect of educational enrolment on women's risk of entering motherhood, and to the relationship between female educational level and fertility, the role of **educational field** in childbearing decisions has been largely neglected. Only in recent years, researchers have emphasised that the type of education a woman has chosen can also serve as an

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[57] Dribe and Stanfors (2009), who also studied the effect of women's educational level on the risk of entering parenthood in Sweden, reported a negative instead of a u-shaped relationship. However, the authors only analysed childbearing behaviour up to age 28, which implies a serious distortion of their results, since they neglect those ages when a large proportion of highly educated women start childbearing.

[58] We described the suggested explanations for the observed positive effect of women's educational level on higher order fertility in detail in Chapter 2.2.5.

indicator for her potential reproductive behaviour. Explanations of the link between educational field and fertility are basically of three kinds. *First*, women are assumed to be heterogeneous in terms of preferences and priorities regarding work-lifestyles and family models. Women’s choices regarding their field of education may therefore be seen as an indicator of their preferences or orientations concerning future roles (see Chapter 2.4). *Second*, enrolment in different educational fields is thought to be accompanied by different socialisation effects, which in turn may influence attitudes to childbearing (see Chapter 3.3). *And third*, the choice of educational field is assumed to have an impact on women’s fertility behaviour through the link between education and the labour market. Different educational choices may, for example, involve differences in the time that it takes a woman to get established in the labour market. In addition, most educational fields lead to specific labour market sectors that potentially vary in the options they offer for combining family life and gainful employment. Furthermore, the opportunity costs of a career break (e.g. earnings loss and skill depreciation during absence) may differ for women educated for different occupations (for a detailed discussion see Chapter 3.4).

Empirical studies on the relationship between educational field and fertility are quite limited, and primarily seek to explain how a woman’s type of education influences her propensity to enter motherhood. Lappegård and Rønsen (2005), who compared first birth rates of Norwegian women with different types of university degrees, found that the risk of entering motherhood is generally higher among women educated as teachers, physicians, nurses or other healthcare workers. Women with a lower university degree in engineering or humanities and aesthetics were found to have comparatively low first birth rates, which – at least in case of humanities and aesthetics graduates – might be related to their unfavourable labour market situation. Likewise, women with a lower degree in social sciences exhibited a low transition rate to a first child. However, for those who graduated from university with a higher degree in social sciences, Lappegård and Rønsen found a first birth risk that was as high as that of women with a higher degree in teaching or health care.[59] The opposite situation applied to women with a university degree in administration and economics. Those with a low degree were found to have an average first birth intensity, whereas those with a higher degree exhibited the lowest risk of entering motherhood among all women with higher university degrees.[60] In a study on the relationship between the field of education and the postponement of motherhood across 21 European countries, Van Bavel (2010) highlighted various features of study disciplines. The author showed that birth postponement is less likely among graduates from fields in which conventional family attitudes prevail, and in which a large share of the graduates are female.[61] By contrast, graduates from fields that are expected to lead to a relatively high starting wage and a steep earnings profile were found to be more likely to delay their first birth. In an investigation into the effect of women's education on fertility in Spain, Martín-García (2006) distinguished between three types of studies: (i) general studies, (ii) studies concerned with the care of individuals and/or those which emphasise social or interpersonal skills, and (iii) all other studies.[62] The investigation showed that women with a degree related to care and/or interpersonal skills displayed a higher propensity to enter motherhood and to continue childbearing, irrespective of the level of education. For first birth intensities, educational type-specific differences were found to be strongest at lower educational levels, while the impact of type of education on higher order childbearing was found to

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59 An explanation might be that, within social sciences, employment prospects are much better for those with a high university degree compared to those with a low one. The low risk of entering motherhood for women with a low university degree in social sciences might therefore be an indicator of their difficulties in finding an appropriate job, or their plans to upgrade their education in the near future.

60 An explanation for this finding could be that the field of administration and economics and related occupations are, in particular, more gender balanced at the lower university level than at the higher university level. Thus, a higher level degree in administration and economics might be more likely to lead to high status positions with a male-dominated work environment and time-intensive work norms that discourage women from entering motherhood.

61 However, the study by Van Bavel (2010) also showed that, in addition to a study discipline gradient in stereotypical family attitudes, there is an even stronger country gradient. Therefore, it might be that the observed relationship between stereotypical family attitudes and birth postponement does not in fact result from differences in stereotypical family attitudes between study disciplines, but rather between countries. In addition, it should be considered that there might be differences in the impact of stereotypical family attitudes on the postponement of motherhood across countries.

62 The results regarding the impact of the type of education on first births have also been published by Martín-García and Baizán (2006). In both studies, the group "degrees related to care and/or interpersonal skills" is very broad, and comprises types of studies that - according to theoretical arguments and results from other studies (e.g. Lappegård and Rønsen 2005) - might exhibit quite different risks of childbearing (e.g. teacher training, health care, arts, humanities).

be especially strong among tertiary educated women. The impact of educational field on continued childbearing has also been analysed in a study carried out by Stanfors (2009). This study, however, focused only on a very specific part of the population; namely, on Swedish couples in which at least one of the spouses obtained a PhD, a medical degree or a law degree. Stanfors showed that physicians, irrespective of gender, are most likely to have a second and a third birth among the three professional groups studied. The author attributed this finding to the fact that, in comparison to lawyers and PhDs, Swedish graduates of medical school attain a secure and well-paid labour market position faster on average than members of the other two professional groups. Stanfors also found that female lawyers, PhDs and medical doctors have higher risks of continuing childbearing if they work in the public sector. Among men, on the other hand, professionals working in the private sector were found to have higher chances of having two or even three children.

By far the most detailed picture of the relationship between educational field and fertility in Sweden has been provided by two studies by Hoem et al. (2006a, 2006b). The authors used an exceptionally large number of educational field-and-level combinations (some 60 in all) to investigate the impact of women's educational level and educational field on the final level of childlessness and the ultimate number of children per woman.[63] One of the main findings of these studies was that, within each field of education, permanent childlessness increases and ultimate fertility decreases with an increasing educational level, but that the field itself is the more important indicator.[64] Women educated for jobs in teaching and health care were found to be in a class of their own, with much lower rates of childlessness and higher ultimate fertility at each educational level than others. In contrast, women educated for artistic or (non-teacher) humanist occupations, for work in hotels and restaurants or as librarians were found to exhibit unusually high proportions of permanent childlessness and low levels

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[63] However, the studies of Hoem et al. (2006a, 2006b) concentrated only on the final outcome of the childbearing process and its relationship to women's final educational attainment. Although both studies constitute a conclusive demonstration of the importance of educational field in explaining fertility differentials among women, event history methods should be more suitable to account for the dynamic nature of processes, childbearing and education.

[64] The importance of educational field as an indicator for permanent childlessness has also been confirmed with Austrian and Greek data in follow-up studies carried out by Neyer and Hoem (2008) and Bagavos (2010).

of ultimate fertility.[65] Women with religious education were found to stand out as having very high proportions of childlessness, but quite an ordinary mean ultimate fertility.[66] Hoem et al. (2006a, 2006b) also showed that a higher share of women in an educational field only systematically leads to lower rates of childlessness and higher ultimate fertility in fields with a clear female dominance (e.g. health, social care or teaching), while this association was found to be less convincing in fields of education with a mixed gender structure, or in fields in which women are a minority.

In general, previous studies have indicated that, in order to explain the impact of education on fertility, the field of education is as least as important as the level of education undertaken by women. For that reason, we include this third educational dimension into our analysis, and expect to find the following relationship:

H5-III: Women with different fields of education will have different transition rates to a first, second and third child. We expect to find high transition rates for women educated in fields in which the main characteristic is working with other people, that are clearly female-dominated, and/or that are marked by a tight link between education and labour market. By contrast, we expect to find low birth risks for women who graduated from educational fields that are clearly male-dominated, that lack an obvious set of occupations, and/or that do not lead to a reliable employment career.

Women educated as teachers, or in the areas of health care or social work, have chosen educational lines that primarily prepare them for working with other people, that are clearly female-dominated during education (and have a high propensity to lead to a female-dominated occupational sector with family-friendly working conditions, and a

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65 According to Hoem et al. (2006b), the high rate of childlessness and the low level of ultimate fertility among women educated in arts and humanities might be the result of their uncertain career possibilities and their unusual working conditions. In addition, some type of self-selection might take place that leads especially those with low preferences for marriage and childbearing to choose to study one of these fields. The authors supposed that family-unfriendly working conditions and self-selection might also explain the same demographic behaviour among women who are trained to work in the hotel and restaurant business. However, these arguments can not be used to explain the high level of childlessness and low ultimate fertility of librarians, since these women have a reasonably secure career path and mostly work in the public sector. Hoem et al. indicated that librarians are on average much less well paid than others with an education at the university level, but the authors are uncertain whether this really can serve as an explanation for the demographic behaviour of librarians.

66 Hoem et al. (2006b) also found that, for women educated in the field of religion, childbearing is much more closely linked to marriage than for women of other educational backgrounds. Those religiously educated women who ever married were found to have had about two children more on average than those who had never married, while this difference constituted only one child in most other educational groups.

low wage penalty for employment interruptions) and that are marked by a tight link between education and the labour market, with a rather calculable future employment career. These women should therefore exhibit a comparatively high probability of entering motherhood and an elevated risk of continued childbearing.[67] Educational fields related to engineering and construction, by contrast, are clearly male-dominated during education (and have a high propensity to lead to a male-dominated occupational sector with time-intensive work norms, a male-dominated work environment and a high wage penalty for employment interruptions). We therefore expect to find a low childbearing risk for women who graduated from engineering or construction programmes. Women with an educational background in the area of humanities (e.g. graduates with degrees in history or philosophy that do not include a qualification for teaching) and women with only general educational qualifications presumably also exhibit a low risk of childbearing, since general degrees, as well as most educational lines in the humanities, do not lead to an obvious set of occupations.[68] As a result, graduates from these fields often face difficulties in finding an appropriate job, which - in a society in which being successfully established in the labour market is viewed as a prerequisite for childbearing - might discourage them form starting a family. In addition, we believe that women educated in the arts (e.g. dance, drama, design, drawing) or media (e.g. radio and TV production, illustration and advertising) have children at lower rates. People educated for occupations in one of these fields often have to work freelance or on temporary contracts. Moreover, for quite a number of graduates from these fields, frequent moves are part of normal life, and being in perfect health and having a high level of physical fitness are essential for getting jobs. In this context, childbearing and childrearing might be seen as a serious impediment to future employment.

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[67] It is important to keep in mind that a high/low risk of childbearing among graduates of certain educational fields might not only result from the specific characteristics of that field (e.g. gender dominance, employment prospects), but also from the fact that women might select themselves in certain fields due to their preferences and interests, which presumably have an impact on both processes education and childbearing (see Chapter 2.4).

[68] Women with a general educational degree are in Sweden primarily those who only have primary or lower secondary education, and those who attained an upper secondary school degree in one of the academically oriented programmes, but did not/not yet continue on to tertiary education.

5.3 Method, sample selection and variables

Discussion of method

We apply event history methods (see Chapter 4.1 for a more detailed description of this technique) to model the transition to a first, second and third conception as a function of an underlying risk modified by a vector of covariates.[69] The equations to be estimated have the following general mathematical form:

$$\ln \mu_i^1(t) = y^1(t) + z_k^1(u_{ik} + t) + \sum_n \beta_n^1 w_{in}(t)$$
$$\ln \mu_i^2(t) = y^2(t) + z_k^2(u_{ik} + t) + v_l^2(u_{il}) + \sum_n \beta_n^2 w_{in}(t)$$
$$\ln \mu_i^3(t) = y^3(t) + z_k^3(u_{ik} + t) + v_l^3(u_{il}) + \sum_n \beta_n^3 w_{in}(t)$$

where $\mu_i^1(t)$, $\mu_i^2(t)$ and $\mu_i^3(t)$ denote the hazard of conception of the first, second and third child for individual *i* at process time *t*. The functions $y^1(t)$, $y^2(t)$ and $y^3(t)$ are piecewise linear splines (for process time since age 16 in the first conception model, for process time since previous birth in the second and third conception model) that capture the impact of the baseline duration on the hazard. The parameters $z_k^1(u_{ik} + t)$, $z_k^2(u_{ik} + t)$, and $z_k^3(u_{ik} + t)$ denote spline representations of the effect of a time-varying variable that is a continuous function of process time *t* with origin u_{ij} (namely, calendar time) while the parameters $v_l^2(u_{il})$ and $v_l^3(u_{il})$ symbolise spline representations of the effect of a continuous variable that is constant in time (namely, the woman's age at the previous birth). The parameter $w_{in}(t)$ represents a time-varying variable whose value can change only at discrete times (e.g. educational level). In all three conception models, we censor if the women emigrate, die, reach age 45 or do not conceive the

[69] In our models on the impact of education on childbearing, we focus on the date of conception rather than on the date of birth since events that occurred after conception might be influenced by the conception itself. To obtain the approximate date of conception, we backdated each date of childbirth by nine months. For convenience we will continue to use terms such as "birth", "birth risk", "risk of getting a child". However, the reader should be aware of the fact that the events that we observe are conceptions that result in births.

observed child before March 2005; whichever comes first.[70] In the higher order conception models, we additionally censor when the previous child reaches age 15.

After estimating separate models for the risk of conceiving a first, second and third child, we model these three transitions jointly with a common factor for unobserved heterogeneity. This approach allows us to account for the possibility that selection processes might play a role in the relationship between education and higher order fertility (see Chapter 2.2.5). The heterogeneity term, denoted with ε_i in the formula below, is assumed to be drawn independently for each woman at the start of the reproductive period, and to stick to that woman through age 45.

$$\ln \mu_i^1(t) = y^1(t) + z_k^1(u_{ik} + t) + \sum_n \beta_n^1 w_{in}(t) + \varepsilon_i$$
$$\ln \mu_i^2(t) = y^2(t) + z_k^2(u_{ik} + t) + v_l^2(u_{il}) + \sum_n \beta_n^2 w_{in}(t) + \varepsilon_i$$
$$\ln \mu_i^3(t) = y^3(t) + z_k^3(u_{ik} + t) + v_l^3(u_{il}) + \sum_n \beta_n^3 w_{in}(t) + \varepsilon_i$$

The distribution from which ε_i is drawn is assumed to be normal, with zero mean and a standard deviation to be estimated. In our final model, we set the number of integration points to 12.

$$\varepsilon_i \sim N(0, \sigma^2)$$

Since we only have information on the women's education from the middle of the year 1990 onwards, we restrict our analyses to the period June 1990 to March 2005. Of course, some women in our data have already been exposed to the risk of experiencing a first, second or third conception before June 1990. This means that we are working with left-truncated data, and that our analyses are conditional on the fact that the women have "survived" to the start of the observation period. In most software packages (e.g. TDA, Stata, aML), the problem of left-truncation can easily be handled by specifying

70 We censor in March 2005 (which is nine months before data extraction) since only those children who were conceived until this point in time are included as births in our data. For the time after March 2005, we do not know whether or not a woman experienced the observed event, since the corresponding birth would have taken place after our time of data extraction (December 2005).

positive starting values for left-truncated episodes that indicate how long a woman has already been exposed to the observed event before she came under observation.[71]

Special attention has to be paid to the estimation of unobserved heterogeneity in a model that is based on left-truncated data. In general, unobserved heterogeneity is assumed to be normally distributed. However, in case of left-truncation, this assumption might no longer hold, since people non-randomly drop out of the data during the truncation period.[72] As a result, the estimated effects might be biased. However, we believe that in our case this bias should be very small, since only those women who already had three or more children in June 1990 are not included in our joint model of first, second and third conceptions; and thus do not contribute to the estimation of the heterogeneity component.[73] To keep the number of women who do not contribute to the joint analysis because of the left-truncation as small as possible, we restrict all of our analyses to women born in 1960 or later. Thus, the maximum age that a woman can have in June 1990 is 30.5 years. At that age, only 1.9 per cent of the women in our sample already have three or more children, and therefore do not contribute to our joint model.

Sample selection for the analyses

The analyses on the impact of women's education on fertility are based on Swedish register data (for more information see Chapter 4.2). The original data encompass 1,196,749 individuals. For our analyses, we excluded (i) all men, (ii) women

[71] For more information on left-truncation in general and the handling of left-truncated data in event-history analysis see, for example, Guo (1993).

[72] In our case, unobserved heterogeneity in the data might, for example, result from the fact that women differ in terms of preferences and attitudes towards childbearing. Women with a very strong preference for children presumably enter motherhood at an earlier stage in the life course relative to others whose preferences for children are less strong. However, those who do enter motherhood at an earlier age (which is also earlier in calendar time) are less likely to be included in our analyses since we only include those who are childless (or one-child mothers, or two-child mothers) in June 1990 in our analysis of first conceptions (second conceptions, third conceptions). Therefore, women with a strong preference for children are probably underrepresented in our analyses, while those with a low preference might be overrepresented. In that case the unobserved heterogeneity component can not be assumed to be normally distributed.

[73] Women who are excluded from the analysis of first conceptions (because they were not childless in June 1990) are still included in the analysis of second conceptions (as long as they do not already have two children in June 1990) or in the model on the transition to a third conception (as long as they do not already have three children in 1990).

of foreign origin, (iii) women born before 1960 and (iv) women who were not domiciled in Sweden at the age of 16.[74] Moreover, we omitted women who were pregnant with their first child before age 16. For the models of higher order births, we additionally excluded women who were not at risk of conceiving a second or third child because (i) they did not have a first or second child before age 45, (ii) they died at the first or second birth, (iii) they emigrated between age 16 and the first birth or between age 16 and the second birth, (iv) their first or second pregnancy resulted in a multiple birth, or (v) they had their first or second child less than 10 months before December 2005.[75] Due to the restriction of all analyses to the period June 1990 to March 2005, we also had to exclude those women who had already experienced the observed event before June 1990, as well as those who emigrated or died before June 1990. This leaves a valid sample of 262,753 female individuals for the analysis of first births, a total of 141,516 women for the analysis of second births and 116,494 women for the analysis of third births. For more details on the sample selection see Table 5.1.

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[74] Women who were not domiciled in Sweden at age 16 (because they emigrated from Sweden as a child and immigrated back to Sweden at an age higher than 16) have to be omitted because of incomplete childbearing histories. In the Swedish system of population registration, children of immigrants are only registered if they also entered Sweden before age 18. In addition, educational histories are less reliable for migrants.

[75] Women who had their first/second child less than 10 months before December 2005 are excluded from the analysis of second/third births, since for them the process time for the transition to a second/third pregnancy starts after March 2005 (the latest point in calendar time at which we censor in all three birth models).

Table 5.1: Description of the number of included and excluded cases for the analyses of the impact of women's education on fertility in Sweden

	1st child	2nd child	3rd child
Number of individuals in original sample		1,196,749	
Number of individuals excluded from the analyses	933,996	1,055,233	1,080,255
Number of individuals included in the analyses	262,753	141,516	116,494
Number of events	122,820	100,781	34,826
Reasons for exclusion:			
(1) Sex (male)		612,572	
(2) Birth country (not Sweden)		126,234	
(3) Birth cohorts 1950 to 1959		126,550	
(4) Individuals were not domiciled in Sweden at age 16		9,962	
(5) Individuals experienced a 1st pregnancy (that resulted in a 1st birth) before age 16		734	
(6) Individuals had no 1st/2nd child (before age 45)		139,063	187,984
(7) Individuals died at 1st/2nd birth		8	2
(8) Individuals emigrated between age 16 and 1st/2nd birth		3,617	2,705
(9) Individuals' 1st/2nd pregnancy resulted in a multiple birth		2,465	1,722
(10) Individuals had their 1st/2nd child less than 10 months before December 2005		7,174	5,953
(11) Exclusion due to the restriction of the analyses to the period June of 1990 to March of 2005:			
a) Individuals were pregnant with their1st/2nd/3rd child before June of 1990	55,485	26,702	5,791
b) Individuals emigrated before June of 1990	2,042	117	36
c) Individuals died before June of 1990	417	35	10

Source: Swedish register data

Covariates in the analyses

In the following, we describe the covariates that are included in our first, second and third conception models. We start with an explanation of the construction and grouping of our educational variables, followed by a short description of further control variables. An overview of the composition of the samples for the analyses of first, second and third conceptions, with measures of exposures and occurrences within the categories of each covariate, is given in Appendix B in Table B. 1, Table B. 2 and Table B. 3.

We constructed a time-varying categorical variable for educational level and a time-varying categorical variable for educational field by converting the yearly information on both variables into event history data.[76] We decided to ignore the fact that some of the educational qualifications registered in our data as having been attained in the year 2000 might have actually been earned in earlier years (for more detailed information see Chapter 4.2).[77] To get a feasible number of categories for educational level and educational field, the very detailed information on both variables were grouped into broader categories. The final groups are a practical compromise between (i) the aspiration to merge those levels, and especially fields, that belong together from a theoretical viewpoint; (ii) the wish to stick to the official grouping of educational levels and fields proposed by ISCED 1997; and (iii) the need to avoid categories with too small case numbers. We grouped **educational levels** into four categories according to the number of years they are assumed normally to take:

primary or lower secondary education (up to nine years of schooling);
upper secondary education (10-12 years);
short post-secondary education, including some college or university education of up to three years (13-15 years); and
long post-secondary education, including all higher education courses that normally take four years or more, such as a master's degree, a licentiate or a doctorate (16 years or more in all).[78]

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76 For a detailed description of the conversion of yearly information on education into event history data see Appendix A.

77 As a result we probably underestimate the attained level of education and misspecify the field of education for some individuals in our data for the years 1990 to 1999.

78 As mentioned in Chapter 4.2, the old system of educational classification (SUN) did not distinguish between complete and incomplete educations at a given level, while this distinction is available within the new system (SUN 2000). As a result, we are able to separate between complete and incomplete educational qualifications for the years 2000 to 2004, but not for earlier years. To reach consistency over the whole study period, we decided not to take into account whether an educational level has been completed or not. Therefore women grouped into, for example, "short post-secondary education" may not necessarily have completed this educational level in our classification. The minimum requirement to reach a certain level is one semester of full-time study at that level (e.g. short post-secondary: half a year of full-time study at a college or university, long post-secondary: three and a half years of full-time study).

For a comparison of our classification of educational levels with the one proposed by ISCED 1997, SUN and SUN 2000 see Table B. 4 in Appendix B.

Our grouping of **educational fields** is primarily based on the first digit of the ISCED 1997 code for educational fields (which is more or less identical to the Swedish SUN 2000 code). Whenever groups seemed too heterogeneous to us, we split them according to the first two digits of the ISCED 1997 code. In addition, we undertook some minor regrouping when we considered it to be necessary (Table B. 5 in Appendix B and the corresponding explanations provide more details on the modifications we made in the grouping of educational fields). In our analysis, we distinguish between the following 14 groups of educational fields:

general;
teacher training;
art and media;
humanities;
social sciences, journalism and law;
business and administration;
natural sciences;
engineering and construction;
manufacturing and processing;
agriculture, forestry, and animal health;
health care and welfare;
technically oriented health care and pharmacy;
personal services; and
security services.

A more detailed insight into the educational lines within each educational field is given in Table B. 6 in Appendix B.

In addition to individual life histories concerning educational level and educational field, we constructed a time-varying categorical variable that provides information about a woman's **educational status** (whether or not she is currently enrolled in education). Since we do not have exact information about the start and end of educational participation, we use the yearly information on whether a person received some kind of financial aid for students during the calendar year as an indicator for educational enrolment.[79] In order to avoid anticipatory analysis, we take the information from the preceding calendar year. We distinguish between the following two categories of the variable educational status:

not enrolled (during the preceding calendar year) and
enrolled (during the preceding calendar year).

As financial assistance for students is only paid to people aged 16 to 54, we do not know whether a woman was enrolled in education during the calendar year that preceded her 16th birthday. However, since in Sweden children are obliged to attend nine years of compulsory schooling, generally between the ages seven to 16, we assume that all individuals in our data participated in education during the calendar year that preceded their 16th birthday.

In addition to variables on education, our models include several control variables. First, we control for **civil status** as a time-varying categorical covariate. Several authors have pointed out that the relationship between union formation and entering motherhood is both strong and complex (e.g. Brien et al. 1999; Santow and Bracher 2001; Baizán et al. 2003). This is because, in addition to partnership status influencing childbearing, (realised or anticipated) childbearing is likely to cause changes in a woman’s civil status. Moreover, the decision to have a child and to cohabit or marry might be taken jointly. In short, entering cohabitation or marriage may be strongly endogenous to entering parenthood. The question of how to deal with this problem when analysing the impact of education on fertility is therefore a difficult one to answer. We have chosen to incorporate time-varying information about civil status into our models on first, second and third conceptions. By repeatedly checking the effect of removing and adding civil status to our models, we keep a close eye on the role

[79] In Sweden all full-time students in upper secondary education between the ages of 16 and 20 receive study assistance (Swedish Institute 2000). Among those enrolled in higher education, the majority (80 per cent in 1995) receive at least some kind of financial student aid (Guille 2002). By using the receipt of financial student aid as an indicator for being in education, we classify some women who undertake higher education (but do not receive financial student aid) as being out of education. This may lead to a small bias of our results regarding the effect of educational enrolment, but it is the best we can do.

of partnership status in mediating the effects of other covariates.[80] Our civil status variable has the following four categories:

single/cohabiting,
married,
divorced and
widowed. [81]

Existing studies also have shown that fertility varies by settlement size (e.g. Kulu et al. 2007). The general finding is that fertility levels decrease as the size of the settlement increases. In addition, it has been shown that the timing of childbearing varies across settlements; the larger the settlement, the later the peak of fertility. We therefore control for settlement size by including **municipality type** as a time-varying categorical variable into our models. We distinguish between the following three types of municipalities:

Stockholm, Malmö, Gothenburg;
other urban municipalities; and
sparsely populated rural municipalities.[82]

In Chapter 3.2.2 we have shown that period fertility fluctuated strongly in Sweden. During our study period, the period TFR decreased from a peak of 2.14 in 1990 to an all-time low of 1.51 in 1998/1999. In the following years, the period fertility level increased again and reached a level of 1.75 in 2004 (which is the last year of our observation period), and a level of 1.91 in 2008. To account for these strong fluctuations, we include a piece-wise linear duration spline for calendar **period** in each of our three conception models. We set nodes at the beginning of the years 1991, 1992 and 1998 in our first conception model; at the beginning of the years 1991, 1992 and

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80 It is beyond the scope of this work to investigate the mutual causal relationship between union formation and childbearing, along with education. Therefore we do not model all three processes simultaneously.

81 Unfortunately our data do not allow us to distinguish between those who are single and those who cohabit. This is a big disadvantage imposed by the format of our data, since in Sweden non-marital childbearing is a prevalent behaviour.

82 Our grouping of municipalities basically corresponds to the one used by Andersson et al. (2004).

1997 in our second conception model; and at the beginning of the years 1991, 1992 and 1996 in our third conception model.[83]

As has been pointed out by Hoem (1993a), it is almost a "demographic law" that the younger a woman is when she starts childbearing, the higher her final fertility level will be. For that reason, intensity regression models on continued childbearing usually include a woman's age as a further control variable. There are several options for taking age into account. Some researchers use a woman's current age (e.g. Kravdal 2007), while others include a woman's age at the previous birth into their higher parity models (e.g. Lappegård 2006). A further option is to use the age at entering motherhood not only in second, but also in third birth models (e.g. Kreyenfeld and Konietzka 2008; Stanfors 2009), and to additionally include the interval between the first two births (e.g. Martín-García 2006). However, Hoem et al. (2001) reported completely parallel results when they replaced age at second birth with age at first birth in their model on the effect of women's education on third births in Austria. In recent years, studies on higher order fertility have increasingly used the concept of relative age at first (or second) birth to account for the very different distribution of ages at previous birth(s) across women with different educational levels (e.g. Hoem 1996; Hoem et al. 2001; Berinde 1999; Kreyenfeld 2002). However, Gerster and Keiding (2008) have critically discussed the implications of using this concept and questioned its applicability, especially in cases in which education is included as a time-varying variable. We decided to use a woman's actual **age at previous birth,** and to include the effect of this variable as a piece-wise linear regressor spline in our models on continued childbearing. We set nodes at 24, 29, 34 and 39 years of age in our second conception model; and picked the ages 21, 25, 29 and 35 as nodes for our third conception model.

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[83] Whenever we use splines, the following procedure has been applied to figure out the most suitable nodes. In the beginning, we estimated a model with yearly nodes (in some cases we even set nodes every six months). Afterwards, we successively deleted those nodes that did not contribute markedly to the shape of the spline. The nodes we have finally chosen are a compromise between the desire to stick as close as possible to the shape of the "original" spline (the one that occurs when very detailed nodes are used) and the wish to work with a manageable number of nodes. Our choice of different nodes for calendar period for our first, second and third conception model results from the fact that initial models carried out have shown a turn in the risk of childbearing during the second half of the 1990s that occurred first for two-child mothers, then for one-child mothers, and subsequently also for childless women.

From a theoretical point of view, it would also have been desirable to control for partner's education in our models, since a positive effect of women's educational level on higher order births might just be the result of positive assortative mating (see our description of the partner effect in Chapter 2.2.5). For Germany, Kreyenfeld (2002) has shown that, by including men's education, the positive effect of women's educational level on the risk of having a second child disappears. However, studies by Kravdal (1992, Norway), Andersson et al. (2006b, Sweden) and Gerster et al. (2007, Denmark) have shown that this does not apply to the Nordic countries. In all three studies, the general finding was that the positive effect of a woman's educational level on continued childbearing remains, even after controlling for the partner's education. From this we conclude that - at least in our case - the lack of information about partners' education does not lead to a serious distortion of the effect of women's education on fertility.

5.4 Women's education and first births

The transition to motherhood is a key life course event, usually considered more life-changing than having a second or higher order child. The first birth is the entry into the mother role, a role that is long-lasting, that is time-consuming when the child is young, and that competes with other roles a woman might occupy, such as being a student or pursuing a career (Rindfuss et al. 2007). Since entering motherhood is such a decisive step in a woman's life, most women strive to time it in a way that reduces conflicts with other demanding roles. In this context, woman's education is generally viewed as one of the most important determinants of the timing of first births. In the following chapters, we therefore analyse the importance of a woman's participation in education, educational level and type of educational training in the transition to a first child in Sweden.

5.4.1 Educational enrolment, educational level and first births

In a first step, we estimated a model that gives us the main effect of educational enrolment and educational level on the risk of conceiving a first child (see Table 5.2). As expected, and in full accordance with previous research, we find that participation in education is connected with a low risk of childbearing. Swedish women who are still enrolled in education have a 48 per cent lower risk of entering motherhood than those who have already left the educational system. Regarding the relationship between educational level and first birth risk, our results show a u-shaped effect. The transition rate to a first child is highest for those who only have a primary or lower secondary level of education, followed by those who attained a very high educational level. Women with a short post-secondary education display the lowest first birth risk.

Table 5.2: Event history model for the transition to a first child - the effect of educational enrolment and educational level

	Relative risk of 1st birth
Educational status	
Enrolled	0.52
Not enrolled (N.e.)	1
Educational level	
Primary/lower secondary	1.49
Upper secondary	1
Short post-secondary	0.95
Long post-secondary	1.09

Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline), period, educational field, civil status and municipality type. (2) For educational status and educational level one additional category (missing information) was included in the analysis; results not shown. (3) The full model is included in Appendix B in Table B. 7 (Model 1).

Table 5.3: Event history model for the transition to a first child - the effect of educational level by educational status

	Relative risk of 1st birth
Educational status & educational level	
Enrolled	0.49
N.e.: Primary/lower secondary	1.18
N.e.: Upper secondary	1
N.e.: Short post-secondary	1.05
N.e.: Long post-secondary	1.10

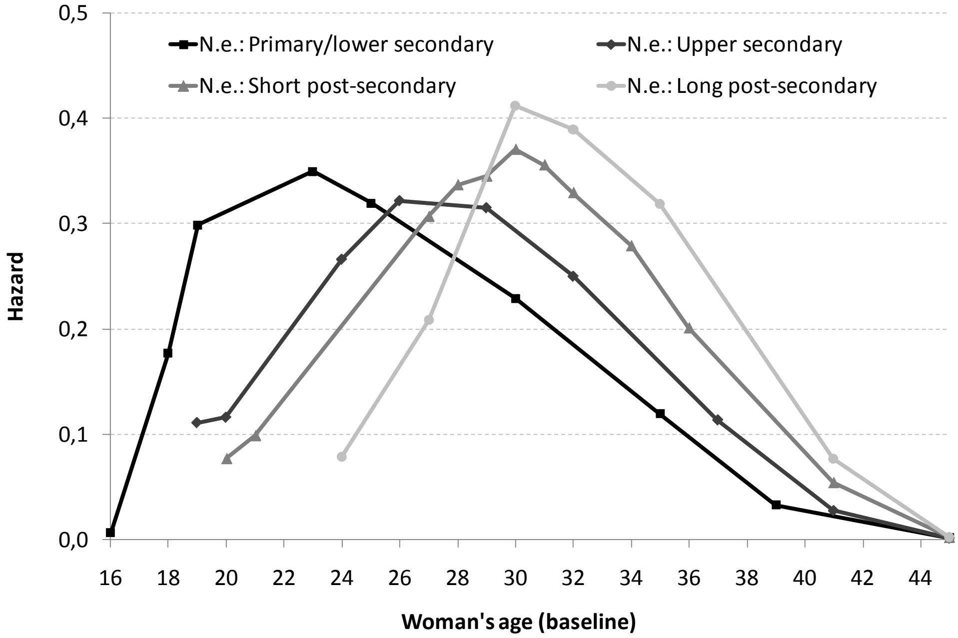
Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline), period, educational field, civil status and municipality type. (2) For educational status and educational level one additional category (missing information) was included in the analysis; results not shown. (3) The full model is included in Appendix B in Table B. 7 (Model 2).

In a second step, we estimated the effect of educational level only for those who - at least temporarily - have finished their education (see Table 5.3). As before, we find a u-shaped relationship between educational level and first birth risk. However, the elevated first birth risk of women with only compulsory or lower secondary education decreases markedly, and the risk of entering motherhood is now lowest among those with an upper secondary degree.[84]

Since several studies have shown that the effect of educational level on the first birth risk varies substantially by age (Rindfuss et al. 1988: 103, 119; 1996; 2007; Kravdal 1994, 2007; Liefbroer and Corijn 1999), we estimated an interaction between a woman's age and her educational level. Figure 5.1 confirms that, in Sweden as well, there is a strong postponement effect of educational level on a woman's risk of entering motherhood. The first birth intensity of women with compulsory education reaches its peak in the early twenties, whereas the first birth intensity of women with upper secondary education is highest between the ages of 26 to 29. For women with post-secondary education, however, the risk of entering motherhood reaches a high only in the early thirties. As a consequence of the different age patterns in first birth fertility among women with different levels of education, there is a negative effect of educational level on the risk of having a first child for women in their teens and early twenties, and a positive effect for women aged 30 or older. Table 5.4 further clarifies this finding by showing the interaction between a woman's age and educational level for three broad age groups.

[84] We also controlled for educational status in the model that shows the main effect of educational level. Therefore, changes in the effect of educational level on the first birth rate cannot be attributed to compositional effects (e.g. a lower proportion of women still enrolled in education at lower levels of education). Instead, the observed changes indicate that there might be educational level-specific differences in how inhibiting the student role is for entering motherhood. It seems as if the negative effect of being enrolled in education is more pronounced at higher levels of education; although this would be contradictory to findings for Norway shown by Lappegård and Rønsen (2005). In order to check this empirically, one has to estimate the effect of educational enrolment separately for each educational level. However, since we do not have exact information on educational enrolment (we use the receipt of financial aid for students during the preceding calendar year as an indicator for a recent participation in education), we refrained from carrying out this kind of analysis.

Figure 5.1: Event history model for the transition to a first child - the effect of woman's age (baseline) by educational status and educational level



Source: Swedish register data, own estimations
Notes: (1) Controlled for period, educational field, civil status and municipality type. (2) For educational status and educational level two additional splines (missing information, enrolled) were estimated; results not shown. (3) The interaction was estimated on the basis of Model 2 (see Appendix B, Table B. 7).

Table 5.4: Event history model for the transition to a first child - the effect of educational enrolment and educational level for three different age groups

	Relative risk of 1st birth		
	Ages 16-24	Ages 25-30	Ages 31-45
Educational status & educational level			
Enrolled	0.40	0.58	0.95
N.e.: Primary/lower secondary	1.73	0.85	0.68
N.e.: Upper secondary	1	1	1
N.e.: Short post-secondary	0.76	1.03	1.32
N.e.: Long post-secondary		0.94	1.60

Source: Swedish register data, own estimations.
Notes: (1) Controlled for woman's age (baseline), period, educational field, civil status and municipality type. (2) For educational status and educational level one additional category (missing information) was included in the analysis; results not shown. (3) For the age group 16 to 24 we combined the categories "short post-secondary" and "long post-secondary" level of education. (4) The full model is included in Appendix B in Table B. 7 (Model 3).

From Table 5.4, we can also see that, for women, the negative effect of educational enrolment decreases with increasing age. At age 31 and above, the transition rate to a first child is only five per cent lower for students than for those who left school after upper secondary education. In comparison to those who left school with a primary or lower secondary school degree, students aged 31 or older even have a 40 per cent higher risk of entering motherhood. However, educational enrolment at ages 31 and above primarily means enrolment in higher education. Compared to women with a short or long post-secondary degree, “senior” students also have a relatively low first birth risk.[85]

Finally, we estimated an interaction between educational level, woman’s age, and civil status (see Table 5.5). In general, we can see that - irrespective of age and educational level – being married substantially increases the likelihood of conceiving a first child. In addition, Table 5.5 shows that, among women who are married and (currently) not enrolled in education, there is no negative effect of educational level on the risk of entering motherhood. For married women in their teens and early twenties, we find a u-shaped effect (instead of a negative effect), with the lowest transition rates among those with a medium level of education. A strong positive relationship between educational level and first birth risk occurs for married women already in the middle age group. By contrast, for singles or cohabiting women, we find a negative impact of educational level on the risk of entering motherhood that turns into a positive one only for women aged 31 to 45.

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[85] In addition, it is important to keep in mind that, in Sweden today, only a small proportion of the population ends up with an education below the upper secondary degree. Women with only primary or lower secondary education who stay childless until age 30 might therefore be a very selective group.

Table 5.5: Event history model for the transition to a first child - the effect of educational level by woman's age and civil status

	Relative risk of 1st birth		
	Civil status		
	Single/ cohabiting	Married	Divorced/ widowed
All women	0.26	1	0.38
Educational level - ages 16-24			
N.e.: Primary/lower secondary	0.57	1.48	1.15
N.e.: Upper secondary	0.32	1	0.56
N.e.: Short/long post-secondary	0.21	1.45	0.55
Educational level - ages 25-30			
N.e.: Primary/lower secondary	0.29	0.56	0.43
N.e.: Upper secondary	0.32	1	0.37
N.e.: Short post-secondary	0.29	1.35	0.40
N.e.: Long post-secondary	0.23	1.43	0.30
Educational level - ages 31-45			
N.e.: Primary/lower secondary	0.24	0.53	0.36
N.e.: Upper secondary	0.33	1	0.44
N.e.: Short post-secondary	0.44	1.29	0.59
N.e.: Long post-secondary	0.49	1.81	0.69

Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline), period, educational field and municipality type. (2) For women aged 16 to 24, we merged the categories "short post-secondary" and "long post-secondary" level of education due to small case numbers. For the same reason, we merged the categories "divorced" and "widowed". (3) For educational level and civil status one additional category (missing information) was included in the analysis; results not shown. (4) For each age group, the model also contains a category for those who are "enrolled" in education; results not shown. (5) Effects with a p-value higher than 0.1 are printed in grey. (6) The full model is included in Appendix B in Table B. 7 (Model 4; effects for all women are based on Model 3).

As described in Chapter 5.3, marrying may be strongly endogenous to entering motherhood. We therefore also estimated a model for the effect of educational enrolment and educational level on the transition to a first child that does not include civil status as a control variable (results are included in Table B. 12 in Appendix B). The main difference between the two models is related to the effect of a short or long post-secondary level of education on the risk of entering motherhood. In a model that does not control for a woman's civil status, the risk of entering motherhood for women aged 25 to 30 is six per cent higher for those with a short post-secondary education and 12 per cent higher for those with a long post-secondary education. Among women aged

31 or older, the differences between the two models are even larger (+7 and +17 per cent). The fact that the inclusion of civil status into our model leads to a reduction in the first birth rate of women with a tertiary education indicates that there is a higher proportion of married women among highly educated Swedish women than among the low or medium educated.[86]

5.4.2 Educational field and first births

The first column in Table 5.6 reveals that there are strong differences in the transition rates to a first child among women educated in different educational fields. Our results show that first birth risks are lowest among women with a degree in humanities or art and media. Likewise, women without any specific educational field enter motherhood at lower rates. This corresponds to our assumption of low birth risks for graduates from fields that do not have an obvious set of occupations (as it applies to humanities and general education) and for graduates from fields that do not lead to a reliable employment career (as it often is the case for educations in art and media). We also find comparatively low first birth risks for women who graduated with degrees in social sciences, natural sciences or engineering and architecture. As expected, first birth rates are highest among women educated as teachers, or in the field of health care and welfare. These findings support our expectation of high birth risks among graduates of fields in which the main characteristic is working with other people, that are clearly female dominated and that lead to a reliable employment career. Women educated for security services - which in the case of women is mainly police work - also exhibit a very high risk of entering motherhood. An explanation for this might be that, in Sweden, graduates of police colleges usually have very good employment prospects, and tend to be relatively well paid. In addition, colleges for police work primarily prepare students for work in the public sector, where parenthood and paid work can

[86] This corresponds to a study on economic independence and union formation in Sweden carried out by Bracher and Santow (1998). The authors showed that, once Swedish women have obtained a university degree, they are among the fastest to cohabit, to move from cohabitation to marriage, or to marry directly. Our data also shows that the proportion of the process time that graduated women spent as married increases strongly with increasing educational level (see Table B. 9 in Appendix B). However, this might also simply be attributed to the fact that highly educated women are on average older when they leave the educational system, and that the proportion of married women increases with increasing age.

more easily be combined than in the private sector. And, finally, police work might also be viewed as an occupation that is primarily directed towards working with and caring for other people.

Table 5.6: Event history model for the transition to a first child - the effect of educational field

	Relative risk of 1st birth	
	All women	Not enrolled
Educational field		
General	0.71	0.79
Teacher training	1.46	1.29
Art and media	0.78	0.78
Humanities	0.69	0.69
Social sciences, journalism and law	0.85	0.91
Business and administration	1	1
Natural sciences	0.89	0.95
Engineering and construction	0.88	0.95
Manufacturing and processing	1.09	1.03
Agriculture, forestry and animal health	1.05	0.99
Health care and welfare	1.37	1.24
Tech. oriented health care and pharmacy	1.13	1.07
Personal services	1.08	1.01
Security services	1.38	1.25

Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline), period, educational level, educational status, civil status and municipality type. (2) For educational field one additional category (missing information) was included in the analysis; results not shown. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full models are included in Appendix B in Table B. 7 (Model 1 and Model 3).

In the second column of Table 5.6, we show the effect of educational field on the risk of conceiving a first child only for those women that are not currently enrolled in education.[87] Although field specific differences are lower if only graduates are taken into account, the observed pattern remains. Changes between the two models indicate that differences regarding the negative effect of educational enrolment on entering motherhood exist not only among women at different levels of education (see footnote 84), but also among women enrolled in different fields of education. For women

[87] The model from which the estimates of the second column were taken also includes an interaction between educational level and age. However, effects for educational field are not affected significantly by the inclusion of this interaction (see Appendix B, Table B. 7, Model 2 and Model 3).

enrolled in the areas of teacher training, health and welfare or security services, the student role seems to be much less inhibiting than for women who are working towards a degree in social sciences, journalism and law, natural sciences or engineering and architecture.

Excluding civil status from the model changes only the effect of one educational field substantially; namely, security services (see Table B. 12 in Appendix B). If we do not control for civil status, the relative first birth risk for security services graduates decreases from 1.25 to 1.14. From this we might conclude that women educated for security services are on average less likely to be married than women who graduated from other fields of studies. However, Table B. 11 in Appendix B shows that women educated for security services do not differ significantly from women with other educational backgrounds in terms of the share who are married; but, rather, in the share who are divorced. While in our data the proportion of the process time that graduated women spent as divorced is on average 1.4 per cent, it amounts to 3.9 per cent for women who graduated from security services.[88] Having chosen to train in the area of security services therefore seems to be connected to lower levels of union stability before the first birth.

Interaction effects between educational field and educational level

The inclusion of an interaction between educational field and educational level reveals that the observed effect of educational field on the transition rate to a first child is largely consistent across all educational levels (see Table 5.7).[89] Women educated as teachers or in the areas of health care, social care and welfare have an exceptionally

[88] Table B. 11 in Appendix B shows the distribution of the process time by educational field and civil status for women who are not enrolled in education. Differences in the proportion of the process time spent as married might of course also result from field-specific differences in the age at graduation. In a field in which women are on average much older when they leave the educational system, the proportion of the process time that women spent as married is presumably higher due to shorter durations between leaving school and entering marriage. However, the main difference that we observe between graduates in the field of security services and other graduates is a very high proportion of the process time spent as divorced, despite of a rather average proportion that is spent as married.

[89] Table 5.7 shows the interaction between educational field and educational level for all women aged 16 to 45. We also estimated the interaction separately for women aged 16 to 24, 25 to 30, and 31 to 45, but did not find any surprising results and do not include them here. For all educational fields, we found a strong negative relationship between educational level and first birth risk for women below age 25 and a clear positive one for women aged 31 or older.

high risk of entering motherhood, irrespective of the attained level of education. Likewise, at all educational levels, first birth rates are lowest among graduates with degrees in art and media; or in humanities, such as history, philosophy or general language courses (without any qualification for teaching).

Table 5.7: Event history model for the transition to a first child - the effect of educational field by women's educational level (women who are not enrolled in education)

	Relative risk of 1st birth			
	Educational level			
	N.e.: Primary/ lower sec.	N.e.: Upper sec.	N.e.: Short post-sec.	N.e.: Long post-sec.
Educational field				
N.e.: General	0.94	0.80	-	-
N.e.: Teacher training	-	-	1.38	1.30
N.e.: Art and media	-	0.78	0.91	1.01
N.e.: Humanities	-	-	0.72	0.89
N.e.: Social sciences, journalism and law	-	-	0.92	1.12
N.e.: Business and administration	-	1	1.11	1.00
N.e.: Natural sciences	-	1.01	1.02	0.99
N.e.: Engineering and construction	-	0.88	0.98	1.12
N.e.: Manufacturing and processing	-	1.05	1.02	1.04
N.e.: Agriculture, forestry and animal health	-	1.02	1.06	1.08
N.e.: Health care and welfare	-	1.28	1.27	1.40
N.e.: Tech. oriented health care and pharmacy	-	1.10	1.15	1.01
N.e.: Personal services	-	1.02	1.13	-
N.e.: Security services	-	-	1.36	-

Source: Swedish register data, own estimations.
Notes: (1) Controlled for woman's age (baseline), period, civil status and municipality type. (2) For educational level and educational field two additional categories (missing information, enrolled) were included in the analysis; results not shown. (3) Table only includes effects for categories in which the number of women who contributed to the exposure time was at least 50 (see Appendix B, Table B. 11). (4) Effects with a p-value higher than 0.1 are printed in grey. (5) The full model is included in Appendix B in Table B. 7 (Model 5).

By contrast, the observed u-shaped effect of educational level on the risk of conceiving a first child (with the lowest transition rates for graduates from upper secondary school) cannot be confirmed for all educational fields. Only those women who left school after obtaining an upper secondary degree in a general programme (academically oriented programmes, such as the social science programme), or in a vocationally oriented program related to art and media or engineering and construction exhibit lower birth rates than women with only primary or lower secondary education.[90] These are programmes that either do not provide any labour-market specific skills (general programmes), that are strongly male-dominated (upper secondary programmes in engineering and construction), or that are marked by a substantial shortage in employment opportunities (upper secondary art programme and upper secondary media programme; most occupations related to art or media require today at least some kind of tertiary education). Our results show that women who graduated from vocationally oriented upper secondary programmes, that are not male-dominated, and that lead to a labour market sector in which there are still employment opportunities for low to medium educated people (e.g. social care and health care, personal services, manufacturing and processing), do not have a first birth risk below that of women with only a primary or lower secondary degree. The interaction in Table 5.7 also reveals that the first birth rate of graduates from long post-secondary education does not always exceed that of women with only upper secondary education or some tertiary education. This applies, for example, to women with a degree in teaching, technically oriented health care and pharmacy or business and administration. In addition, there are fields of study in which the educational level has nearly no effect on a woman's relative risk of entering motherhood (natural sciences, manufacturing and processing).

5.4.3 Control variables

In addition to the educational variables discussed so far, our models of first birth risks in Sweden include a limited number of control variables. In the previous chapters, we emphasised the importance of a *woman's age* in the relationship between educational level and first birth behaviour. We also discussed the effect of *civil status* on a woman's risk of entering motherhood, and showed how the exclusion of this covariate from the first birth model changes the effect of our educational variables. We now turn to a short description of two further control variables: *period* and *municipality*.

Since period fertility fluctuated strongly in Sweden during our study period, we included a piece-wise linear spline for calendar time in all of our models on first births.

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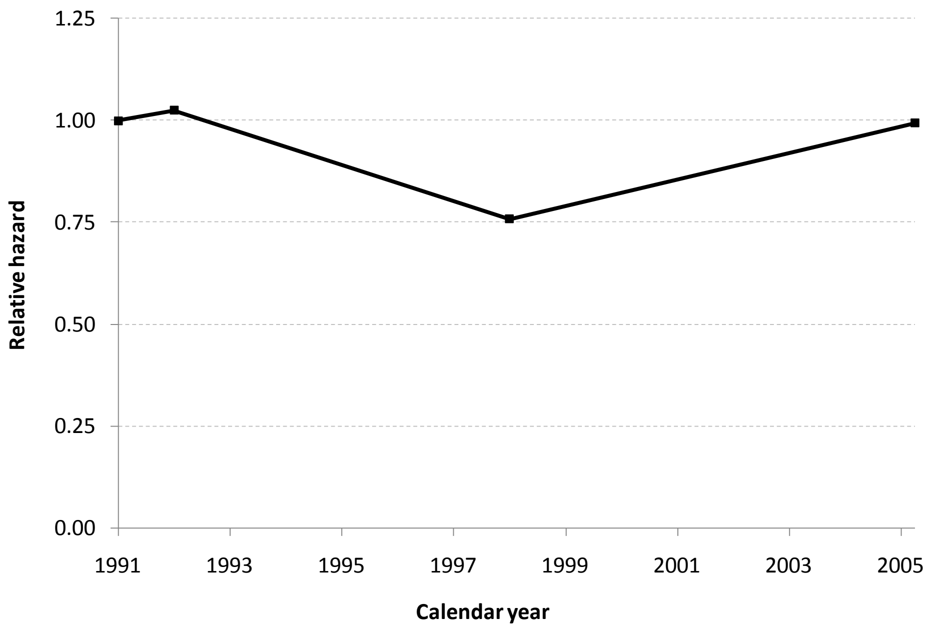
[90] In 2007, the proportion of women who had chosen an upper secondary programme in one of these fields amounted to approximately 65 per cent (Skolverket 2008: 158, own estimations).

In Figure 5.2 we display the spline gradient for period. We can see that the gradient of the period spline for the risk of entering motherhood is very similar to the development of the period TFR (see Chapter 3.2.2). In our data, first conception rates increase until 1992. Subsequently, first birth rates fall drastically as a reaction to economic uncertainties. After 1998, transition rates to a first child increase again, and, by the end of our observation time (March 2005), they are nearly at the same level as in the early 1990s.

Figure 5.2: Event history model for the transition to a first child – the effect of period (January 1991 to March 2005)



Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline), educational level, educational field, educational status, civil status and municipality type. (2) The full model is included in Appendix B in Table B. 7 (Model 3).

Since there are often geographic differences in educational attainment - with highly educated people being more likely to settle in urban areas - we also control for municipality in our models on education and first births. Table 5.8 shows that, in Sweden as well, the risk of conceiving a first child decreases with increasing settlement size. First birth rates are lowest in Sweden's metropolises (Stockholm, Malmö and Gothenburg) and highest in sparsely populated rural municipalities.

Table 5.8: Event history model for the transition to a first child - the effect of municipality type

	Relative risk of 1st birth
Municipality type	
Stockholm, Malmö, Gothenburg	0.79
Other urban municipalities	1
Sparsely populated rural municipalities	1.10

Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline), period, educational level (age specific), educational field, educational status and civil status. (2) For municipality type one additional category (missing information) was included in the analysis; results not shown. (3) The full model is included in Appendix B in Table B. 7 (Model 3).

5.5 Women's education and higher order births

The previous chapters have shown that, for Swedish women, education plays a decisive role in the transition to a first child. We now turn to the impact of educational enrolment, educational level and educational field on a woman's risk of conceiving a second and third child. We estimated separate models for each parity, but decided to present the results jointly for the following reasons. Our analyses of second and third birth risks are based on a very similar modelling strategy. In both cases the basic time dependency is time since previous birth. We also use the same set of control variables in both models. Presenting the results simultaneously therefore makes sense from a practical point of view alone. However, from a strategic point of view as well, there are good reasons for showing the results in a joint chapter. In Sweden, the strong two-child norm implies that, once the first child is born, the second one most often follows more or less "automatically" (Thalberg 2009). As a consequence, economic factors - such as education, employment status or income - might have only a relatively weak impact on second birth risks. The opposite situation applies to third births, since in Sweden the third child is the first birth order that many women today choose to avoid. We therefore take the opportunity to look more closely at any differences in the effect of education on the transition to a second and third child by presenting the results in a comparative manner.

5.5.1 Educational enrolment, educational level and higher order births

As for first births, we initially estimated a model that gives us the main effect of educational enrolment and educational level on the risk of conceiving a second and a third child. In line with our assumption, the results show that being enrolled in education also reduces the risk of childbearing among those who have already entered motherhood (see Table 5.9). However, for mothers the negative effect of educational enrolment on childbearing is much weaker than for childless women. While educational enrolment reduces the risk of entering motherhood by nearly 50 per cent (see Table 5.2), the risk of continued childbearing is only lowered by 22 per cent for one-child mothers and by 10 per cent for two-child mothers.

Table 5.9: Event history models for the transition to a second and third child - the effect of educational enrolment and educational level

	Relative risk of 2nd birth	Relative risk of 3rd birth
Educational status		
Enrolled	0.78	0.90
Not enrolled (N.e.)	1	1
Educational level		
Primary/lower secondary	0.76	1.04
Upper secondary	1	1
Short post-secondary	1.28	1.33
Long post-secondary	1.51	2.00

Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, educational field, civil status and municipality type. (2) For educational status and educational level one additional category (missing information) was included in the analysis; results not shown. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full models are included in Appendix B in Table B. 14 (Model 1) and Table B. 19 (Model 1).

From Table 5.9 we can also see that there is a strong positive effect of educational level on the risk of conceiving a second child. Likewise, third conception risks are highest for women with a long post-secondary education, followed by those with a short post-secondary education. However, in contrast to second conception risks, third conception risks do not differ between women with an upper secondary school degree and those with only primary or lower secondary school education.

For second and third birth risks, as well, we subsequently estimated a model that gives the effect of educational level only for those who - at least temporarily - have finished their education (see Table 5.10). Unlike in our first birth investigation, this step does not lead to any substantial change in the effect of educational level on second or third birth risks. This indicates that, in Sweden, educational level-specific differences in the negative effect of educational enrolment on continued childbearing are rather small. However, it might also be the case that the negative effect of being a student varies among mothers enrolled at different educational levels, but that the proportion of mothers still enrolled in education is simply too small to have any effect.[91]

Table 5.10: Event history models for the transition to a second and third child - the effect of educational level by educational status

	Relative risk of 2nd birth	Relative risk of 3rd birth
Educational status & educational level		
Enrolled	0.79	1.14
N.e.: Primary/lower secondary	0.75	1.04
N.e.: Upper secondary	1	1
N.e.: Short post-secondary	1.29	1.36
N.e.: Long post-secondary	1.49	2.00

Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, educational field, civil status and municipality type. (2) For educational status and educational level one additional category (missing information) was included in the analysis; results not shown. (3) The full models are included in Appendix B in Table B. 14 (Model 2) and Table B. 19 (Model 2).

Table 5.9 shows that mothers of two children who are enrolled in education have in general a 10 per cent lower risk of having an additional child. From Table 5.10, however, we can see that, relative to a two-child mother with an upper secondary degree, those who are still (or once again) enrolled in education have an even higher third birth risk (it should be noted that we do not observe a similar change in our models on first or second births). Since our data do not allow us to estimate the effect of educational enrolment separately for each level of education (see footnote 84, page 112), we can only speculate about the reasons for this change. We believe that, among

[91] In our first birth model, the proportion of the process time that women spent in education is 49.5 per cent, while it is only 11.7 per cent in the second birth model and 9.6 per cent in the third birth model.

two-child mothers, educational enrolment nearly exclusively means short or long post-secondary studies (while this might apply less strongly to mothers of one child). Even if women enrolled in post-secondary education had a (let us assume) 10 per cent lower risk to of having a third child compared to graduates from post-secondary education, their third birth intensity would still be well above the intensity of upper secondary graduates.

Although the correlation between marriage and fertility is presumably less strong for higher order births than for first births, we examined whether the exclusion of civil status leads to any substantial change in the effect of educational enrolment or educational level on second and third birth risks. Table 5.11 shows first how civil status influences a woman's risk of continuing childbearing.

Table 5.11: Event history models for the transition to a second and third child - the effect of civil status

	Relative risk of 2nd birth	Relative risk of 3rd birth
Civil status		
Single/cohabiting	0.66	0.84
Married	1	1
Divorced	0.51	1.46
Widowed	0.36	0.96

Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, educational level, educational field, educational enrolment and municipality type. (2) For civil status one additional category (missing information) was included in the analyses; results not shown. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full models are included in Appendix B in Table B. 14 (Model 2) and Table B. 19 (Model 2).

As in our first birth model (see Table 5.5), second birth rates are highest for those who are married. However, in comparison to first births, differences in second birth risks by civil status are less pronounced. For third births, we see a completely different picture. The risk of family enlargement is considerably elevated among two-child mothers who are divorced, while there is comparatively little difference in third birth intensities among those who are married, single or cohabiting, or widowed. Excluding civil status from our second and third birth model leads to an effect similar to the one we observed in our model on entering motherhood. While the effect of educational enrolment remains unchanged, we find an even stronger positive effect of educational level on higher order birth risks.[92] As for first births, this change can be attributed to the fact that, also in our second and third birth models, the proportion of the process time that graduated women spent as married increases strongly with increasing educational level (see Table B. 18 and Table B. 23 in Appendix B).

Finally, we investigated whether the observed positive effect of educational level on second and third birth risks can be explained by the so-called *time-squeeze effect*, meaning that the elevated higher order birth intensities among highly educated women result from their shorter birth intervals due to a comparatively late entry into motherhood (see Chapter 2.2.5). For our analysis, we adopted an approach proposed by Gerster et al. (2007), and estimated for both parities three types of interactions, namely:

a two-way interaction between time since previous birth (baseline) and a woman's age at previous birth,

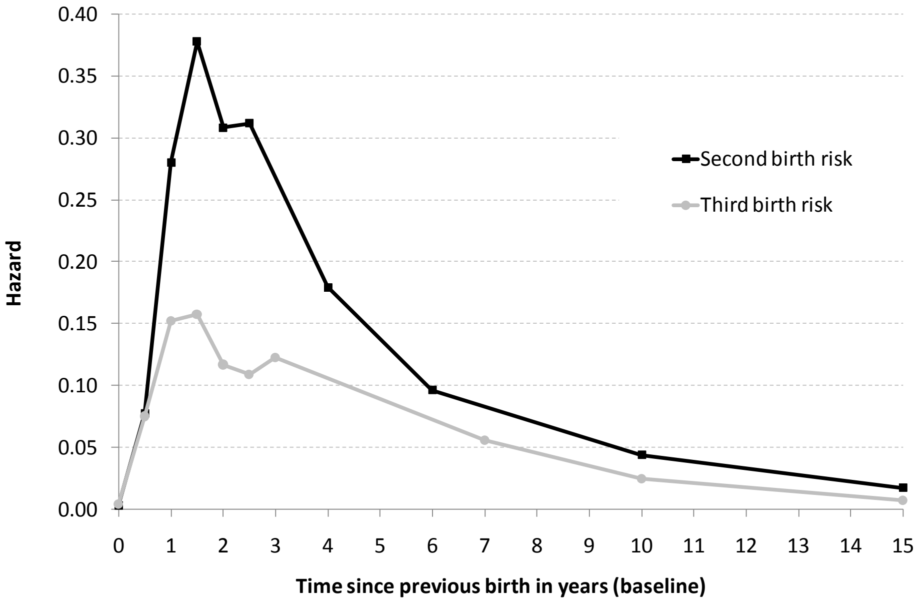
a two-way interaction between time since previous birth (baseline) and a woman's educational level, and

a three-way interaction between time since previous birth (baseline), a woman's age at previous birth and a woman's educational level.

In Figure 5.3 and Figure 5.4 we first show the main effects of time since previous birth and age at previous birth on a woman's risk of conceiving a second and a third child.

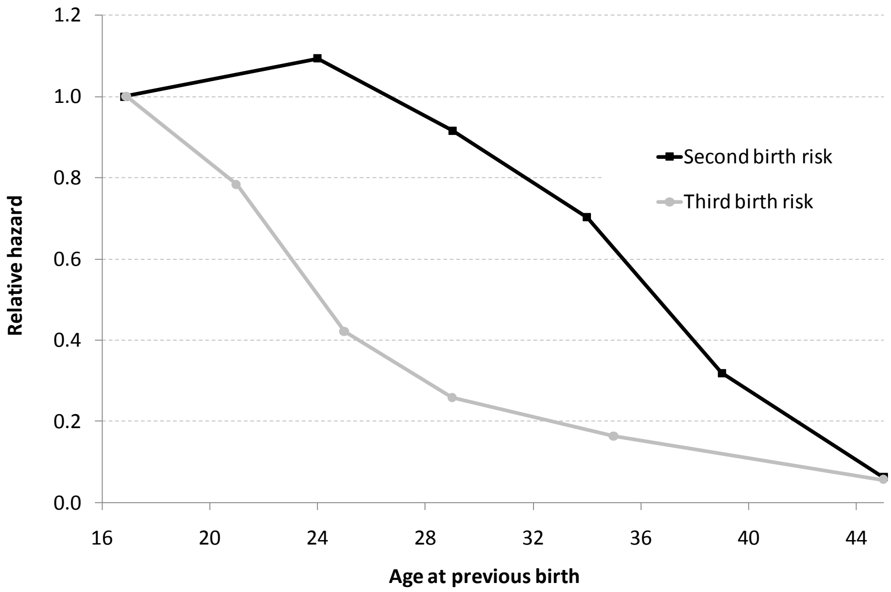
92 Second birth risks increase by nine per cent for short post-secondary graduates and by 21 per cent for long post-secondary graduates. The corresponding increases for third birth risks are three per cent and nine per cent, respectively (see Table B. 22 in Appendix B).

Figure 5.3: Event history models for the transition to a second and third child - the effect of time since previous birth (baseline)



Source: Swedish register data, own estimations
Notes: (1) Controlled for age at previous birth, period, educational level, educational field, educational status, civil status and municipality type. (2) The full models are included in Appendix B in Table B. 14 (Model 2) and Table B. 19 (Model 2).

Figure 5.4: Event history models for the transition to a second and third child - the effect of age at previous birth



Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth, period, educational level, educational field, educational status, civil status and municipality type. (2) See Figure 5.3, note 2.

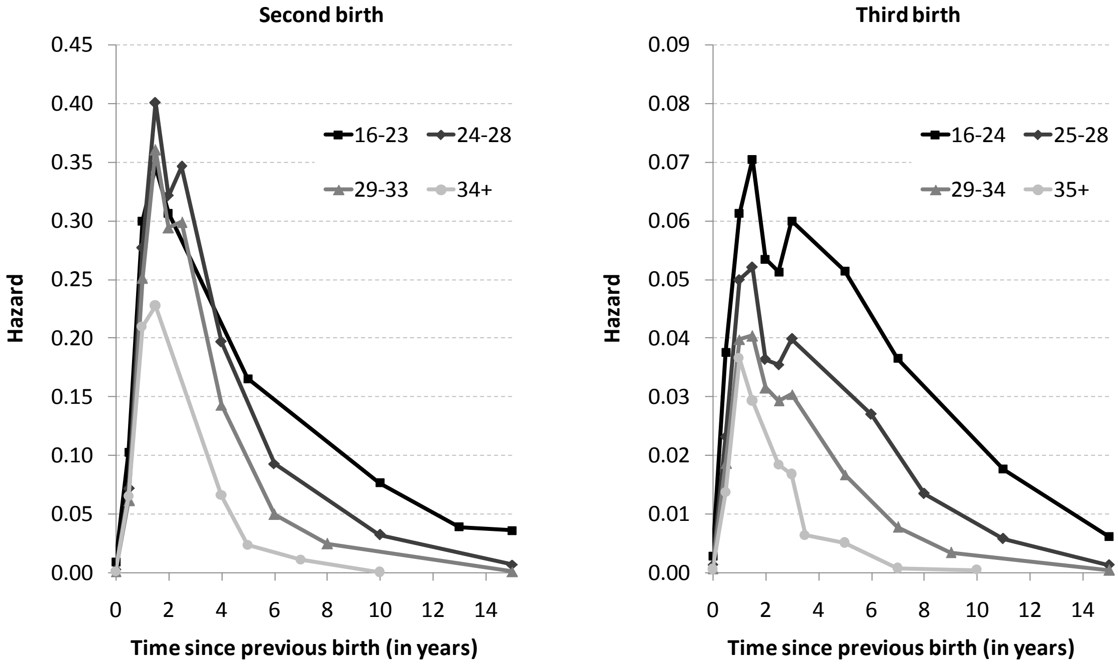
As can be seen in Figure 5.3, higher order conception risks increase in Sweden strongly during the first one-and-a-half years after delivery, followed by a sharp decrease during the following years that is much more pronounced for second than for third conception risks. For both parities, Figure 5.3 shows a short break in the decrease of conception rates at two years to two-and-a-half years (in case of third conceptions, at three years) after the previous birth. This peculiarity can be attributed to a particular aspect of the Swedish parental leave policy - namely, the "speed premium" – which makes it economically advantageous for parents to space children less than 30 months apart (see Chapter 3.2.1). Quite a number of Swedish women try to stay within the eligibility interval. As a result of this pre-ponement of second and third births, conception risks drop more strongly between one-and-a-half and two years than they would have done without the speed premium.

Figure 5.4 reveals that a woman's age at previous birth has a decisive impact on her higher order conception risks. Second conception rates increase up to an age of 24 years at first birth, but decrease strongly with higher ages at entering motherhood. For two-child mothers, the propensity to conceive instead decreases without interruption with increasing ages at second birth.

In Figure 5.5 we present the first interaction; namely, the interaction between *time since previous birth and a woman's age at previous birth*.[93]

[93] The software aML, which we use for the estimation of all our models, does not allow for interacting two duration splines. Therefore, we included women's age at previous birth as a categorical variable (not as a piecewise linear spline) whenever we estimated an interaction between women's age at previous birth and a further duration spline, such as time since previous birth. For the main effect of women's age at previous birth as a time-constant categorical variable see Appendix B, Table B. 14 (Model 3) and Table B. 19 (Model 3).

Figure 5.5: Event history models for the transition to a second and third child - the effect of time since previous birth (baseline) by age at previous birth

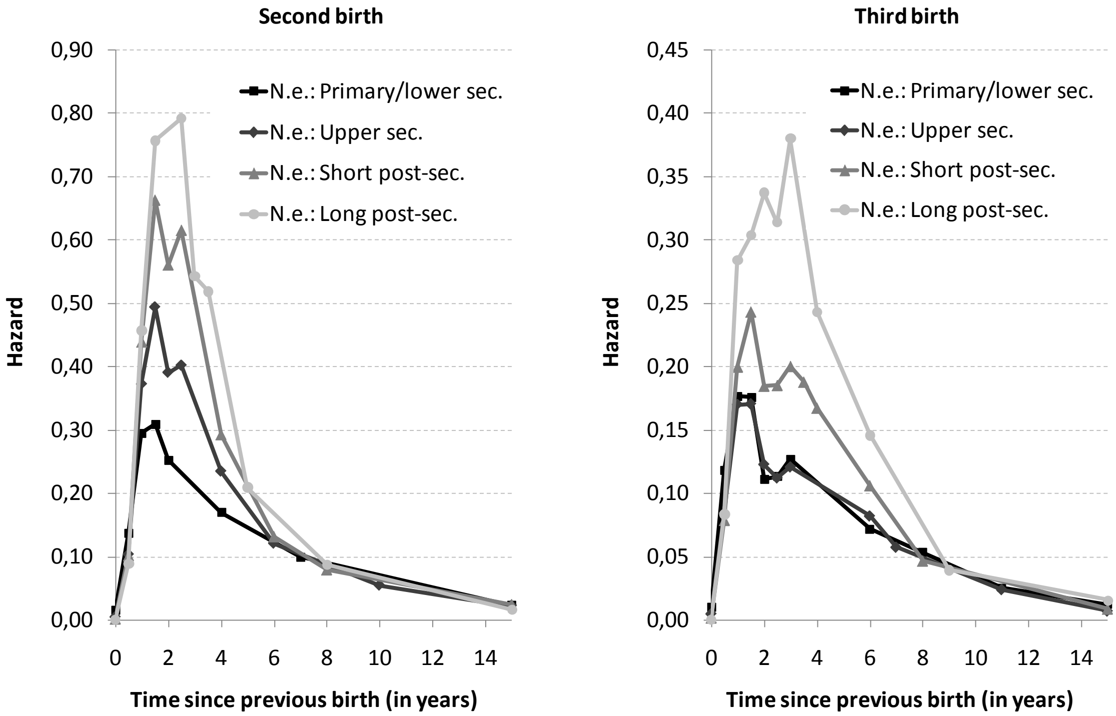


Source: Swedish register data, own estimations.
Notes: (1) Controlled for period, educational level, educational field, educational status, civil status and municipality type. (2) The interactions were estimated on the basis of Model 3 (see Appendix B, Table B. 14 and Table B. 19).

Irrespective of the age at the previous birth, second and third conception rates reach their peak during the first one-and-a-half years after the previous child is born, which means that the "speed premium" affects women at all ages. Nevertheless, we observe an age-related time-squeeze pattern for both parities. Women who had their first/second child late conceive the following child on average within a shorter period of time than those who were young at entering motherhood/at the birth of their second child. This pattern mainly results from the fact that, for women who were comparatively young at the birth of their previous child, higher order conception rates fall less steeply at longer time spans since the previous birth. For second births, Figure 5.5 even reveals a change in the ordering of conception rates with increasing duration since the first birth. One-and-a-half years after the first child is born, the risk of conceiving a second child is highest for women who entered motherhood at ages 24 to 28, followed by those who were aged 29 to 33 at first birth. At longer durations, however, women who entered motherhood at very young ages have the highest risk of conceiving a second child. As to the timing of third conceptions, especially those who gave birth to their second child at very high ages stand out. For these women, the third conception risks already reach a peak one year after the previous child is born, and decrease thereafter much faster than for all other women.

To see whether there is also a time-squeeze pattern that is related to educational level, we fitted a second interaction; namely, the interaction between *time since previous birth and a woman's educational level*. The results are displayed in Figure 5.6.

Figure 5.6: Event history models for the transition to a second and third child - the effect of time since previous birth (baseline) by educational level

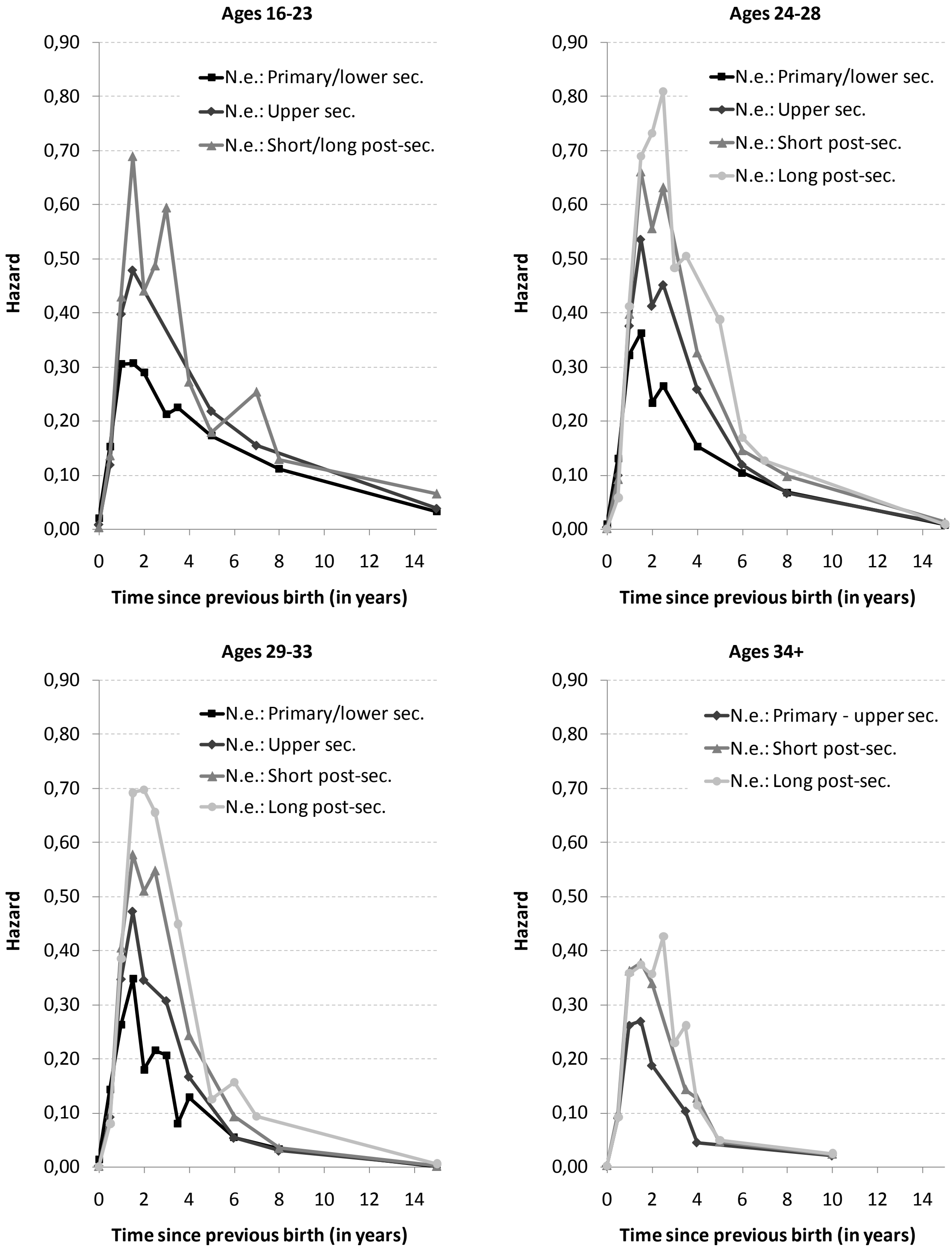


Source: Swedish register data, own estimations
Notes: (1) Controlled for age at previous birth, period, educational field, civil status and municipality type. (2) The interactions were estimated on the basis of Model 2 (see Appendix B, Table B. 14 and Table B. 19) and also include a spline for those enrolled in education; results not shown.

If there is an educational level-related time-squeeze effect, we would expect to find highly educated women having particularly high second and third birth rates at early durations. Figure 5.6 shows however that – once age at previous birth is controlled for – no such pattern can be discerned. Indeed, it turns out that, in Sweden, highly educated women have high rates of continued childbearing later, not earlier than women with less education. For women with low or medium levels of education, second and third conception rates are highest after one-and-a-half years, whereas women with a long post-secondary degree are most likely to conceive a second child two-and-a-half years after the first one is born, and transition rates to a third child are highest after three years. In our view, there are three possible explanations for this surprising finding. First, it might be that, due to their higher incomes, highly educated Swedish women feel freer to space their births independent of any financial incentive, such as the “speed premium”. Furthermore, it might be the case that highly educated women are less likely to space their children close together because they prefer to have several short interruptions in employment, rather than being out of the labour force for a longer period. Finally, decreases in fecundity with increasing age may be an explanation for longer birth intervals among the highly educated. Due to their extended educational careers, highly educated women usually enter motherhood at higher ages, and are therefore older when they are at risk of conceiving a second or a third child. Lower fecundity at these ages might induce longer waiting times for subsequent children.

We saw in Figure 5.5 that a high age at the previous birth is connected to a more condensed pattern of higher order birth rates. Contrary to our expectations, however, Figure 5.6 showed that birth intervals are not shorter for highly educated women. To verify that there really is not more to the time-squeeze than age, we estimated a final interaction between *time since previous birth, a woman’s age at previous birth, and a woman’s educational level*. The results for second conception rates are displayed in Figure 5.7.

Figure 5.7: Event history model for the transition to a second child - the effect of time since previous birth (baseline) by age at previous birth and educational level



Source: Swedish register data, own estimations
Notes: (1) Controlled for period, educational field, educational status, civil status and municipality type.
(2) The interaction was estimated on the basis of Model 3 (see Appendix B, Table B. 14) and includes also a spline for those enrolled in education; results not shown.

If we look at Figure 5.7, we can see that there is no indication that highly educated women proceed more quickly to a second child than their lower educated counterparts. Also those highly educated women who started childbearing late (lower panels of Figure 5.7) do not have a more condensed second conception pattern than the lower educated "late starters". We fitted the same interaction for third conception rates as well and found very similar results (Figure not shown). For that reason, we conclude that there is no evidence of an educational level-related time-squeeze effect that can serve as an explanation for the elevated higher order birth rates of highly educated Swedish women.

5.5.2 Educational field and higher order births

In Chapter 5.4.2 we showed that there are strong differences in the transition rates to a first child among women educated in different educational fields. We now turn to the impact of field of education on a woman's risk of continuing childbearing. Table 5.12 shows second and third conception risks for women who are not enrolled in education, depending on the field of education they were trained in.[94]

First, we can see that educational field has a much weaker impact on the transition to a second child than on entering motherhood (for first births see Table 5.6). This might be attributed to the fact that the two-child norm is well established in Sweden. Most of those who decide to enter motherhood also have a second child (Oláh and Bernhardt 2008), which probably reduces field-specific differences in second conception risks. As in our first conception model, we find relatively low second conception rates for women with a degree in art and media or humanities. Women who were educated in the areas of social sciences or personal services also conceive a second child at lower rates. In addition, women educated for security services exhibit a relatively low second birth risk, which is surprising since they showed one of the highest first birth intensities. Second conception rates are highest for women educated

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[94] For the effect of educational field on higher order birth risks, we also first estimated a model that gives the effect for all women, regardless of whether they are still in education or not (see Appendix B, Table B. 14, Model 1 and Table B. 19, Model 1). However, contrary to our first birth model, the effect of educational field on second and third birth rates does not change markedly when the effect is estimated only for graduated women instead of for all women. Therefore, we only show the results for the effect of educational field on higher order fertility for graduated women.

in the fields of agriculture, forestry and animal health, as well as for women educated for jobs in the health care and welfare sectors. Women educated for teaching do not have an elevated risk of having a second child, although they displayed one of the highest risks of entering motherhood.

For the transition to a third child, we once again find strong differences between women educated in different educational fields. Table 5.12 reveals that the probability of having a third child is lowest among women educated for security services or for jobs in the area of business and administration. In addition, women with a degree in social sciences, journalism and law, or in natural sciences exhibit a relatively low third birth risk. The risk of having a third child is highest for women educated in the field of agriculture and animal health, followed by women with a degree in humanities. Women educated in health care and social work or teaching also display high transition rates to a third child.

Table 5.12: Event history models for the transition to a second and third child - the effect of educational field

	Relative risk of 2nd birth	Relative risk of 3rd birth
Educational field		
N.e.: General	1.01	1.17
N.e.: Teacher training	0.99	1.13
N.e.: Art and media	0.84	1.15
N.e.: Humanities	0.87	1.27
N.e.: Social sciences, journalism and law	0.91	1.02
N.e.: Business and administration	1	1
N.e.: Natural sciences	0.98	0.99
N.e.: Engineering and construction	0.94	1.06
N.e.: Manufacturing and processing	0.94	1.20
N.e.: Agriculture, forestry and animal health	1.08	1.61
N.e.: Health care and welfare	1.05	1.19
N.e.: Tech. oriented health care and pharmacy	1.02	1.04
N.e.: Personal services	0.91	1.11
N.e.: Security services	0.92	0.94

Source: Swedish register data, own estimations

Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, educational level, educational status, civil status and municipality type. (2) For educational field one additional category (missing information) was included in the analyses; results not shown. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full models are included in Appendix B in Table B. 14 (Model 2) and Table B. 19 (Model 2).

While most of the results for the effect of educational field on fertility are as we expected them to be, there are also a couple of things that puzzled us. First, why do women educated for security services have such a high risk of entering motherhood, but one of the lowest risks of continuing childbearing?[95] Second, why do we not find very high second and third birth risks for women educated for teaching? And third, why do women with general education and women who graduated in humanities or art and media not have a low risk of conceiving a third child, but rather an average or even elevated one? We will discuss these issues in the concluding part of this chapter, when we contrast our findings with our initial hypothesis.

As in the previous sections, we also checked whether there are any changes in the relationship between educational field and higher order childbearing when civil status is excluded from the model. However, we only found minor changes. This can probably be attributed to both smaller differences in civil status with increasing age between graduates from different educational fields, and a generally weaker effect of civil status on higher order births than on entering motherhood.

Interaction effects between educational field and educational level

For higher order births, we finally also estimated an interaction between educational field and educational level. From Table 5.13 and Table 5.14 we can see that, in the case of higher order births, it is the effect of educational level that can be largely confirmed for all educational fields.[96] Second conception risks increase with increasing educational levels in all fields of education. For third conceptions, we also find the same general pattern of educational level in nearly all educational fields. Exceptions are women educated in art and media or agriculture, forestry and animal health, for which

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[95] While the first birth risk for women educated in the field of security services is highly significant (see Table B. 7 in Appendix B), we do not get a significant effect for this educational field in our higher order birth models. We primarily attribute this lack of significance to the large differences in the number of women who contribute to the different categories of educational field, with "security services" being by far the smallest category (see Table B. 1 to Table B. 3 in Appendix B). Even if women trained in security services do not differ significantly in their higher order births risk from women educated for business and administration, we might still wonder why they only have an average second and third birth risk despite of their high risk of entering motherhood.

[96] In our first birth model, we found that the effect of educational field is nearly consistent across all educational fields, but that there are field-specific differences in the effect of educational level on entering motherhood (see Chapter 5.4.2).

the risk of conceiving a third child does not increase between the two highest educational levels. Likewise, the third birth risk of a woman with a general degree at the upper secondary level does not exceed the risk of a woman with only primary or lower secondary general education.

To some extent the interactions also reveal consistency in the effect of educational field on higher order births. Women educated for jobs in agriculture, forestry and animal health or in the health care and welfare sectors have an elevated risk of conceiving a second and a third child, regardless of their attained level of education. Likewise, graduates in the humanities show a very high third conception risk, regardless of the number of years they spent in post-secondary education. Finding a consistent pattern of fields with a low risk of having a second or a third child appears to be more difficult. The model that included only the main effect of educational field on women's risk of continuing childbearing has shown low second conception risks for graduates with degrees in humanities, art and media, social sciences, journalism or law and personal services (see Table 5.12). From the interaction table, however, we can see that only those with a degree in art or media have a low risk of conceiving a second child at each level of education. Among humanities graduates, only those with a short post-secondary degree have a low risk of having a second child, while the second birth risk of humanities graduates with a long post-secondary level is average. The opposite applies to graduates with degrees in social sciences, journalism or law. For women educated in the area of personal services, our interaction shows the most contradictory results. Women educated for personal services at the upper secondary school level have one of the lowest risks of continuing childbearing after the first child, whereas those with a short tertiary education in the same field have one of the highest second conception risks. We can only speculate about the reasons for this finding. It might be the case, for example, that improvements in income, working conditions and employment stability with an increasing level of education are particularly strong in the area of personal services.[97] With respect to third conceptions, our main effect model has

[97] Women with an upper secondary degree in personal services primarily find employment in areas such as hotel and restaurant services, household services, office cleaning or hair and beauty care, which are often marked by low wages and irregular working hours. By contrast, women with longer educations in personal services often have jobs in the areas of tourism, recreation, sport or physical welfare, which have a much higher occupational status and often offer much better income opportunities.

shown the lowest transition rates for graduates with degrees in security services, business and administration, and the natural sciences (see Table 5.12). The interaction of educational level and educational field confirms that women educated for security services have a very low risk of having a third child relative to other women with the same level of education. Graduates in the natural sciences have a low risk of conceiving a third child at nearly all educational levels (they show an average third birth risk only at the upper secondary level). Women educated in business and administration, however, appear to have a low risk of having a third child at the upper secondary school level only, while women with tertiary education in this area show a rather average transition rate.

Table 5.13: Event history model for the transition to a second child - the effect of educational field by women’s educational level (women who are not enrolled in education)

	Relative risk of 2nd birth			
	Educational level			
	N.e.: Primary/ lower sec.	N.e.: Upper sec.	N.e.: Short post-sec.	N.e.: Long post-sec.
Educational field				
N.e.: General	0.76	1.01	-	-
N.e.: Teacher training	-	-	1.29	1.46
N.e.: Art and media	-	0.86	1.09	1.14
N.e.: Humanities	-	-	1.11	1.39
N.e.: Social sciences, journalism and law	-	-	1.21	1.30
N.e.: Business and administration	-	1	1.33	1.59
N.e.: Natural sciences	-	1.01	1.31	1.35
N.e.: Engineering and construction	-	0.92	1.20	1.50
N.e.: Manufacturing and processing	-	0.96	1.02	1.33
N.e.: Agriculture, forestry and animal health	-	1.09	1.47	1.59
N.e.: Health care and welfare	-	1.07	1.32	1.64
N.e.: Tech. oriented health care and pharmacy	-	1.02	1.34	1.44
N.e.: Personal services	-	0.91	1.40	-
N.e.: Security services	-	-	1.20	-

Source: Swedish register data, own estimations

Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, civil status and municipality type. (2) For educational level and educational field two additional categories (missing information, enrolled) were included in the analysis; results not shown. (3) Table only includes effects for categories in which the number of women who contributed to the exposure time was at least 50 (see Appendix B, Table B. 16). (4) Effects with a p-value higher than 0.1 are printed in grey. (5) The full model is included in Appendix B in Table B. 14 (Model 4).

Table 5.14: Event history model for the transition to a third child - the effect of educational field by women's educational level (women who are not enrolled in education)

	Relative risk of 3rd birth			
	Educational level			
	N.e.: Primary/ lower sec.	N.e.: Upper sec.	N.e.: Short post-sec.	N.e.: Long post-sec.
Educational field				
N.e.: General	1.22	1.17	-	-
N.e.: Teacher training	-	-	1.54	2.33
N.e.: Art and media	-	1.19	1.74	1.65
N.e.: Humanities	-	-	1.74	2.35
N.e.: Social sciences, journalism and law	-	-	1.48	1.91
N.e.: Business and administration	-	1	1.41	2.31
N.e.: Natural sciences	-	1.11	1.36	1.75
N.e.: Engineering and construction	-	1.19	1.31	2.03
N.e.: Manufacturing and processing	-	1.21	1.45	2.55
N.e.: Agriculture, forestry and animal health	-	1.62	2.99	2.93
N.e.: Health care and welfare	-	1.19	1.63	2.86
N.e.: Tech. oriented health care and pharmacy	-	1.08	1.45	1.65
N.e.: Personal services	-	1.12	1.60	-
N.e.: Security services	-	-	1.32	-

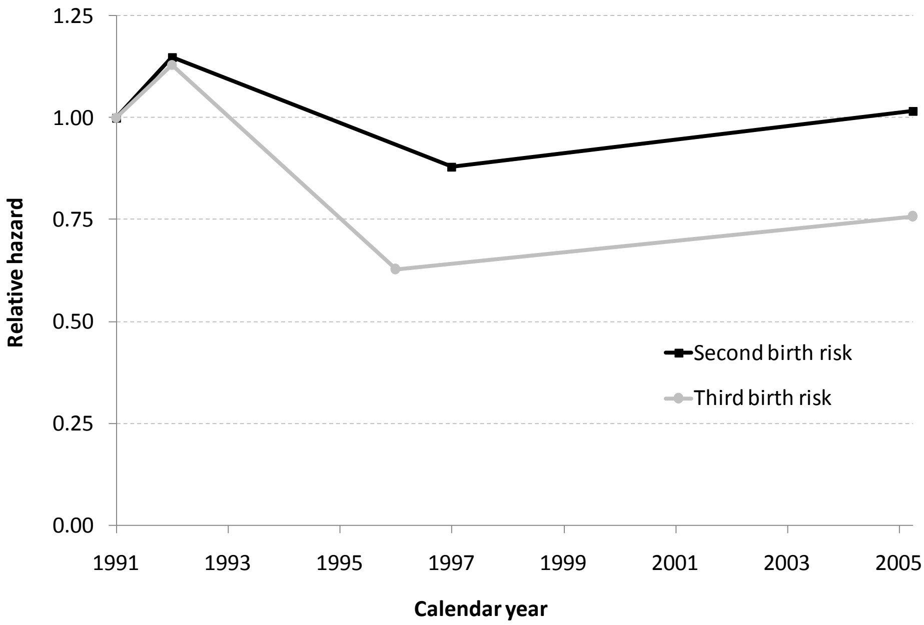
Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, civil status and municipality type. (2) For educational level and educational field two additional categories (missing information, enrolled) were included in the analysis; results not shown. (3) Table only includes effects for categories in which the number of women who contributed to the exposure time was at least 50 (see Appendix B, Table B. 21). (4) Effects with a p-value higher than 0.1 are printed in grey. (5) The full model is included in Appendix B in Table B. 19 (Model 4).

5.5.3 Control variables

As in our chapter on first births, we now turn to a short description of the impact of further control variables on higher order births. We have already discussed the relationship between *time since previous birth* and higher order childbearing in our investigation of the time-squeeze effect. In this context, we also demonstrated how *age at previous birth* influences women's risk of continuing childbearing. In addition, we discussed the effect of *civil status* on a woman's risk of having a second or third child, and we tested how the exclusion of this covariate from higher order birth models changes the effect of our educational variables. As in the corresponding chapter on first births, we now turn to two further control variables: *period* and *municipality type*.

In our models on continued childbearing, we basically get the same effect for period as in our model on first births (see Figure 5.8). Higher order conception risks increase until 1992, decline sharply during the years of the economic crisis, and stabilise or start to increase again in 1996/1997. However, unlike for first birth rates (see Figure 5.2), higher order transition rates remain below the level of the early 1990s throughout the remaining study period.

Figure 5.8: Event history models for the transition to a second and third child - the effect of period (January 1991 to March 2005)



Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, educational level, educational field, educational status, civil status and municipality type. (2) The full models are included in Appendix B in Table B. 14 (Model 2) and Table B. 19 (Model 2).

For municipality type, we get very similar effects in all three conception models. Women living in one of Sweden's big cities not only enter motherhood at lower rates; they are also less likely to continue childbearing. Transition rates to a first, second and third child are highest in municipalities with very low population densities.

Table 5.15: Event history models for the transition to a second and third child - the effect of municipality type

	Relative risk of 2nd birth	Relative risk of 3rd birth
Municipality type		
Stockholm, Malmö, Gothenburg	0.89	0.93
Other urban municipalities	1	1
Sparsely populated rural municipalities	1.07	1.17

Source: Swedish register data, own estimations
Notes: (1) Controlled for time since previous birth (baseline), age at previous birth, period, educational level, educational field, educational status and civil status. (2) For municipality type one additional category (missing information) was included in the analyses; results not shown. (3) The full models are included in Appendix B in Table B. 14 (Model 2) and Table B. 19 (Model 2).

In preliminary analyses of third conceptions, we also considered the gender composition of the previous children as a control variable. For Sweden, earlier studies have yielded quite contrary results. While a study by Hoem (1993a) suggested that Swedish parents of two daughters have a significantly higher third birth risk than parents of two boys or a mixed pair of children, most other researchers (e.g. Schullström 1996; Hank and Kohler 2000; Andersson et al. 2006a) have found that Swedish parents of same-sex children exhibit a higher third birth intensity than those who have both a son and a daughter. In accordance with Andersson et al. (2006a), we found that the risk of conceiving an additional child is lowest for women with a mixed pair of children, while those with two boys are most likely to continue childbearing (results not shown).[98] However, since controlling for the gender composition of the previous children did not lead to any changes in our educational variables, we decided to not include this variable in our final models.

5.6 Simultaneous modelling of all birth transitions

In recent years several researchers have objected that statistical models such as the one used in this investigation may produce a false impression about the role of education in women's higher order childbearing behaviour (e.g. Kravdal 2001, 2007;

[98] We also checked whether the sex of the first child affects women's risk of conceiving a second one, but we did not find any evidence for this kind of influence.

Kreyenfeld 2002). According to Kravdal (2007: 212) a major problem is that “… there are educational differentials in the selection of women who, at a given age, have already had their first (second) child and therefore are exposed to the chance of having a second (third) child”. Comparing two women with the same age at the previous birth, but completely different educational trajectories, might in fact be a comparison of women with completely different preferences or family orientations (Gerster et al. 2007). This *selection effect* might be an explanation of the elevated second and third conception risks of highly educated women (see our corresponding explanations in Chapter 2.2.5).

In our chapter on fertility patterns we have shown that, in Sweden, differences by educational level in the proportion of women who remain childless are rather small (see Chapter 3.2.2, Table 3.1). In the context of Sweden, it might therefore be argued that highly educated women with children are not more selected than lower educated women with children; and that, therefore, selection effects should not be of great importance in explaining the relationship between education and higher order fertility. However, the main argument for controlling for selection effects is that event history models compare women with different levels of education at “a given age”/”a given age at previous birth”, and that the composition of women who already have one/two children at this age might be quite different for women with different educational backgrounds (e.g. age 24 might be an average age for becoming a mother among low educated women, but a rather unusual age among highly educated women, which means that we are comparing an “average” low educated women with a rather selective highly educated one). Although Swedish women with different levels of education do not differ significantly in their propensity to become a mother, they do differ greatly with respect to the age at which they enter motherhood/have a second child. We therefore believe that, in the Swedish context as well, event history models might lead to biased results for the effect of educational level on higher order childbearing if selection effects are not taken into account. In addition, it is important to keep in mind that selection effects might play a role, not only in the relationship between educational level and higher order childbearing, but also in the relationship between educational field and rates of continued childbearing. Hoem et al. (2006a, 2006b) have shown that, in Sweden, differences in childlessness and in ultimate fertility are much more pronounced between women educated in different fields of education than between women with different levels of education. Women with a degree in a field in which a large proportion of women remain childless (e.g. humanities), and who are at risk of having a second or a third child, might be a selected group. By becoming a mother despite of their unfavourable labour market prospects, they have already shown a strong preference for having children. They might therefore be more likely to continue childbearing than mothers educated in fields in which nearly all women have children. This kind of selection process might explain our finding of an average or even high (instead of a low) third birth risk for women with general degrees and graduates with degrees in humanities or art and media.

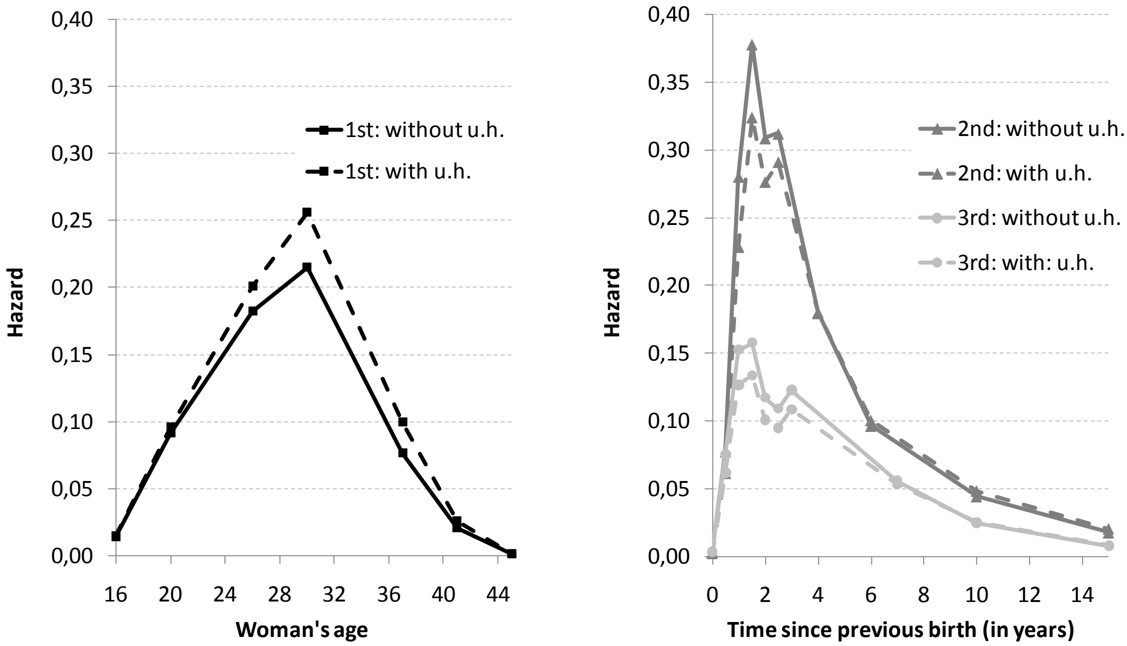
To examine the selection, effect researchers usually estimate several parity transitions jointly by including a woman-specific unobserved heterogeneity term that represents a woman's unobserved characteristics (e.g. her family orientation). Previous studies have shown that this modelling strategy can lead to significant changes in the impact of educational level on higher order childbearing. However, to our knowledge, the positive gradient of the educational variable only disappeared in those studies that used educational level as a time-independent variable measured at the time of the interview or at the end of the reproductive age span (Kravdal 2001, 2007; Kreyenfeld 2002), but not in studies in which education was constructed as time-dependent (Martín-García 2006: 166-169, 189-193; Kravdal 2007). Nevertheless, Kravdal (2007) warned against generalising from previous findings, and recommended always checking whether the inclusion of unobserved heterogeneity gives different estimates for the effect of education on higher order childbearing.[99] We therefore estimated a joint model for first, second and third conceptions (for methodological details see Chapter 5.3). The results of this joint model are included in Appendix B in Table B. 24, Table B. 25 and Table B. 26.

In our analysis, the standard deviation of the unobserved heterogeneity term equals 0.44, and is significantly different from zero. This means that there are

[99] We strongly agree with him, especially since there is a study that has shown that a joint modelling strategy can lead to changes in the effect of educational variables, even if they are constructed as time-dependent. In an investigation of fertility patterns in Bulgaria, Koytcheva (2006: 222-228) initially found no significant effect of educational level (time-dependent) on the risk of entering motherhood and a negative effect on second birth risks. Once Koytcheva modelled both fertility transitions simultaneously, the estimations revealed a clear negative impact of educational level on first birth risks and a much stronger negative relationship between educational level and second birth risks.

unobserved characteristics of the women in the data that affect fertility outcomes. In Figure 5.9 we visualise how the control for unobserved heterogeneity changes the run of the baseline intensity for first, second and third conceptions.

Figure 5.9: Comparison of separate models and joint model - the baseline intensity

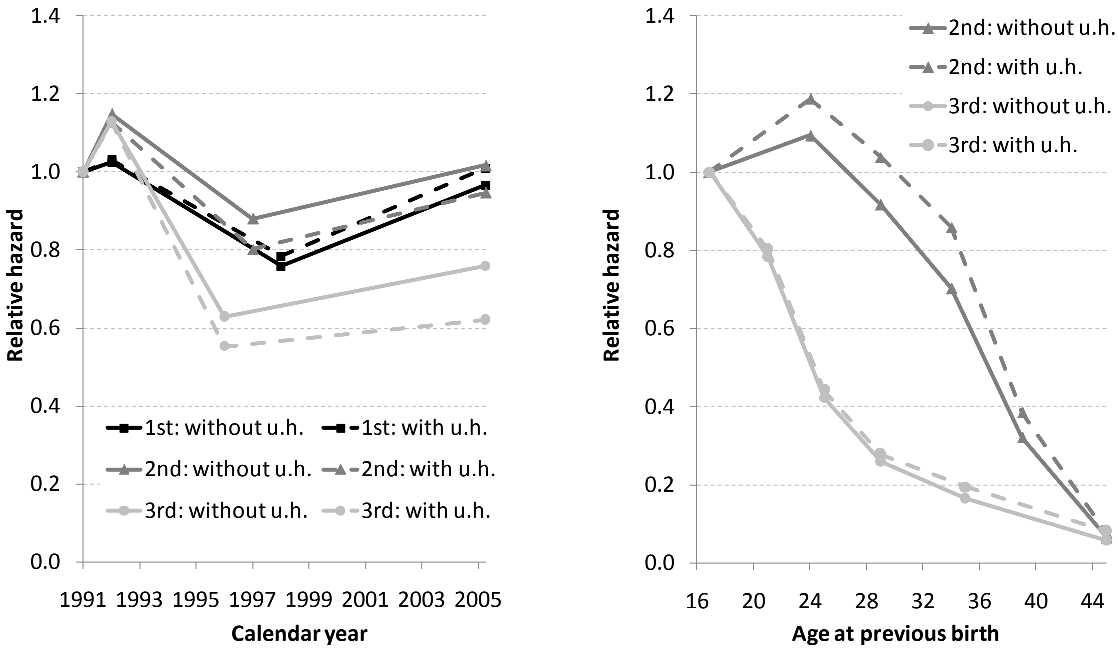


Source: Swedish register data, own estimations
Notes: (1) u.h.=unobserved heterogeneity. (2) Controlled for age at previous birth (only in higher order birth models), period, educational level, educational field, educational status, civil status and municipality type. (3) The full models are included in Appendix B in Table B. 24, Table B. 25 and Table B. 26.

For all three parities, the shape of the spline basically stays the same; adding an unobserved heterogeneity term only affects the absolute risk level. Neglecting unobserved heterogeneity leads to an underestimation of first conception intensities for women aged 20 to 40, and to an overestimation of second conception intensities at one to two-and-a-half years of duration and of third conception intensities at one to seven years of duration.

Effects for period and age at previous birth change in a similar way (see Figure 5.10). Once again adding an unobserved heterogeneity term does not lead to any profound modifications in the spline gradients. Models without a frailty term slightly underestimate first conception risks between 1998 and 2005. For second and third conceptions, the joint modelling approach leads to clearly lower risk levels after 1996/1997 than the estimates that were produced by the separate models. For age at previous birth, Figure 5.10 shows that neglecting unobserved characteristics of the woman results in an underestimation of second conception risks, especially at ages 22 to 36, whereas there are only small differences in the spline gradients for third conceptions.

Figure 5.10: Comparison of separate models and joint model - the effect of period and the effect of age at previous birth



Source: Swedish register data, own estimations
Notes: (1) u.h.=unobserved heterogeneity. (2) Effect of period: controlled for woman's age (first birth), time since previous birth (higher order births), age at previous birth (higher order births), educational level, educational field, educational status, civil status and municipality type. Effect of age at previous birth: controlled for time since previous birth, period, educational level, educational field, educational status, civil status and municipality type. (3) The full models are included in Appendix B in Table B. 24, Table B. 25 and Table B. 26.

Our main motivation for running a joint model of first, second and third conceptions were to verify the robustness of the estimates of our educational variables. If, indeed, selection effects play a role in the relationship between educational level and higher order childbearing, then the elevated conception risks for highly educated one-child and two-child mothers should disappear, or at least diminish once unobserved characteristics are controlled for. Likewise, one might expect changes in the effect of educational field on continued childbearing. However, the inclusion of an unobserved heterogeneity factor does not lead to any substantial differences in the estimates of our educational variables. Some effects get slightly stronger, such as the negative effect of educational level on the risk of entering motherhood among women aged 16 to 24, or the elevated first birth intensity among women educated as teachers or as health care and welfare sector workers (see Table B. 24 in Appendix B). Yet most educational effects, especially those for higher order births, are remarkably stable (see Table B. 25 and Table B. 26 in Appendix B). For our further control variables (civil status, municipality) we also only find a few weak changes. Thus, we can confirm the finding of Kravdal (2007), who showed that the control for selection in studies on the impact of education on fertility is only of limited importance when current educational attainment is considered.

5.7 Discussion and concluding remarks

CHAPTER 5 was devoted to an empirical investigation of the first dimension of the mutual relationship between educational trajectories and fertility outcomes; namely, the multifaceted impact of education on women's childbearing behaviour. Unlike most other researchers, who have only analysed the influence of educational enrolment and educational level on women's reproductive behaviour, we also looked at the field of education a woman is trained in. In the following, we briefly summarise our main findings for all three aspects of education, and relate them to our theoretical considerations and the hypothesis stated at the beginning of this chapter.

From a theoretical viewpoint, **educational enrolment** and giving birth is assumed to be incompatible, either for practical reasons (monetary constraints, time constraints) or because of normative expectations that young people should have finished education and reached a certain level of economic reliability before they start a family. We therefore expected to find lower birth rates for women who are still enrolled in education. In addition, we assumed that educational enrolment impedes motherhood most strongly among childless women. The results of our empirical investigations fully support our first hypothesis. We have shown that Swedish women who are enrolled in education have lower first, second and third conception risks compared to women who are not currently enrolled. In Sweden, educational enrolment reduces the risk of entering motherhood by nearly 50 per cent, whereas second and especially third conception rates are lowered only to a minor degree.

While the relationship between educational participation and childbearing appears to be clear, both in terms of theoretical explanations and with respect to empirical research findings, the reverse applies to **educational level**. Standard economic theories, as well as theories on social-structural or cultural change, predict lower levels of ultimate fertility and higher levels of childlessness among highly educated women. However, for quite a number of countries, previous research has shown a positive relationship between educational level and higher order birth intensities (in some cases, even first birth intensities). Existing theories also do not give a clear answer to the question of whether postponing motherhood is more or less advantageous for highly educated women (see Chapter 2.2.2). After discussing the implications of economic theories of fertility timing, we therefore concluded that institutional aspects might play an important role in educational level-specific differences in fertility timing. We subsequently explained why we believe that, in an institutional context such as that of Sweden; highly educated women should have a stronger incentive to postpone motherhood than their lower educated counterparts (see Chapter 3.5).

Our investigation of the impact of educational level on women's first conception risk confirmed this assumption. For Sweden we have shown that there is a strong postponement effect of education on women's risk of entering motherhood. However, although highly educated Swedish women enter motherhood at higher ages, they do not have a first child at lower rates. In line with our second hypothesis, we found a u-shaped relationship between educational level and the transition to a first child that is caused by a negative effect of educational level on the risk of conceiving a first child for women in their teens and early twenties, and a positive effect for women aged 30 or older.

Our research results also supported our assumption of a positive relationship between educational level and higher order births. Second as well as third conception risks were found to be highest among those with an extended tertiary education, and lowest among those who have only a primary or secondary school degree. Our further investigations have shown that, in Sweden as well, elevated risks of continuing childbearing among highly educated women can be explained neither by a time-squeeze effect nor by a selection effect. Since we lack information on women's partners, we were not able to check whether the high second and third birth intensities of highly educated women are, in fact, the result of positive assortative mating. However, as was already noted in Chapter 5.3 for the Nordic countries, the effect of women's education on higher order childbearing has been found to be consistent even if partners' characteristics are controlled for. We therefore agree with Kravdal (2007), who stated that there have to be other explanations for the positive effect of education on fertility (see Chapter 2.2.5). In our view, the most likely explanation seems to be that, in a modern society such as Sweden, where employment and childrearing are compatible for most women due to extensive public childcare and other social policies, educational level-specific differences in opportunity costs have indeed diminished, disappeared or even reversed. As a result of their higher income, and possibly also because of "their greater confidence about their ability to control non-familial opportunities, even after the arrival of an additional child" (Hoem and Hoem 1989: 64), highly educated Swedish women today are more willing to continue childbearing after the first - and even after the second - child.

In addition to investigating the role of educational participation and educational level in women's fertility behaviour, a major aim of CHAPTER 5 was to analyse how a woman's type of education influences her childbearing behaviour. Based on existing theoretical explanations of the link between **educational field** and fertility and previous research findings, we assumed in our third hypothesis that women with different educational fields will have different transition rates to a first, second and third child. Our estimations supported this assumption by showing that, in Sweden, educational field has a strong impact on the risk of entering motherhood and on the transition to a third child. Also second conception risks differed among women educated in different educational fields, but the effects were much less pronounced. We attributed this to the fact that the two-child norm is well established in Sweden, which probably reduces field-specific differences in second conception risks.

We expected to find particularly high transition rates for women educated in fields in which the main characteristic is working with other people; that are clearly female-dominated during education and have a high propensity to lead to a female-dominated occupational area; and that that are marked by a tight link between education and the labour market, with good prospects of a stable employment career. These fields include teaching, health care and social work. We therefore expected to find a comparatively high probability of entering motherhood and an elevated risk of continued childbearing among women educated in one of these fields. Our empirical results confirmed this assumption, at least in the case of women educated for health care or welfare occupations. For teachers we found a high risk of conceiving a first child, but only an average higher order birth probability. We have no reasonable explanation for this finding. There are two further fields of study that stood out as having high levels of fertility: agriculture, forestry or animal health and security services. Most courses of education in these two areas, as well as the related occupational fields, are not female-dominated. However, graduates certainly do not face problems in finding appropriate and stable employment. Furthermore, work in the areas of security services, and in agriculture, forestry or animal health, can also be viewed as being related to working with and caring for others (in the latter case, not with people, but with nature and animals). For graduates of agriculture, forestry or animal health programmes, we found especially high second and third birth intensities. Women educated for security work, however, showed only a high risk of entering motherhood, while their second and third birth intensities turned out to be among the lowest. It appears that the low risk of continuing childbearing among graduates of security services programmes is closely connected to their lower level of marital stability. As we have shown, graduates of educational programmes for security services are much more likely to separate from their partners than graduates of any other educational field. Subsequent periods of singlehood and only partial re-partnering might lead to higher proportions of one-child mothers, or at least longer waiting times before having a subsequent child.

We expected fertility rates to be low among graduates of educational fields that are clearly male-dominated, with time-intensive work norms and a male-dominated work environment. However, graduates of engineering and construction programmes - which is the most male-dominated field of study in our investigation – were not found to have low, but rather average first, second and third conception intensities. We also expected to find low transition rates for women educated in fields that do not lead to a reliable employment career, or that lack an obvious set of occupations. However, this expectation has been only partly confirmed by our research results. For women who graduated from programmes that do not lead to a reliable employment career (e.g. drawing, music, dance, drama or design), we found low transition risks to a first and second conception, but an average transition rate to a third child. Likewise, our expectation of low fertility rates for women educated in fields that do not have an obvious set of occupations (e.g. general education; studies in humanities, like history or philosophy, without any qualification for teaching) has been confirmed conclusively only for the transition to a first conception. With respect to the risk of conceiving a third child, women with a general degree showed an average risk, and those educated in humanities even had one of the highest risks. An explanation for the surprisingly high third conception risk of women educated in the field of humanities, and the average third conception risk of women with general education or a degree in art and media, might be that the women who graduated with a degree in one of these fields, and who had already become the mothers of two children, might have been among the "lucky ones" who managed to get established on the labour market, despite their unfavourable educational backgrounds. Likewise, they might have found partners who serve as good providers, and who compensate for their own insecure employment opportunities.

In the theoretical part of this dissertation, we argued that women's choices of educational fields, as well as their choices in the area of fertility, might be related to their social origin, to their personal traits, and to their preferences and goals regarding family and employment. Since our data do not contain this kind of information, we also estimated models that include a factor for unobserved heterogeneity. However, just as for educational level, we did not find any substantial difference in the effect of educational field on fertility once unobserved characteristics were controlled for. We will come back to the issue of unobserved heterogeneity when we analyse the simultaneous influence of unobserved characteristics on educational trajectories and childbearing behaviour (CHAPTER 7). In the following chapter, however, we first investigate empirically how fertility affects women's educational careers.

CHAPTER 6

The impact of childbearing on women's risk of educational change

6.1 Introduction

In our theoretical considerations, we argued that the causal relationship between fertility and education is exceedingly complex, and that probably not only education has an influence on women's childbearing behaviour, but that fertility might affect women's educational careers as well (see Chapter 2.3). In our second empirical chapter, we therefore analyse how events in the fertility domain affect women's educational trajectories. Our investigation is structured in the following way. In Section 6.2 we briefly summarise previous research findings. In addition, we specify precisely the event we are going to analyse, and we introduce our working hypothesis. Section 6.3 starts with a description of the sample selection, the variables and the method used for the empirical analyses. Subsequently, we present the results of our empirical investigation. Section 6.4 includes the empirical findings of an additional investigation that we carried out in order to verify our line of reasoning. We conclude with a short discussion of our main findings in Section 6.5.

6.2 Previous empirical findings and research hypothesis

Previous studies on the impact of fertility on education have mainly concentrated on the consequences of an early first birth on young women's educational attainment. The general finding is that entering motherhood early is detrimental to a young woman's educational attainment, since it increases the likelihood that she will drop out of school early. In addition, not many of those who leave school due to an early childbirth manage to obtain a higher educational level later in life. As a result, women who become mothers at an early age accumulate on average less education than those who delay entry into parenthood (e.g. Waite and Moore 1978; Hofferth and Moore 1979; Marini 1984; Anderson 1993; Panis et al. 1995; Klepinger et al. 1995, 1999; Hofferth et al. 2001; Berthoud and Robson 2001).[100]

However, the finding of low re-entry rates into the educational system among those who started childbearing early does not necessarily mean that women in general do not experience changes in education after entering motherhood. Kravdal (2007) has shown that, in Norway, a considerable number of women achieve improvements in education after the birth of their first or even a higher order child. Other studies have revealed that, in Sweden as well, a substantial number of women continue or restart their educational careers after entering motherhood (Hoem 1995b: 35; Henz 1999). Sweden and Norway are countries with highly flexible educational systems and generous policies towards families with children. Such an institutional background allows women to adjust their education to changes in their needs and interests, and to react to developments in their family life (see also our argumentation in Chapter 3.3). The probability that women will return to the educational system after entering motherhood might therefore be higher in countries like Sweden or Norway than in countries where the level of support for families and/or the flexibility of the educational system is low.

Empirical studies on women - and especially mothers - returning to school are rare, and they mainly concentrate on the situation in the United States. Felmlee (1988),

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[100] Research on this topic has mainly been carried out for the United States. However, in a study on 13 European countries, Berthoud and Robson (2001) also found a consistent pattern of lower educational attainment among early mothers, even though these countries differ greatly in their social and educational systems.

for example, examined the rate of return from full-time employment to full-time school enrolment with no employment. Her primary interest was in women's occupational incentives and disincentives to return to school, and in the subsequent occupational returns to additional schooling. Nevertheless, Felmlee also included women's marital and parental status in her models, and observed that being married and having children under age six decrease the rate of return to school.

For Sweden, the relationship between childbearing and re-entering the educational system has been analysed in a study carried out by Henz (1999). The author investigated the impact of union status and motherhood status on women's risk of entering university for the first time at age 22 or higher.[101] Her results showed that both union and motherhood status strongly influence the transition probabilities into university. At ages 22 to 25, cohabitation as well as marriage was associated with to a lower risk of starting university studies. At higher ages, marriage (but not cohabitation) reduced women's risk of entering university. Being a mother was generally found to be connected to lower risks of entering university. However, single mothers aged 26 or older showed a higher transition rate to university studies than singles of the same age without children.[102]

In the two investigations mentioned above, the risk of re-entering education has been examined for women in general (childless women and mothers), with motherhood status being one out of several covariates that shape women's risk of returning to school. In another study with U.S. data, Bradburn et al. (1995) explicitly modelled women's return to school following the transition to motherhood. According to this study, key variables related to an increased re-entry rate among mothers include higher levels of prior education, having non-traditional gender role orientations, being employed part-time (rather than full-time) and life course experiences, such as separation, divorce or widowhood. With respect to children, the authors found that mothers are more likely to return to school before, not after, their youngest child leaves home.

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[101] At these ages most women have spent at least some time outside of the educational system (Henz 1999).

[102] According to Henz (1999), the rather high transition rates to university studies among single mothers can be explained by their need to prepare for an independent living in the future and their option of compensating for income losses through state support for lone parents.

What has been neglected in previous research is that women's - and especially mothers' - risk of re-entering the educational system might differ markedly depending on the field in which they have been educated. In Chapter 3.4, we argued that different fields of education generate differences in labour market conditions. If this is true, then different fields of education also should involve different incentives to re-enter the educational system.[103] In our view, there are several plausible explanations of why women with certain types of educational backgrounds should be more likely than others to strive for further schooling once they have entered motherhood. Women educated for clearly male-dominated occupations, for example, might face serious problems in combining gainful employment and childrearing. After becoming a mother, they might struggle with their male-dominated work environment, with its time-intensive work norms or the low availability and/or acceptance of family-friendly work arrangements, such as part-time jobs or unpaid leave. As a result, they might be more likely than women who have been trained for female-dominated occupations to restart their educational careers after childbirth in order to obtain a degree in a new educational field. For graduates of educational fields that lack an obvious set of occupations (e.g. general education; studies in humanities, such as history or philosophy) giving birth to a child might arouse or enforce the desire for further education in a more occupation-oriented field in order to achieve a more stable position in the labour market. Likewise, we believe that women educated for jobs in art (e.g. in dance, drama, design, or drawing) or media (e.g. radio and TV production, illustration and advertising) may have an increased risk of changing their field of education after entering motherhood. Employment in these areas is often marked by temporary contracts or freelance work, as well as the need for spatial mobility and/or physical fitness. After women educated for jobs in one of these areas have entered motherhood, they may strive for more stable and family-friendly working conditions. In order to achieve these conditions, some of them might decide to re-enter the educational system to earn a degree in a different educational field.

In general, we believe that, for most women, becoming a mother is a decisive event in life that increases their desire for a secure, stable and family-friendly position

[103] A similar argument has been presented by Hällsten (2010) in a paper on late entry into Swedish tertiary education.

in the labour market. Especially women whose educational background is not likely to lead to such a position might start to think about their occupational situation and opt for a change in their educational career.[104] With these considerations in mind, we decided to investigate empirically the factors that affect women's risk of undergoing a change in educational field after entering motherhood.[105] Our primary interest is in the question of whether the field of education a woman is trained in plays a decisive role in her decision to pursue a further degree in a different educational field after the birth of her first child. We expect to find the following linkage between a woman's educational background at the time of her first birth and her probability of earning a further degree in a different educational field in our Swedish data:

H6: *Women with different educational backgrounds at their first birth will have different risks of undergoing a subsequent change in educational field. We expect to find relatively low risks of change for women educated in fields that normally lead to a female-dominated occupational sector with family-friendly working conditions and a low wage penalty for employment interruptions (teacher training, health care and welfare). By contrast, we expect to find high risks of change for women educated in fields that have a high propensity to lead to a male-dominated occupational sector (engineering and construction), that lack an obvious set of occupations (general, humanities) and/or that tend not to lead to a reliable employment career (art and media).*

[104] Of course, attaining a degree in a different field of education takes time. By the time a woman has attained the aspired degree, her first child will already be a couple of years old and might no longer need as much care. We might therefore raise the question of whether starting a new educational programme is a reasonable strategy for mothers. We think that it is a reasonable strategy for the following reasons. First, although children might need less care and attention as they grow up, they still demand a lot of time, at least up to the early teenage years (the age when most children are able to and want to do most things on their own). Second, one-child mothers might want to have further children. In total, it then takes much longer to get all of their children out of the "demanding" ages than to attain a further educational degree. Finally, in an institutional setting that supports a mother's participation in education, re-entering education might even be a strategy that facilitates life with small children.

[105] For the sake of simplicity, we will sometimes use the term "risk of educational change" or "risk of change". However, we are always talking about women's risk of undergoing a change in educational field.

6.3 Women’s risk of educational change following the transition to motherhood

6.3.1 Method, sample selection and variables

Discussion of method

We use event history techniques (see Chapter 4.1 for a more detailed description of this method) to model the transition to a first change in educational field after the birth of a first child as a function of an underlying risk modified by a vector of covariates.[106] The equation to be estimated has the following general mathematical form:

$$\ln \mu_i(t) = y(t) + z_k(u_{ik} + t) + \sum_m \alpha_m x_{im} + \sum_n \beta_n w_{in}(t)$$

where $\mu_i(t)$ denotes the hazard of attaining a first degree in an educational field different from that at first birth for individual i at process time t.[107] The function $y(t)$ is a piecewise linear spline (for process time since first birth) that captures the impact of the baseline duration on the hazard. The parameter $z_k(u_{ik}+t)$ denotes a spline representation of the effect of a time-varying variable that is a continuous function of process time t with origin u_{ik} (e.g. women’s current age). The parameter x_{im} represents a time-constant variable (e.g. educational field at first birth), while the parameter $w_{in}(t)$ represents a time-varying variable whose value can change only at discrete times (e.g. civil status).

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106 Instead of using the attainment of a degree in an educational field different from the one at first birth as the observed event, we would have preferred to have modelled the time until women enrol in a programme that leads to a degree in a different field of education. The reason is that, simply by embarking on studies in an educational field different from the educational background at first birth a woman indicates her desire to modify her educational qualifications. By concentrating on attained degrees only, we miss those women who started an educational programme in a different educational field after entering motherhood, but did not manage to obtain a degree. In addition, the time that it takes to obtain a certain degree (and thus also our process time) might differ depending on the educational level of the degree (to a minor extent, duration differences probably also exist between educational fields). However, our data only provide information on the year of attainment of educational degrees, and we refrained from imputing the date of uptake since imputed educational careers might also give misleading results (see for example Kravdal 2004).

107 Changes in educational level within the same field of education do not contribute to this hazard.

In our analysis, we censor if the women emigrate, die or do not attain a degree in an educational field that diverges from their educational background at the time of their first birth until June 2004, whichever comes first. In addition, we censor women if there is a period with missing information on educational field.[108]

There are some aspects of the educational system and of our data that need to be considered in an investigation of women's risk of undergoing a change in educational field. The first is related to the fact that our data do not allow us to distinguish between complete and incomplete educational qualifications.[109] In case of strong field-specific differences in the number of students who drop out of upper secondary school programmes or tertiary study programmes, our investigation might lead to slightly different results than a study that uses data in which only complete educational qualifications are included.[110] However, since we do not know about field-specific differences in dropout rates (and since there are probably also strong differences within our rather broad fields of education), we do not address this aspect in our analysis. The second aspect concerns the different opportunities available to pursue tertiary studies. In Sweden, tertiary students can be enrolled in a study programme that leads to one of the general degrees (e.g. bachelor's, master's) or in a study programme that results in a professional degree (e.g. medical doctor). However, there are also tertiary students who

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[108] We have to censor women at the beginning of the period for which we do not have information on educational field since we do not know whether they actually obtained a degree in a different educational field during this period.

[109] We are able to separate complete from incomplete educational qualifications for the years 2000 to 2004 (see Chapter 4.2), but this time period is much too short to allow us to analyse changes in educational field. As in our chapter on the impact of women's education on fertility (CHAPTER 5), we therefore also do not take into account whether an educational degree has been completed in our current investigation (for more information see footnote 78, p. 105).

[110] To give an example, if the probability of dropping out before the final examination is much higher in field x than in all other fields, then the proportion of mothers who do not have a complete degree at first birth is probably also higher among those educated in field x than among those educated in other fields. Those with only an incomplete degree at first birth (and right now we assume that the dropout did not take place due to the birth, but rather due to unmet course requirements) probably have a higher risk of returning to the educational system in order to attain a complete degree in the same or a different field of education. For those fields of education in which the risk of dropping out is high, the estimated risk of undergoing a change in educational field might therefore be higher in our investigation than in a study that concentrates only on completed degrees.

are not enrolled in any kind of programme, but just take single courses instead.[111] While in the first two cases an individual's field of education is determined by the faculty an educational programme belongs to, Statistics Sweden is responsible for determining the educational field of individuals who study on a course-by-course basis. Whenever an individual has accumulated credit points in more than one field, Statistics Sweden assigns the person to the field of education he or she currently has most of the credit points in.[112] The problem is that this might change from time to time, and that, for some individuals, our data therefore contain quite a large number of changes in educational field.[113] These changes do not result from an individual's choice to study in a different field of education, but from the way in which these types of tertiary studies are registered in Sweden. Unfortunately, with our data we are not able to separate those who study on a course-by-course basis from those who study within a programme. As a result, there are some changes in field of education in our data that will turn up as an event in our model, although in this particular case, no "real" change has taken place. Finally, we want to mention a particular field of education, teaching, and the problems related to it. In Sweden, as in many other countries, there are several ways to become a teacher. Those who start studying with the goal of later working as a teacher can enrol in one of the numerous teacher education programmes. However, especially for those who want to work as a subject teacher in upper secondary school, there is also the option of simultaneously pursuing a master's degree in a certain subject and a degree in teaching. Depending on how these students organise their studies, they might first attain a general degree (bachelor's, master's) in the field of education their main subject

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[111] The proportion of tertiary students not enrolled in a formal programme increased strongly in the past. Unfortunately, official numbers on course-by-course students versus programme students exist only for recent years. In the academic year 1999/2000, approximately 34 per cent of all university students studied on a course-by-course basis rather than as part of a full programme. In the academic year 2008/2009, the proportion amounted to 42 per cent (Högskoleverket and SCB 2010: 15, 19, own estimations). However, these numbers also include foreign students (exchange students, free movers) who almost exclusively take individual courses instead of enrolling in programmes, and who will not be included in our analysis.

[112] We thank Hans Odelholm from Statistics Sweden for the useful information he provided. We greatly benefitted from his extensive knowledge of the Swedish system of registration of educational qualifications.

[113] In these cases, the field of education sometimes even changes yearly between two fields of education. Most often such changes occur between fields that are relatively close to each other such as humanities and social sciences, social sciences and business/administration, or natural sciences and engineering/construction.

belongs to (e.g. natural sciences in the case of mathematics or biology) and only afterwards obtain the professional teaching degree. For those women in our data who had attained the general degree before their first child was born, but who earned their teaching degree afterwards, we will then observe a change in field in the data (which will be included as an event in our model) even though in this case as well no "real" change has taken place.[114] We do not see any feasible way to solve this problem, especially since there are, of course, also women who first passed through a bachelor's programme (or even a master's programme) in a certain field of education with no intentions of becoming a teacher and who later decided for some reason (e.g. problems in reaching a stable employment position) to pursue an additional qualification as a teacher (which is exactly the behaviour we want to study).

We are well aware of the fact that all of these aspects limit the explanatory power of our model. However, we have to make the most of this situation, and we therefore very carefully take into account the limitations imposed by the data when discussing our results in the final section of CHAPTER 6.

Sample selection for the analysis

Our analysis of women's risk of undergoing a change in educational field after entering motherhood is based on longitudinal Swedish register data (for more information see Chapter 4.2). The original data consist of 1,196,749 residents of Sweden. For our analysis, we excluded all men, as well as all women of foreign origin. In addition, we excluded women who were enrolled in education during the calendar year that preceded the birth of their first child, since for these women, a degree obtained after the first child was born probably only constituted a continuation of an educational career that was already underway.[115] We also had to exclude women who were not

[114] This problem does not apply to women who attained a general degree (bachelor's, master's) and a professional degree (e.g. teaching, medical) at the same level of education within one calendar year, since in this case our data reports only the field the professional degree was attained in.

[115] Unfortunately, we do not have exact information on the start and end of educational participation. To figure out who was enrolled in education prior the first childbirth, we therefore use our data on the receipt of financial aid to students. Given that there are also tertiary students in Sweden who do not receive financial aid (approximately 20 per cent in 1995), we probably do not exclude all of those who already started to study for a degree in a different field before the first child was born. As there are no other options available, this is the best we can do.

domiciled in Sweden during the calendar year that preceded the birth of their first child, since our data do not allow us to draw good conclusions about their educational activity during the year that preceded the first birth. Because we only have information on the women's education for the years 1990 to 2004, we restrict our analysis to women who became mothers between January 1991 and May 2004.[116] We also excluded women who emigrated or died in the same month as the first child was born (for them, the process time would be equal to zero). Furthermore, we did not include women for whom we have no valid information on educational field at the start of the process time.

Preliminary analyses of our data have shown an unusually high number of recorded changes in educational field in the year 2000.[117] We attribute this to the transition from the old Swedish system of educational classification (SUN) to the new one (SUN 2000) that took place in this year.[118] In order to prevent any further bias in our estimates, we decided to exclude all corresponding occurrences (events that occurred in June 2000) and exposures (person years between July 1999 and June 2000) from our analysis.

We ended up with a valid sample of 98,141 female individuals that contributed to the analysis of changes in educational field following the transition to motherhood. For more details on the sample selection see Table 6.1.

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[116] Like in our analyses on the effect of education on first, second and third conceptions (see CHAPTER 5), we imputed "June" as the month for all educational changes. Therefore, our information on educational field start in June 1990 and end in May 2005. We had to exclude women whose first child was born before January 1991, since for these women our data do not contain any information on educational enrolment during the year that preceded the first birth. For those who became a mother before June 1990, we additionally lack information on the field of education women were trained in at the start of our process time (first birth). Women who gave birth to their first child after May 2004 were excluded, since their process time would have started only at or even after our latest point of censoring (which we set at June 2004).

[117] In our data the number of changes in educational field that occurred in 2000 was more than three times as high as in any other year.

[118] In the course of the transition from SUN to SUN 2000, Statistics Sweden added information from a number of new data sources to the register (for more information, see Chapter 4.2). Thus, an educational qualification that turns up in our data in the year 2000 was not necessarily attained in this year. In addition, it could be that there are irregularities in the translation guide that we used to transfer the old SUN codes for the years 1990 to 1999 into new SUN 2000 codes (see Appendix A). It could be that some educations have been grouped into other fields of education before 2000 than afterwards, and that the translation guide we have at our disposal does not fully account for this. As a result, we may observe for some women changes in educational field in the year 2000 that are not the result of educational attainments, but rather can be attributed to changes in how educational qualifications are coded.

Table 6.1: Description of the number of included and excluded cases for the analysis of women's risk of undergoing a change in educational field after entering motherhood

Number of individuals in original sample	1,196,749
Number of individuals excluded from the analysis	1,098,608
Number of individuals included in the analysis	98,141
Number of events	4,952
reason for exclusion:	
(1) Sex (male)	612,572
(2) Birth country (not Sweden)	126,234
(3) Individuals did not give birth to a first child (before June 2004)	182,004
(4) Individuals' first child was born before January 1991	155,387
(5) Individuals emigrated or died at first birth	84
(6) Individuals were not domiciled in Sweden during the calendar year that preceeded the birth of their first child	1,577
(7) Individuals were in education during the calendar year that preceeded the birth of their first child	18,233
(8) No information on educational field at start of the process time	2,254
(9) Individuals process time started and ended between July 1999 and June 2000 (time period that has been excluded from the analysis)	263

Source: Swedish register data

Covariates in the analysis

In the following, we describe the covariates that are included in our analysis of changes in educational field after entering motherhood. An overview of the composition of the sample with measures of exposures and occurrences within the categories of each covariate is given in Appendix C in Table C. 1.

Most of the variables included in our model on educational change after first childbirth also served as explanatory variables in our investigation of the impact of education on first, second and third conception risks in Sweden. For these covariates, we only briefly repeat the categories we have chosen. More detailed information on the construction of these variables can be found in Chapter 5.3.

Our main interest is in the question of whether women with certain types of education are more likely to undergo a change in educational field after they entered motherhood than others. We therefore include **educational field at first birth** as a time-constant categorical variable into our model, and distinguish between the following 14 groups of educational fields:

general;
teacher training;
art and media;
humanities;
social sciences, journalism and law;
business and administration;
natural sciences;
engineering and construction;
manufacturing and processing;
agriculture, forestry and animal health;
health care and welfare;
technically oriented health care and pharmacy;
personal services and
security services.[119]

Women's risk of re-entering the educational system and earning a degree in a field of education that diverges from their educational background at the time of their first birth presumably also depends on the level of education they have achieved so far. We would expect to find higher risks of changing educational field among those with lower levels of education, since for them the opportunity costs of leaving the labour force (foregone income) in order to obtain a further degree are lower. In addition, those with a high level of education have already spent many years in the educational system, and comparatively little time in the labour market. Next to economic reasons, normative expectations (e.g. that one finally should convert one's education into income) might prevent them from adding even more years to their educational career. In our analysis,

[119] For a more detailed insight into the educational lines within each field of education see Table B. 6 in Appendix B.

we control for **educational level** as a time-varying categorical variable consisting of four categories:

primary or lower secondary education (up to nine years of schooling);
upper secondary education (10-12 years);
short post-secondary education, including some college or university education of up to three years (13-15 years); and
long post-secondary education, including all higher education courses normally taking four years or more, such as a master's degree, a licentiate or a doctorate (16 years or more in all).[120]

Previous studies have shown that a woman's risk of returning to school depends strongly on her family circumstances (e.g. Felmlee 1988; Henz 1999). We therefore include in our model a time-varying variable for woman's **civil status** with the following four categories:

single/cohabiting,
married,
divorced and
widowed.

Furthermore, we control for the **number of children** a woman has given birth to by including a time-varying categorical variable that distinguishes between:

one child,
two children,
three children and
four or more children.

The probability that a woman will return to school and attain a degree in a different educational field might also depend on the availability of universities and other facilities of adult education close to her home. Especially for mothers, this might be

[120] Women may enrol in further education not only in order to change their field of education, but also in order to achieve a higher level of education in the same educational field. We do not count further educational degrees in the same field of education as an "event", but we take into account this kind of educational activity by operationalising educational level as a time-varying variable.

important, since they are probably less willing than childless women to move or to commute over long distances. The availability of educational facilities for adults is often closely connected to factors such as settlement size. We control for settlement size by including **municipality type** as a time-varying categorical variable into our models and distinguish between the following three types of municipalities:

Stockholm, Malmö, Gothenburg;
other urban municipalities; and
sparsely populated rural municipalities.

To prevent any bias in our estimation results due to the change in the coding of educational qualifications in the year 2000 we excluded the period July 1999 until June 2000 from our analysis. In addition, we include a time-varying categorical variable for calendar **period** in our model that distinguishes between:

January 1991 through June 1994,
July 1994 through June 1999,
July 2000 through June 2001 and
July 2001 through June 2004.

Finally, in our analysis of a woman's risk of changing her educational field after childbirth, we control for the impact of a **woman's current age**. We include this variable as a piece-wise linear duration spline in our model; with nodes at 18, 19, 20, 21, 23, 31 and 45 years of age.

6.3.2 Empirical findings

In the following, we present the results of our investigation into women's risk of educational change after the transition to motherhood. We start with some descriptive findings on the impact of a woman's educational background at the time of her first birth on her risk of attaining a further degree in a different field of education later in life. Subsequently, we present findings from our event history model regarding changes in educational field after first childbirth.

Descriptive analysis

Based on the sample described in Chapter 6.3.1, we estimated Kaplan-Meier failure functions for the transition to a first change in educational field after becoming a mother. In Table 6.2, we display the cumulative Kaplan-Meier failure estimates at 10 years after first birth. In total, the proportion of women who earned a further degree in a different field of education within 10 years after the first child was born amounts to 8.8 per cent of our sample. In addition, we can see that the percentage of women who underwent a change in educational field after becoming a mother differs substantially depending on the field in which the women were educated at the time of the first birth.

Table 6.2: Descriptive findings - Kaplan-Meier failure estimates: Cumulative failure function at 10 years after entering motherhood by educational field at first birth

	Proportion of women who underwent a change in educational field 10 years after first birth (in %)
Educational field at first birth	
General	15.0
Teacher training	1.5
Art and media	17.3
Humanities	25.0
Social sciences, journalism and law	11.8
Business and administration	7.3
Natural sciences	10.6
Engineering and construction	7.7
Manufacturing and processing	14.2
Agriculture, forestry and animal health	9.3
Health care and welfare	5.3
Tech. oriented health care and pharmacy	9.1
Personal services	9.5
Security services	6.4
Total	8.8

Source: Swedish register data, own estimations

Among those who had been educated as teachers when their first child was born, only 1.5 per cent returned to the educational system and attained a degree in a different field of education within 10 years. Also among those who had been educated for jobs in the areas of health care and welfare (5.2 per cent) or security services (6.4 per cent), the proportion of women who enrolled in further education after entering motherhood in order to earn a degree in a different field of education is comparatively low. The proportion of women who restarted their educational career after the birth of their first child is highest among those educated in humanities (25.0 per cent) or in art and media (17.3 per cent). Moreover, quite a number of women with only a general degree (15.0 per cent) or a degree in manufacturing and processing (14.2 per cent) changed their educational field after first birth.

In addition to seeking to determine which women were most and least likely to return to school after entering motherhood in order to earn a further degree in an educational field different from the field they had studied prior to the first birth, we were interested in finding out which areas women chose when continuing their education. In Table 6.4, we therefore listed for all of the women who underwent a change in educational field after entering motherhood the four most frequently chosen fields of education by educational field at first birth. For a more comprehensive picture, we also display sample statistics on the distribution of women and events (changes in educational field) according to women's educational field at first birth (see Table 6.3).

Table 6.3: Sample statistics - distribution of women (exposures) and events (occurrences) according to women's educational field at first birth

	Exposures		Occurences	
	N_{Exp}	$\frac{N_{Exp,\,x}}{N_{Exp,\,Total}} * 100$	N_{Occ}	$\frac{N_{Occ,\,x}}{N_{Exp,\,x}} * 100$
Educational field at first birth (x)				
General	19,152	19.5	1,746	9.1
Teacher training	9,006	9.2	79	0.9
Art and media	1,823	1.9	118	6.5
Humanities	1,534	1.6	194	12.6
Social sciences, journalism and law	3,202	3.3	198	6.2
Business and administration	22,558	23.0	980	4.3
Natural sciences	2,336	2.4	140	6.0
Engineering and construction	4,309	4.4	174	4.0
Manufacturing and processing	1,456	1.5	106	7.3
Agriculture, forestry and animal health	1,366	1.4	65	4.8
Health care and welfare	22,974	23.4	694	3.0
Tech. oriented health care and pharmacy	1,011	1.0	49	4.8
Personal services	7,083	7.2	397	5.6
Security services	331	0.3	12	3.6
Total	98,141	100.0	4,952	5.0

Source: Swedish register data, own estimations

Table 6.4: Descriptive findings - most frequently attained fields of education after change by educational field at first birth

Educational field at first birth	Educational field after change (in % of all women educated in field x at first birth)
General	Health care and welfare (27.4%); Teacher training (18.8%); Social sciences, journalism and law (14.4%); Business and administration (10.8%)
Teacher training	Social sciences, journalism and law (26.6%); Health care and welfare (17.7%); Humanities (17.7%); Business and administration (11.4%)
Art and media	Teacher training (25.4%); Humantities (20.3%); Social sciences, journalism and law (17.8%); Health care and welfare (15.3%)
Humanities	Teacher training (43.8%); Social sciences, journalism and law (23.7%); Business and administration (11.9%); Health care and welfare (8.2%)
Social sciences, journalism and law	Business and administration (32.3%); Teacher training (31.8); Health care and welfare (15.2%); Humanities (9.1%)
Business and administration	Social sciences, journalism and law (25.4%); Teacher training (23.3%); Health care and welfare (21.1%); Natural sciences (8.2%)
Natural sciences	Teacher training (22.9%); Health care and welfare (19.3%); Business and administration (16.4%); Engineering and construction (15.7%)
Engineering and construction	Natural sciences (24.7%); Business and administration (17.8%); Teacher training (16.7%); Health care and welfare (16.1%)
Manufacturing and processing	Teacher training (22.6%); Health care and welfare (20.8%); Personal services (11.3%); Engineering and construction (9.4%)
Agriculture, forestry and animal health	Health care and welfare (27.7%); Teacher training (23.1%); Humanities (12.3%); Social sciences, journalism and law (9.2%)
Health care and welfare	Teacher training (40.8%); Social sciences, journalism and law (20.2%); Business and administration (10.4%); Humanities (6.6%)
Tech. oriented health care and pharmacy	Health care and welfare (57.1); Engineering and construction (12.2%); Business and administration (12.2%); Teacher training (8.2%)
Personal services	Health care and welfare (28.7%); Teacher training (26.7%); Social sciences, journalism and law (14.9%); Business and administration (11.1%)
Security services	Teacher training (25%); Social sciences, journalism and law (25%); Business and administration (17%); Health care and welfare (8%)

Source: Swedish register data, own estimations

In Table 6.4, two things in particular attracted our attention. First, women who return to school after giving birth to their first child quite often choose *a field of education that is relatively close to their "original" field of education*. Women educated in social sciences, journalism and law, for example, most often attained a degree in business and administration, whereas natural sciences was the most frequently chosen field of education among those who had degrees in engineering and architecture at the time of the first birth. We believe there are several explanations for this finding. First, for most women, the main motivation for choosing a certain field of education is their general interest in this field. The choice of an educational field that is close to the original field of education might therefore simply be attributable to a woman's basic interests. Second, selecting a field of education that is close to the original area might also be a strategic choice that can be advantageous in many ways. By choosing a field of education that has a strong linkage to the one in which they already have a degree in, women avoid a complete break in their educational career and minimise the devaluation of their previous educational attainments. Already having a degree in a related field of education might in some cases even enable or facilitate access to higher levels of educations (e.g. students with a bachelor's degree in social sciences might be allowed to enrol in a master's programme in business and administration, given that some general requirements have already been fulfilled). The second thing we noticed when looking at Table 6.4 is that - regardless of the educational backgrounds of women at the time of their first birth - a high proportion of those who return to school after entering motherhood do so in order to earn *a degree in teaching or health care and welfare*. For 10 out of 14 fields of education at first birth, "teaching" and "health care and welfare" are the types of degrees most frequently attained once a change in field has occurred.

However, we also have to consider the possibility that both of the findings described above may not only result from demographic behaviour, but might also be caused, at least to some extent, by the peculiarities of the data we are using. Our finding that a woman who returns to school after having her first child quite often chooses a field of education that is close to the one in which she earned her previous degree might at least partially result from the fact that we are not able to eliminate those changes that occur when women take individual courses (instead of programmes) and accumulate credits in more than one field of education (see also our corresponding explanations in

Chapter 6.3.1). Likewise, the high proportion of women who attain a degree in teaching after becoming a mother might partly be attributable to the fact that the Swedish system of teacher education in some cases enables students to earn not only a teacher's degree, but also a master's degree in their main subject (and that some women might have attained the master's degree or at least a bachelor's degree before their first child was born, but the teacher's degree only afterwards; for more information see Chapter 6.3.1).

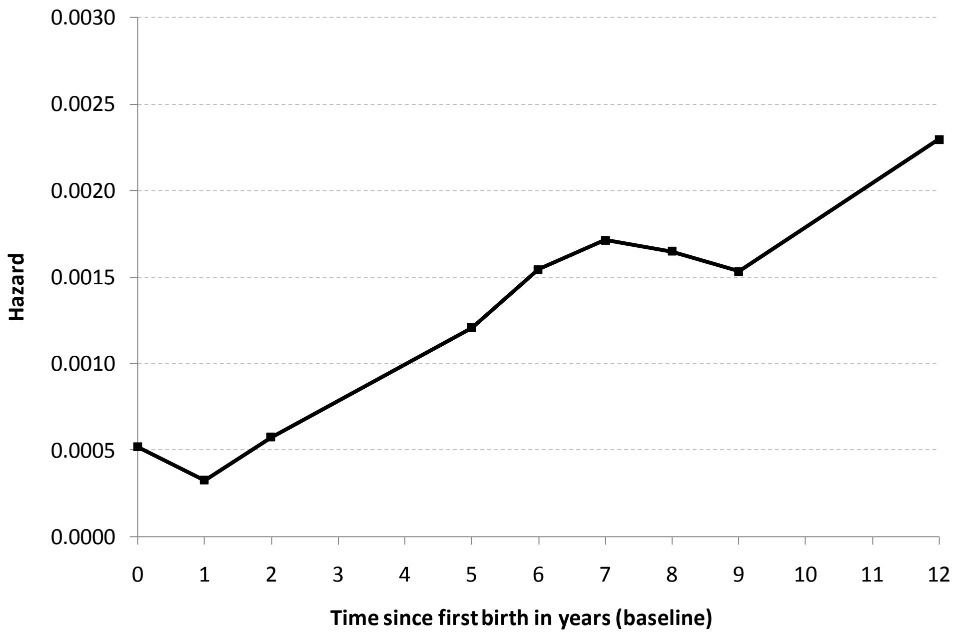
A big disadvantage of a crude descriptive analysis, such as the Kaplan-Meier failure estimates we displayed in Table 6.2, is that it does not account for the possibility that the relationship between a woman's educational background at the time of her first birth and her risk of undergoing a change in educational field later in life might be influenced by other variables, such as a woman's age or civil status. In the following, we therefore present results from an event history model on the impact of the educational background at the time of the first birth on a woman's risk of subsequently attaining a further degree in a different field of education.

Event history analysis

We start our presentation of the results of our event history analysis on women's risk of undergoing a change in educational field after entering motherhood with a description of the effect of the baseline duration, which is *time passed since the first child was born*. From the graph plotted in Figure 6.1, we can see that a woman's risk of attaining a degree in an educational field that diverges from her educational background at the time of her first birth decreases during her first year as a mother.[121] When her child is between the ages of one and six, there is a steady increase in a mother's risk of undergoing a change in educational field. This increase grinds to a halt when the first child enters primary school, but a woman's risk of educational change continues to increase after the first child has reached nine years of age.

[121] With an ideal sample (which means a sample that really only includes women not enrolled in any kind of educational activity at first birth), the risk of educational change should be zero at first birth and remain at a very low level until the first child reaches age one or two. This is because women usually do not enrol in educational activities during the first months after a child is born. In addition, it normally takes some time to complete an educational qualification. Our finding of a non-zero risk of educational change at first birth, which decreases during the first year as a mother, probably results from the fact that we are not fully able to exclude those women from our sample who were enrolled in education when they became a mother (see also footnote 115).

Figure 6.1: Event history model for women's risk of undergoing a change in educational field after entering motherhood - the effect of time since first birth (baseline)



Source: Swedish register data, own estimations
Note: (1) Controlled for a woman's current age, educational field at first birth, educational level, civil status, number of children, municipality type and period. (2) The full model is included in Appendix C in Table C. 2, Model 4.

We now turn to the factor we are mainly interested in: namely, the effect of *educational field at first birth* on a woman's risk of subsequently undergoing a change in her field of education. In Table 6.5, we show results from four different models. In the first model, we only control for the effect of time passed since the first child was born (baseline). The results are very similar to those of our descriptive statistics (see Table 6.2). The risk of attaining a further degree in an educational field different from the educational background at the time of the first birth is highest for women with degrees in humanities. Moreover, women with degrees in art and media, and those without any specific field of education, change their field of education at higher rates. In addition, our event history model shows a comparatively high risk of change among women educated in social sciences, journalism and law, natural sciences and manufacturing and processing. The risk of undergoing a change in educational field after becoming a mother is lowest among women educated in the areas of teaching, health care and welfare, and security services.

Table 6.5: Event history models for women's risk of undergoing a change in educational field after entering motherhood - the effect of educational field at first birth

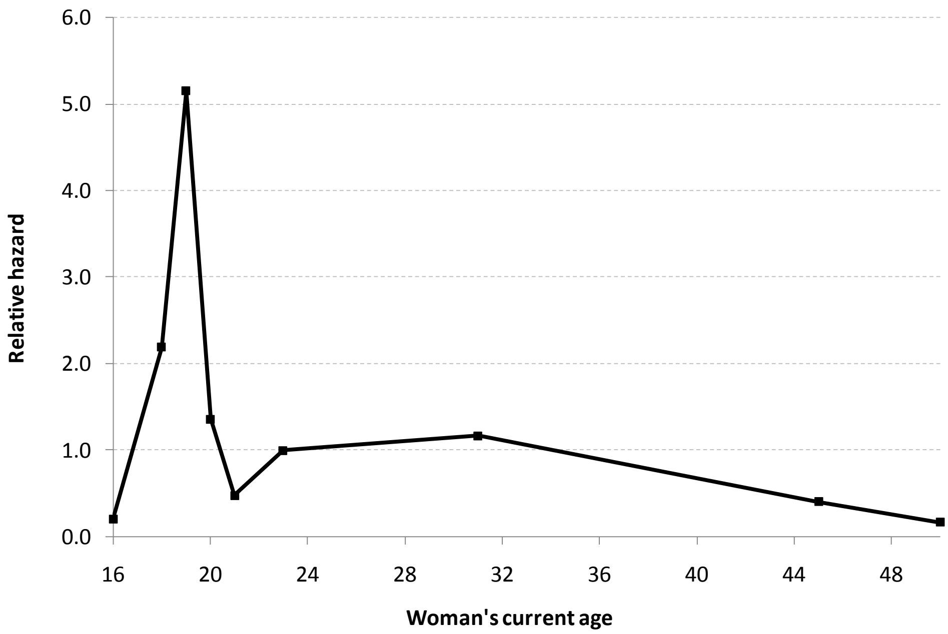
	Relative risk of change in educational field after entering motherhood			
	Model 1	Model 2	Model 3	Model 4
Educational field at first birth				
General	2.20	2.17	2.59	2.73
Teacher training	0.23	0.24	0.38	0.36
Art and media	2.52	2.68	2.87	2.66
Humanities	4.90	5.50	8.22	7.55
Social sciences, journalism and law	2.38	2.71	5.60	5.14
Business and administration	1	1	1	1
Natural sciences	1.83	1.92	2.74	2.65
Engineering and construction	1.11	1.12	1.59	1.55
Manufacturing and processing	1.90	1.85	1.78	1.77
Agriculture, forestry and animal health	1.26	1.29	1.38	1.43
Health care and welfare	0.71	0.70	0.74	0.75
Tech. oriented health care and pharmacy	1.09	1.22	1.72	1.70
Personal services	1.28	1.23	1.16	1.17
Security services	0.86	0.94	1.29	1.23

Source: Swedish register data, own estimations
Notes: (1) Model 1: controlled for time since first birth (baseline); Model 2: controlled for time since first birth (baseline) and woman's current age; Model 3: controlled for time since first birth (baseline), woman's current age and educational level; Model 4: controlled for time since first birth (baseline), woman's current age, educational level, civil status, number of children, municipality type and period. (2) Effects with a p-value higher than 0.1 are printed in grey. (3) The full models are included in Appendix C in Table C. 2.

In Model 2, we additionally control for the effect of the *woman's current age*. Figure 6.2 shows that a woman's risk of attaining a degree in a field that diverges from her educational background at the time of her first birth reaches a peak at age 19 (the age when Swedish pupils normally receive their upper secondary degree) and decreases strongly thereafter.[122] After age 21, there is again a slight increase in the risk of educational change, which then turns into a more or less constant risk between the ages of 23 to 31. From age 31 onwards, there is a continuous decrease in a woman's risk of undergoing a change in educational field after the birth of her first child.

[122] It is important to keep in mind that very few Swedish women become a mother before age 21 (in our sample the proportion is 0.5 per cent). Thus, despite the strikingly high relative risk of educational change at very young ages, it is mostly women aged 21 to 40 who contribute to our model.

Figure 6.2: Event history model for women's risk of undergoing a change in educational field after entering motherhood - the effect of woman's current age



Source: Swedish register data, own estimations
Note: (1) Controlled for time since first birth (baseline), educational field at first birth, educational level, civil status, number of children, municipality type and period. (2) The full model is included in Appendix C in Table C. 2, Model 4.

Adding a woman's current age to our event history model on women's risk of educational change after entering motherhood leads to an intensification of the observed pattern. Women educated in humanities, art and media, social sciences, journalism and law or natural sciences now have an even higher relative risk of experiencing a change in educational field (see Table 6.5, Model 2). This can be attributed to the fact that degrees in these fields are nearly exclusively awarded at the post-secondary school level (art and media being an exception), which means that women educated in one of these fields are on average older than those educated in other fields.[123]

In a third step, we additionally controlled for the *educational level* a woman has attained. As expected, we find that the risk of experiencing a change in educational field after the first childbirth is lowest for those who already have a very high level of

[123] In addition, Hoem et al. (2006a) have shown that women with a post-secondary degree in arts, humanities, social sciences or natural sciences do have a very high mean age at first birth (between ages 28.3 and 31.3), which means that these women enter our study at comparatively high ages.

education. However, mothers with only a primary or lower secondary school degree also show a surprisingly low risk of changing their educational orientation (see Table 6.6).[124] Controlling for women’s level of education leads to some remarkable changes in the effect of educational field at first birth on a woman’s risk of experiencing a subsequent change in educational field (see Model 3 in Table 6.5). Relative risks of educational change increase strongly for many of those fields of education in which degrees are primarily or exclusively awarded at the post-secondary school level (e.g. humanities, social sciences, natural sciences, technically oriented health care, security services).

Finally, we estimated a model that includes four additional control variables: *women’s civil status*, *number of children*, *municipality type* and *period*. Table 6.6 reveals that the risk of attaining a degree in a field different from the educational background at the time of the first birth is higher among married and divorced women than among women who are single, cohabiting or widowed. With respect to the number of children a woman has given birth to, we find a very clear negative relationship: the more children a woman has to take care of, the lower is her risk of attaining a further degree in a different field of education. As expected, we find that a woman’s risk of returning to school in order to earn a degree in a different field of education varies by municipality type. The relative risk of educational change is highest in Sweden’s big cities and lowest in municipalities with a very low population density. According to our period variable, Swedish mothers were less likely to undergo a change in their educational career during the second half of the 1990s than during the early 1990s or after the turn of the millennium.

[124] We believe that the unexpected finding of a low risk of change in educational field among women with only primary or lower secondary education can nearly exclusively be attributed to the structure of the Swedish school system. At the lowest level of education, all women have the same “general” type of education. In order to change their field of education, these women have to attain an upper secondary school degree in one of the vocationally oriented programmes. However, at the upper secondary level approximately 40 per cent of all degrees are awarded in a “general” field of education; namely the academically oriented social science programme and the natural science programme (see also Chapter 3.3.2). Among those who attain an upper secondary degree within the Swedish system of adult education, the proportion might be even higher.

Table 6.6: Event history model for women's risk of undergoing a change in educational field after entering motherhood - the effect of educational level, civil status, number of children, municipality type and period

	Relative risk of change in educational field after entering motherhood
Educational level	
Primary/lower secondary	0.42
Upper secondary	1
Short post-secondary	0.68
Long post-secondary	0.20
Civil status	
Single/cohabiting	0.87
Married	1
Divorced	1.10
Widowed	0.69
Number of children	
One child	1.40
Two children	1
Three children	0.93
Four or more children	0.57
Municipality type	
Stockholm, Malmö, Gothenburg	1.09
Other urban municipalities	1
Sparsely populated rural municipalities	0.84
Period	
01/1991-06/1994	1.93
07/1994-06/1999	1
07/2000-06/2001	1.96
07/2001-06/2004	1.73

Source: Swedish register data, own estimations
Note: (1) Controlled for time since first birth (baseline), woman's current age and educational field at first birth. (2) Due to the small number of women who contribute to the exposure time, we grouped women with missing information on civil status together with those who are single or cohabiting. For the same reason, we also grouped women with missing information on municipality type together with those who live in Stockholm, Malmö or Gothenburg. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full model is included in Appendix C in Table C. 2, Model 4.

Adding these further control variables to our model leads to only some minor changes in the effect of educational field at first birth on a woman's risk of educational change (see Table 6.5, Model 4).[125] Once all of the variables are included in our model, we find the following relationship between a woman's educational field at first birth and her risk of attaining a further degree in a different field of education:

Women educated for teaching have by far the lowest risk of changing their field of education. Women trained for health care and welfare occupations are also very unlikely to return to the educational system in order to attain a degree in a different field of education. Thus, our results support our assumption of low risks of change for women educated in fields that primarily lead to a female-dominated occupational sector with family-friendly working conditions and a low wage penalty for employment interruptions.

For women who held a degree in humanities at the time of the first birth, we find an extremely high risk of educational change (nearly eight times higher than that of women educated for jobs in business and administration, which we used as our reference category). This finding is in line with our assumption of a higher risk of change for women educated in fields that do not lead to an obvious set of occupations.

As expected, we also find a comparatively high risk of attaining a degree in a new field of education among those with degrees in art (e.g. in dance, drama, design or drawing) or media (e.g. radio and TV production, illustration and advertising), which we define as fields that tend not to lead to a reliable employment career.

Contrary to our expectations, we do not observe a high risk of change among women whose educational backgrounds were in engineering or construction; areas in which graduates are very likely to end up in a clearly male-dominated occupational sector.

In addition to women educated in humanities or art and media, our event history model shows comparatively high risks of attaining a degree in a field that diverges from the educational background at the time of the first birth for women who only have a general degree, as well as for women who graduated from natural sciences or social sciences, journalism and law. We believe that women with an educational background in one of

[125] Further investigations have shown that these changes result primarily from including the period variable into our model.

these areas are also likely to face difficulties in finding a suitable and stable position in the labour market, which might lead them to pursue further studies after childbirth.[126]

Most parts of our hypothesis regarding a woman's field of education at the time of her first birth and her risk of subsequently undergoing a change in educational field were supported by our empirical investigation. However, due to the peculiarities of our data (which we described in detail in Chapter 6.3.1) we have to be cautious in drawing general conclusions. In addition, there is one further aspect we need to consider. It might be the case that not only mothers, but also childless women who graduated with degrees in fields like humanities, art, or social sciences have a high probability of returning to the educational system in order to attain a degree in a different field of education. Our finding of high or low risks of change after entering motherhood for women with certain educational backgrounds might then prove to simply be the result of an overall high or low risk of change in these fields, regardless of whether a woman has a child. In order to determine whether the risk of educational change after entering motherhood is particularly high in some fields of education we therefore also have to take into account the "general" level of educational change in each field. In a study set-up such as the one we used above, this is not possible because our sample only includes those who had already entered motherhood. In the following, we therefore carry out a further event history analysis that will provide greater insight into the role of

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[126] In our section on the transition from school to work in Sweden (see Chapter 3.4.1) we have shown that unemployment is highest among women who only hold a general degree, and that the percentage of those who get established relatively quickly in the labour market is low not only among graduates of humanities or arts programmes, but also among those who attained their degree in social sciences or natural sciences. Employment in these areas primarily takes place on short-term contracts, and the number of graduates often outnumbers the number of available positions. As a result, it often takes years until a reasonably stable position in the labour market is achieved, and quite a number of graduates from social or natural sciences do not manage to do so at all. Similar arguments apply to those educated for journalism. For graduates from law schools, the situation is different. Once they have managed to earn their degree, they have good prospects of finding a suitable position in the labour market. However, according to Stanfors (2009) work in this area is often challenging and demanding when it comes to work hours. Law professionals often must wait until their mid-thirties to reach a position that is stable enough for childbearing and childrearing. Some women might decide against such a demanding career and aim for a degree in a field where employment and raising a family are more compatible. We decided to keep together women educated in social sciences, journalism and law for two reasons. First, there are too few women with a tertiary degree in law in our sample to make them a group of their own. We also did not think any other group would be a better fit. Second, as far as possible we would like to stick to the same grouping of educational fields throughout all the empirical investigations carried out in this dissertation in order to avoid unnecessary confusion, and to be able to draw general conclusions in our final chapter.

motherhood status on women's risk of educational change within each field of education.

6.4 The impact of motherhood status on women's risk of educational change

6.4.1 Method, sample selection and variables

Discussion of method

In Sweden, individuals can first attain degrees in different fields of education at upper secondary school. Therefore, it is reasonable to start observing women at the attainment of their first upper secondary school degree. A change in educational field (if it occurs at all) may then already take place with the attainment of a first post-secondary degree.[127] However, most women are rather young at that time (between the ages of 20 and 26). Since we are primarily interested in the impact of motherhood status on women's risk of educational change, it is necessary to observe women at higher ages as well. For that reason, we have chosen to analyse women's risk of educational change in a repeated event model set-up. By means of event history methods, we model for each individual one or several transitions to a change in educational field as a function of an underlying risk, modified by a vector of covariates. The equation to be estimated has the following general mathematical form:

$$\ln \mu_{ij}\left(t\right) = y\left(t\right) + z_k\left(u_{ijk} + t\right) + \sum_m \alpha_m x_{ijm} + \sum_n \beta_n w_{ijn}\left(t\right) + \varepsilon_i$$

where $\mu_{ij}(t)$ denotes the hazard of attaining a degree in an educational field different from the one the previous degree was attained in for individual i in educational change episode j at process time t. The function $y(t)$ is a piecewise linear spline (for process time since attainment of the previous degree) that captures the impact of the

[127] A change in educational field also takes place if a woman attains a further upper secondary degree in a different field of education. However, this probably does not occur very often.

baseline duration on the hazard.[128] The parameter $z_k(u_{ijk}+t)$ symbolises a spline representation of the effect of a time-varying variable that is a continuous function of process time t with origin u_{ijk} (e.g. women's current age). The parameter x_{ijm} represents a time-constant variable (e.g. educational field in which the previous degree was attained), while the parameter $w_{ijn}(t)$ represents a time-varying variable whose value can change only at discrete times (e.g. motherhood status). Since educational change episodes are nested within individuals, we include an individual-level factor for unobserved heterogeneity in our model. Thus, we control for the fact that, due to some unobserved characteristics (e.g. an erratic mind), some women might be more likely than others to contribute more than one educational change episode to our model. The heterogeneity term, denoted with ε_i in the formula above, is assumed to be drawn independently for each woman at the start of the educational career, and to stick to that woman throughout her life. The distribution from which ε_i is drawn is assumed to be normal, with zero mean and a standard deviation to be estimated. In the final model, we set the number of integration points to 12.

$$\varepsilon_i \sim N\left(0, \sigma^2\right)$$

In our analysis, we censor if the women emigrate, die or do not attain a further degree in an educational field different from the one in which the previous degree was attained until June 2004, whichever comes first. As in our analysis of educational changes after entering motherhood, we additionally censor women in case there is a period with missing information on educational field (for more details see footnote 108, p. 157).

In the methodological section of Chapter 6.3.1, we very explicitly described several aspects of the Swedish educational system and of our data (e.g. educational changes recorded in the data that are not "real" changes), and we indicated how they might affect our analysis. These aspects apply to the current investigation as well. To avoid any unnecessary repetition, we do not list them again.

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[128] For each individual, the process time of the first educational change episode starts at the attainment of the first upper secondary degree. The process times of potential subsequent educational change episodes start at the occurrence of the event in the previous educational change episode (attainment of a degree in a different field of education).

Sample selection for the analysis

For our analysis of the impact of motherhood status on women's risk of educational change, we use Swedish register data that we described in detail in Chapter 4.2. For our investigation, we excluded all men, as well as all women of foreign origin. We restrict our analysis to women who attained their first upper secondary school degree between 1990 and 2003. Consequently, we excluded women born before 1972, since they would have been older than age 18 in 1990, and would likely have earned an upper secondary school degree before 1990.[129] Of the women born in 1972 or later, we have excluded those who did not attain a degree from upper secondary school until June 2003. In addition, we decided to concentrate on women who attained their upper secondary school degree at "regular" ages. Therefore, we excluded those women for whom our data report the attainment of an upper secondary degree before age 17.[130] As in our previous empirical investigations, we imputed "June" as the month for all educational attainments. Women who emigrated in June of the year in which they attained their first upper secondary degree were excluded, since for them the process time would be equal to zero. Furthermore, we excluded women who were not domiciled in Sweden for some time between age 16 and the attainment of the first upper secondary school degree.[131] Like in our analysis of women's risk of undergoing a change in educational field after entering motherhood, we excluded women for whom we have no valid information on educational field at the start of the process time.

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[129] In Sweden, the upper secondary school degree normally is attained at age 18 or 19 (until the early 1990s, some upper secondary programmes only took two years, which means that some students had already graduated at age 17). For women born before 1972 (aged 19 or older in 1990) we do not know the exact year in which the upper secondary degree was attained since our data only provide information on educational qualifications held in the year 1990 and changes in subsequent years.

[130] We excluded those with a registered upper secondary degree below age 17 primarily for the following reason. The "Longitudinell Integrationsdatabas för Sjukförsäkrings- och Arbetsmarknadsstudier" (LISA), from which we derived our information on educational level and educational field, only includes information on individuals aged 16 or older. An educational degree that a person holds when she enters the database at age 16 in year x might have been attained at age 16 or at any younger age (in year x-1, year x-2, etc.). We therefore only have precise information on the year of attainment of an educational degree from age 17 upwards.

[131] Even though Statistics Sweden also tries to incorporate educational qualifications attained abroad, educational histories tend to be less reliable for migrants. Thus, for those who spent some time abroad after age 16, we cannot be sure whether a registered upper secondary degree really has been attained in the specified year.

Because of the unusually high number of recorded educational changes in the year 2000 (see Chapter 6.3.1), which presumably results from the transition from the old Swedish system of educational classifications (SUN) to the new one (SUN 2000), we also decided to exclude the year 2000 from our analysis of the impact of motherhood status on women's risk of educational change. We omitted all corresponding occurrences (events that occurred in June 2000) and exposures (person years between July 1999 and June 2000) from our analysis. In addition, we excluded educational change episodes that started in the year 2000.[132] These steps led to some further reductions of our sample size. In our final sample for the analysis of the impact of motherhood status on women's risk of educational change, we have 120,905 women who were born between 1972 and 1985.[133] These women contribute a total of 176,691 educational change episodes. For more details on the sample selection see Table 6.7.

Table 6.8 shows that most women in our sample contribute only one educational change episode to the model (66.6 per cent). For 23.5 per cent of the women, we observe two educational change episodes, while the proportion of women with three episodes amounts to 7.7 per cent. Very few women contribute four or more educational change episodes to the model (2.2 per cent).

[132] In the year 2000, Statistics Sweden added information from a number of new data sources to the register (see also footnote 118, p. 160). Since we do not know whether a degree registered in 2000 really was attained in 2000, or whether it was earned before, we omit all educational change episodes that start in 2000 from our analysis.

[133] We restrict our analysis to cohorts born in 1972 or later since it is only for these cohorts that our data allow us to determine the year in which the first upper secondary degree was attained. However, as we deal with rather young cohorts, and as we are only able to observe them for 14 years (calendar years 1990 to 2004), the maximum age to which a woman can be followed is age 32. We would have preferred to have followed women to higher ages, but did not see any suitable way to do so.

Table 6.7: Description of the number of included and excluded cases for the analysis of the impact of motherhood status on women's risk of undergoing a change in educational field

Number of individuals in original sample	1,196,749
Number of individuals excluded from the analysis	1,075,844
Number of individuals included in the analysis	120,905
Number of educational change episodes in the analysis	176,691
Number of events	60,356
reason for exclusion:	
(1) Sex (male)	612,572
(2) Birth country (not Sweden)	126,234
(3) Individuals were born before 1972	289,151
(4) Individuals were not domiciled in Sweden (for some time) between age 16 and the attainment of the first registered upper secondary degree	462
(5) Individuals did not attain an upper secondary degree (until June 2003)	29,125
(6) Individuals attained a first upper secondary degree before age 17	952
(7) Individuals emigrated at attainment of first upper secondary degree	62
(8) No information on educational level/no information on the field the first upper secondary degree was attained in	8,389
(9) Individuals first upper secondary degree is registered to be attained in June 2000 (and the respondents do not contribute to the model with further educational change episodes)	8,168
(10) Individuals only have one educational change episode that started and ended between July 1999 and June 2000 (time period that has been excluded from the analysis)	729

Source: Swedish register data

Table 6.8: Distribution of educational change episodes across women

Total number of educational change episodes per woman	N	in %
1	80,533	66.6
2	28,362	23.5
3	9,305	7.7
4	2,107	1.7
5	508	0.4
6	79	0.1
7	11	0.0
Total number of women in the sample	120,905	100.0

Source: Swedish register data

Covariates in the analysis

In the following, we briefly present the variables included in our model on the impact of motherhood status on women's risk of undergoing a change in educational field. Most of these variables also served as explanatory variables in the empirical analyses carried out before, and therefore do not need to be described in detail again.[134] An overview of the composition of the sample with measures of exposures and occurrences within the categories of each covariate is given in Appendix C in Table C. 3.

In this part of our empirical investigation, we want to find out whether the risk of returning to school in order to attain a further degree in a different field of education differs between childless women and mothers. Previous studies have shown that women are less likely to re-enter the educational system once they have become mothers (e.g. Felmlee 1988; Henz 1999). We therefore also expect to find a lower overall risk of educational change for mothers than for childless women with our Swedish data. We include in our model a woman's **motherhood status** as a time-varying categorical variable consisting of two categories:

childless and
mother.[135]

Our primary interest is in the question of whether the impact of motherhood status on women's risk of educational change differs between women with different educational backgrounds. We therefore also include the **educational field in which the previous degree was attained** as a time-constant[136] categorical variable in our model, and distinguish between the following 14 fields of education:

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[134] For a detailed description of the construction of these variables see Chapter 5.3 and Chapter 6.3.1.

[135] Unlike in our previous investigation, we do not distinguish between mothers at different parities. This is justified due to our rather young sample (we only observe women to a maximum age of 32).

[136] In this empirical chapter, time-constant means constant within educational change episodes. However, time-constant variables (e.g. educational field the previous degree was attained in) do vary across the different educational change episodes of an individual.

general;
teacher training;
art and media;
humanities:
social sciences, journalism and law;
business and administration;
natural sciences;
engineering and construction;
manufacturing and processing;
agriculture, forestry and animal health;
health care and welfare;
technically oriented health care and pharmacy;
personal services; and
security services.[137]

To find out whether the effect of motherhood status on women's risk of educational change differs depending on the field women are educated in, we estimate an interaction between the two variables. We expect to find that being a mother reduces a woman's risk of attaining a further degree in a different field of education, regardless of the field in which she attained her previous degree. However, we also assume that the depressing effect of having children on women's risk of educational change varies depending on the field in which women have been educated. In line with our hypothesis regarding educational field and women's risk of educational change after becoming a mother (see hypothesis H6-I in Chapter 6.2), we expect to find that the depressing effect of being a mother on women's risk of educational change is strongest for women educated in fields that lead to a stable employment career in a female-dominated occupational sector (teaching, health care and welfare). On the other hand, we expect to find only a weak depressing effect of motherhood on transition rates to a further degree among women educated in fields that lack an obvious set of occupations (humanities,

[137] For a more detailed insight into the educational lines within each field of education see Table B. 6 in Appendix B.

general) or that tend not to lead to a reliable employment career (art and media, social sciences, journalism and law, natural sciences).[138]

As in the previous investigation, we include several further covariates in our analysis of women's risk of educational change. First, we control for women's **educational level** as a time-varying categorical variable. Since our sample only includes women who have already attained an upper secondary school degree we only distinguish between:

upper secondary education (10-12 years);
short post-secondary education, including some college or university education of up to three years (13-15 years); and
long post-secondary education, including all higher education courses normally taking four years or more, such as a master's degree, a licentiate or a doctorate (16 years or more in all).[139]

In addition, we control for the number of changes in educational field a woman has already undergone. We constructed a time-constant categorical variable for the **number of previous changes in educational field**, which consists of four categories:

no previous change,
one previous change,
two previous changes and
three or more previous changes.

In our investigation of women's risk of undergoing a change in educational field after entering motherhood, we found a strong effect of the baseline duration (time since first birth) on women's transition rates (see Chapter 6.3.2). We therefore also control for time since first birth in our current analysis. For those who are mothers, we include a

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[138] In hypothesis H6-I in Chapter 6.2, we also assumed a high risk of change for mothers educated for strongly male-dominated occupations. However, our analysis of women's risk of educational change after entering motherhood showed a rather average risk of change for women with such an educational background. We will check whether we also do not find an elevated risk for graduates from educational programmes that lead to male-dominated occupations in the current investigation.

[139] See footnote 120, p. 163.

time-varying categorical variable for the **age of the first child**, which consists of the following categories:

ages 0-1,
ages 2-3,
ages 4-5,
age 6 and
ages 7+.

Furthermore, we include in our model time-varying categorical variables for a woman’s civil status, the type of municipality she lives in and the calendar period as well as a piece-wise linear duration spline for the woman’s current age. We operationalised the variables **civil status** and **municipality type** in the same way as in the previous investigation.[140] For calendar **period**, we have chosen slightly different categories that are:

July 1990 until June 1995,
July 1995 until June 1999,
July 2000 until June 2001,
July 2001 until June 2002 and
July 2002 until June 2004.

With respect to the piece-wise linear duration spline for **woman’s current age**, we decided to set nodes at ages 24, 26 and 27.[141]

[140] For a detailed description of these variables and our reasons for including them in our analysis, see Chapter 6.3.1.

[141] In a first step, we estimated models with very detailed categories for some of our time-varying variables and numerous nodes for the duration splines. We then successively merged categories with similar risks and deleted nodes that do not contribute markedly to the shape of the duration splines. Since the sample used in this investigation differs from the one used in our analysis of women’s risk of change after becoming a mother, we ended up with a slightly different classification of some of our variables.

6.4.2 Empirical findings

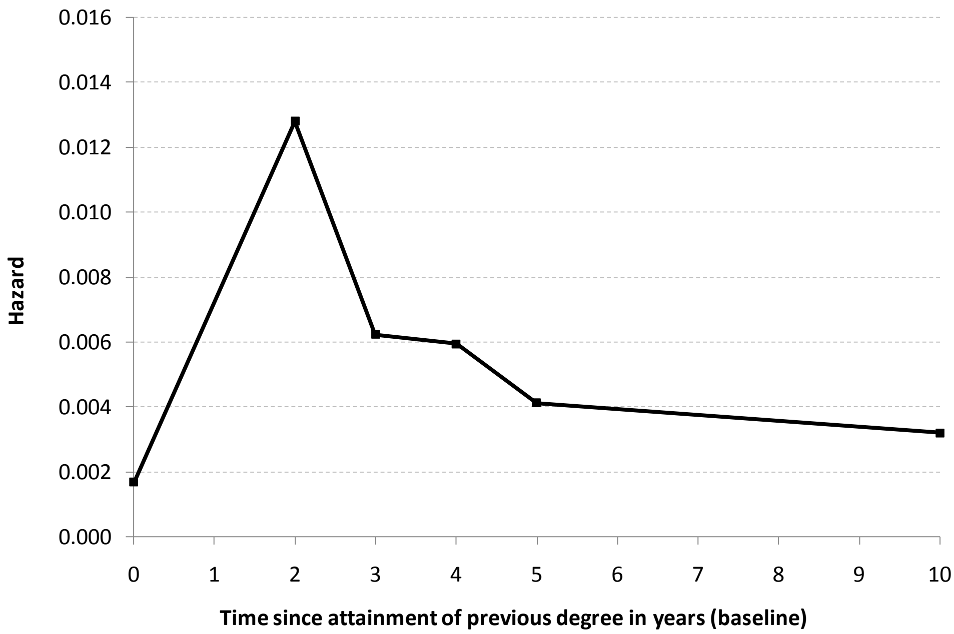
In our model, we analyse educational change episodes. However, these educational change episodes are nested within women. Due to certain unobserved characteristics, some women might be more likely to undergo a change in educational field than others.[142] As a consequence, they are also more likely to contribute to more than one educational change episode. To avoid biased results, we include an individual-level factor for unobserved heterogeneity into our model. In our analysis, the standard deviation of this unobserved heterogeneity term equals 0.75, and is significantly different from zero (see Table C. 4 in Appendix C). This means that there are unobserved characteristics of the women in the data that affect the risk of educational change. The results presented in the following are therefore based on a model that controls for unobserved heterogeneity.[143]

We start our presentation of the results of our event history analysis on the impact of motherhood status on women's risk of undergoing a change in educational field with a description of the effect of the baseline duration, which is *time since attainment of the previous degree*. Figure 6.3 shows that women's risk of attaining a further degree in a different field of education is highest two years after the previous degree was attained. Between two and three years after the attainment of the previous degree there is a strong decrease in women's risk of educational change. After a rather constant risk at three to four years of duration, there is a further sharp decline in a woman's risk of undergoing a change in educational field. However, with increasing durations, this decline levels off.

[142] We are thinking in particular about certain individual traits that cannot be measured with our data, and that might affect women's risk of educational change in a positive or in a negative way.

[143] In comparison to a model that does not include an unobserved heterogeneity term, the one that controls for unobserved heterogeneity yields slightly different results for nearly all variables. However, the effect does not change markedly for any of the variables. We therefore only show the results from the model in which unobserved heterogeneity is controlled for.

Figure 6.3: Event history model for women's risk of undergoing a change in educational field - the effect of time since attainment of the previous degree (baseline)



Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's current age, educational field in which the previous degree was attained, number of previous changes in educational field, educational level, civil status, motherhood status, age of first child, municipality type and period. (2) The full model is included in Appendix C in Table C. 4, Model 1.

We now turn to the results for the impact of the *educational field the previous degree was attained in* on women's risk of educational change. Despite the differences in the samples used, we find very similar effects of educational field at first birth (see Chapter 6.3.2, Table 6.5, Model 4) and educational field at attainment of the previous degree (see Table 6.9) on women's risk of attaining a further degree in a different field of education.[144]

[144] In our investigation of women's risk of undergoing a change in educational field after entering motherhood, we included women who had at least one child, regardless of their level of education or birth cohort. In the present investigation, we also included childless women, but we restricted our analysis to those with at least upper secondary education who were born after 1971. Due to the restriction to younger cohorts and an observation period that already ends in 2004, we observe women only up to a maximum age of 32 in our current investigation. In our model on women's risk of educational change after entering motherhood, we were able to follow women to a much higher age.

Table 6.9: Event history model for women's risk of undergoing a change in educational field - the effect of educational field in which the previous degree was attained

	Relative risk of change in educational field
Educational field in which the previous degree was attained	
General	4.48
Teacher training	0.28
Art and media	1.53
Humanities	3.64
Social sciences, journalism and law	2.78
Business and administration	1
Natural sciences	2.71
Engineering and construction	1.06
Manufacturing and processing	0.52
Agriculture, forestry and animal health	0.47
Health care and welfare	0.44
Tech. oriented health care and pharmacy	0.48
Personal services	0.64
Security services	0.55

Source: Swedish register data, own estimations
Notes: (1) Controlled for time since attainment of previous degree (baseline), woman's current age, number of previous changes in educational field, educational level, civil status, motherhood status, age of first child, municipality type and period. (2) Effects with a p-value higher than 0.1 are printed in grey. (3) The full model is included in Appendix C in Table C. 4, Model 1.

In line with our previous empirical investigation, we find that the risk of attaining a further degree in an educational field different from the field in which the previous degree was attained is highest among women educated in fields that lack an obvious set of occupations (humanities, general), or that tend not to lead to a reliable employment career (art and media, social sciences, journalism and law, natural sciences).[145] For women educated in fields that normally lead to a clearly male-dominated occupational sector (engineering and construction), we once again do not observe a particularly high risk of educational change. As in our previous investigation, we find a very low risk of undergoing a change in educational field for women educated in fields that lead to a stable employment career in a clearly female-dominated occupational sector (teaching,

[145] We have already pointed out that, in addition to women educated in art and media, those with a degree in social sciences or natural sciences also often face difficulties in getting established in the labour market (see footnote 126, p. 176).

health care and welfare). In contrast to our analysis of women's risk of undergoing a change in educational field after entering motherhood, the current investigation also reveals very low (relative risks of below 0.5), rather than average, risks of educational change for women educated for jobs in agriculture, forestry and animal health, or in technically oriented health care and pharmacy. This can probably be attributed to differences between the women included in the samples used (see footnote 144, p. 187).[146]

A major drawback of our previous investigation of women's risk of undergoing a change in educational field after entering motherhood was that it did not allow us to compare the risk for mothers with the risk for childless women. We doubted whether our results really could be taken as a clear evidence for our assumption of particularly high/low risks of educational change after entering motherhood for women with different educational backgrounds. We considered the possibility that our findings of high or low risks of change after entering motherhood in certain fields of education might also simply be the result of an overall high or low risk of change in these fields, regardless of whether a woman is a mother (see Chapter 6.3.2). In the present analysis, we can alleviate this uncertainty by looking more closely at the impact of *motherhood status* on women's risk of educational change within each field of education. In Table 6.10, we first show the effect of being a mother on a woman's risk of attaining a further degree in a field different from the field in which she earned her previous degree. In addition, we show how the effect of having children on women's risk of educational change varies by the *age of the first child*.

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[146] One possible explanation is that graduates of educational programmes for agriculture, forestry and animal health or technically oriented health care and pharmacy have a low general risk of educational change, but a somewhat higher risk once they entered motherhood (although this would contradict our assumption of a lower general risk of educational change for mothers relative to childless women). Another explanation is that among graduates of these fields the relative risk of attaining a further degree in a different field of education varies by cohort and/or by age (with younger cohorts/women having a low relative risk of change, and older cohorts/women having an average relative risk of change).

Table 6.10: Event history model for women's risk of undergoing a change in educational field - the effect of motherhood status and age of first child

	Relative risk of change in educational field
Motherhood status	
Childless	2.03
Mother	1
Age of first child (for mothers)	
ages 0-1	0.42
ages 2-3	0.82
ages 4-5	1
age 6	1.16
ages 7+	0.96

Source: Swedish register data, own estimations
Notes: (1)) Controlled for time since attainment of previous degree (baseline), woman's current age, educational field in which the previous degree was attained, number of previous changes in educational field, educational level, civil status, municipality type and period. (2) Effects with a p-value higher than 0.1 are printed in grey. (3) The full model is included in Appendix C in Table C. 4, Model 1.

As expected, our investigation reveals a strong depressing effect of motherhood on women's risk of undergoing a change in educational field. Compared to childless women, mothers (with a first child aged four to five) are only half as likely to earn a further degree in a different field of education.[147] Motherhood lowers women's risk of educational change most strongly during the initial years after the first child is born. As her first child grows older, a mothers' risk of attaining a further degree in a different field of education increases, but remains clearly below the risk of childless women, at least until the first child reaches primary school age (which is the highest child age we are able to observe).[148]

In order to gain greater insight into the role of motherhood status on women's risk of educational change within each field of education, we estimated an interaction between both variables (see Table 6.11).

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[147] The effect of the age of the first child is only estimated for those who are mothers. As a result, our motherhood variable reports the risk of educational change for a childless woman relative to the risk of a mother with a first child who is four to five years old.

[148] As in our previous investigation (see Figure 6.1, p. 170), we find a lower risk of change for mothers of a child starting school (ages seven or older) than for mothers whose first child is of pre-school age, which indicates that some Swedish mothers at least temporarily put on hold their own educational career when their first child enters primary school.

Table 6.11: Event history model for women's risk of undergoing a change in educational field - the effect of educational field in which the previous degree was attained by motherhood status

	Relative risk of change in educational field			
	Motherhood status		**Motherhood status**	
	Childless	Mother	Childless	Mother
	Risks relative to the risk for mothers with a previous degree in business and administration		Risks for mothers relative to the risk for childless women within each field of education	
Educational field in which the previous degree was attained				
General	11.31	4.33	1	0.38
Teacher training	0.69	0.39	1	0.57
Art and media	3.82	2.50	1	0.66
Humanities	8.88	13.64	1	1.54
Social sciences, journalism and law	6.80	8.44	1	1.24
Business and administration	2.53	1	1	0.40
Natural sciences	6.71	4.88	1	0.73
Engineering and construction	2.66	1.19	1	0.45
Manufacturing and processing	1.22	1.10	1	0.90
Agriculture, forestry and animal health	1.16	0.64	1	0.55
Health care and welfare	1.13	0.46	1	0.41
Tech. oriented health care and pharmacy	1.13	1.50	1	1.32
Personal services	1.61	0.80	1	0.49
Security services	1.43	-	-	-
All educational fields	2.03	1	1	0.49

Source: Swedish register data, own estimations
Notes: (1)) Controlled for time since attainment of previous degree (baseline), woman's current age, number of previous changes in educational field, educational level, civil status, age of first child, municipality type and period. (2) Table only includes effects for categories in which the number of women who contributed to the exposure time was at least 50 (see Appendix C, Table C. 6). (3) On the left-hand side of the table effects with a p-value higher than 0.1 are printed in grey. (4) The full model is included in Appendix C in Table C. 4, Model 2. (5) Effect for "all educational fields" is taken from Table 6.10.

The left-hand side of Table 6.11 shows women's risk of educational change by motherhood status and educational field in which the previous degree was attained. relative to the risk for mothers with a degree in business and administration. By looking at this part of the table, we are already able to reject our assumption that being a mother reduces women's risk of educational change, regardless of the field in which they attained their previous degree. For graduates of humanities, social sciences, journalism and law programmes, as well as for graduates of programmes in the area of technically oriented health care and pharmacy, we find not a lower, but a higher risk of educational change for mothers than for childless women.

On the right-hand side of Table 6.11, we display the risk of educational change for mothers relative to the risk for childless women within each field of education. Shown in this way, it becomes even more obvious that there are strong differences in the impact of motherhood status on women's risk of educational change between women educated in different fields of education. In the following, we highlight the findings that appear to be most important to us:

Having children strongly reduces the risk of educational change for women educated for jobs in health care and welfare. Among women who earned a previous degree in teaching, the risk to take a further degree in a different field of education is also clearly lower for mothers than for childless women. Thus, our results support our expectation of a strong depressing effect of motherhood on the risk of educational change for women educated in fields that are clearly female-dominated, and that offer stable employment prospects.

However, our investigation also reveals that the strong depressing effect of motherhood on women's risk of educational change is not exclusively restricted to fields of education that are clearly female-dominated, and that offer stable employment prospects. From Table 6.11, we can see that there are several further fields of education in which the risk of undergoing a change in educational field is much lower for mothers than for childless women. Among them, there are even two fields of education for which we expected to find only a weak negative impact of motherhood on women's risk of educational change (engineering and construction, general).[149]

For graduates of humanities programmes, we expected to find only a weak negative effect of children on the risk of undergoing a change in educational field. Our analysis shows that mothers with a degree in humanities have an even higher risk of earning a further degree in a different field of education than childless women. This finding contradicts our assumption of a generally lower risk of educational change after entering motherhood. However, it supports our reasoning that, for women educated in a field that lacks an obvious set of occupations, giving birth to a child might be an event that leads them to pursue a further degree in a different field of education in order to achieve a more stable position in the labour market.

We also expected to find that the depressing effect of motherhood on women's risk of educational change is weak for women educated in fields that tend not to lead to a reliable employment career. For women with a degree in social sciences, journalism or law, our analysis shows nearly the same effects as for graduates of humanities programmes. In comparison to childless women, mothers with a degree in social sciences, journalism or law have a higher, not a lower risk of attaining a further degree in a different field of education. However, our investigation does not yield a similar result for mothers educated in art and media or in natural sciences, even though graduates in these fields also often face difficulties in getting established in the labour

[149] We expected to find a high risk of change for mothers with a degree in engineering and construction, since a degree in this area primarily leads to male-dominated occupations (for our argumentation see Chapter 6.2). However, our investigation into women's risk of educational change after entering motherhood showed an average - not an elevated - risk of educational change for women with this educational background (see Chapter 6.3.2). We are therefore not totally surprised that we did not find a weak depressing effect of motherhood on women's risk of educational change for women educated in engineering and construction in the current investigation. For mothers with a general education (who are predominantly mothers with a degree from an academically oriented upper secondary programme), we expected to find a high risk of change, since these educational programmes do not impart labour market specific knowledge, and graduates may therefore face difficulties in getting established in the labour market. The unexpected finding of a much lower risk of educational change among mothers than among childless women with a general education probably results from the fact that changes from "general" to a different field of education most often take place at rather young ages (namely, when women with a degree from an academically oriented upper secondary programme attain their first tertiary degree). Those who, at the time when their first child is born, still only have a general degree from upper secondary school might be selective in that they - for some reason - have decided to not pursue further education.

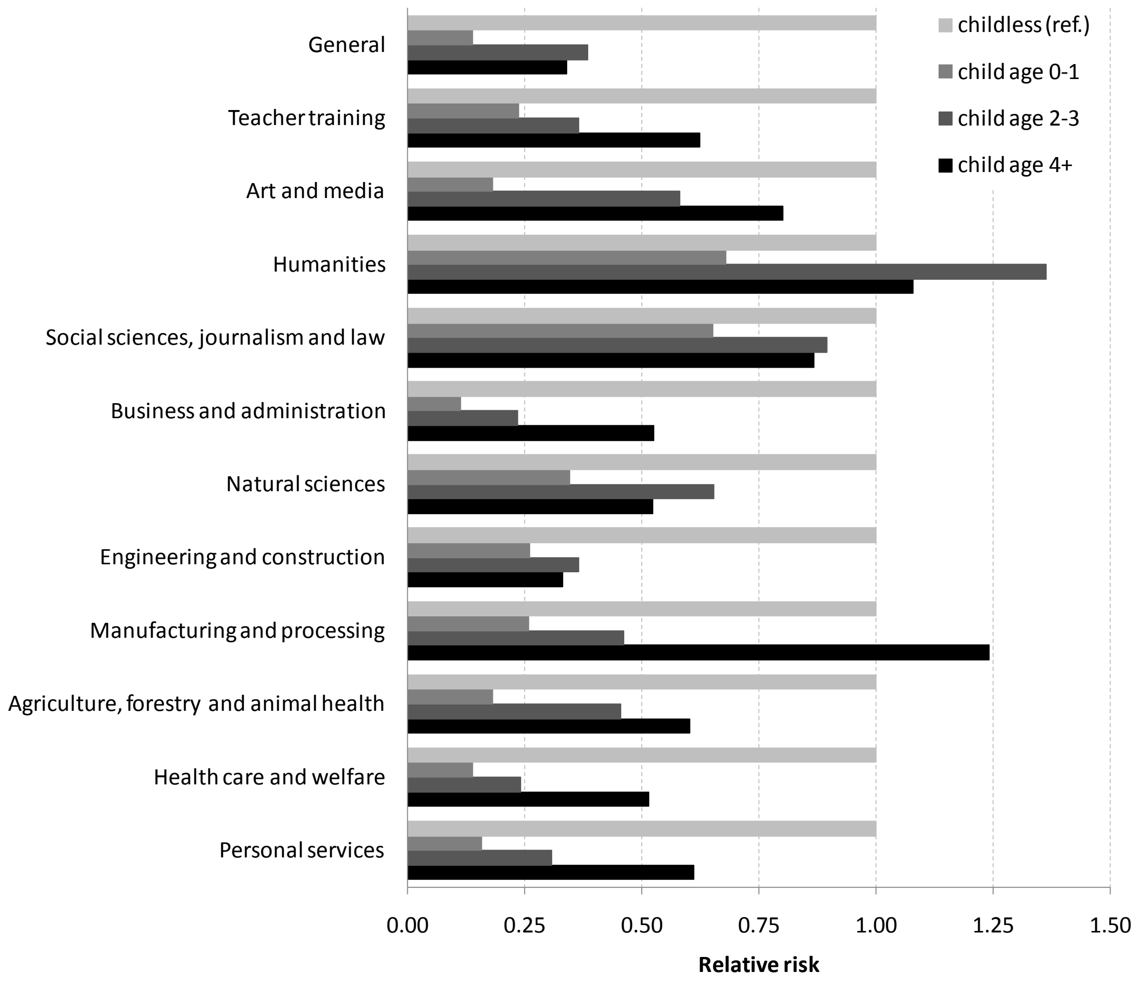
market, and most manage to reach a secure position in the labour market (if at all) only relatively late in life.
We find a higher risk of educational change for mothers relative to childless women not only among graduates of humanities programmes and of social sciences, journalism and law programmes; but also among those who attained their previous degree in technically oriented health care (e.g. biomedical analysis, orthopaedic engineering, radiology nursing) and pharmacy. Unfortunately, we lack any good explanation for this finding.

In our first empirical investigation (Chapter 6.3), we concentrated on mothers only and investigated whether the risk of undergoing a change in educational field differs depending on the field mothers were educated in at first birth. The current investigation also includes childless women, and thus allows us to disentangle whether field-specific differences in mothers' risk of educational change really are caused by a different effect of motherhood on women's risk of returning to education, or whether these differences only result from a high or low general risk of change in certain fields of education (regardless of whether a woman is a mother). We will draw some conclusions regarding this aspect in the final section of CHAPTER 6. First, however, we should point out a further difference between the two investigations. In our analysis of women's risk of educational change after the transition to motherhood (Chapter 6.3), we made sure that a degree attained after the first childbirth was not the result of an ongoing educational career by restricting our analysis to women who were not enrolled in education during the year that preceded the birth of their first child. Unfortunately, in our current investigation, we are not able to control for the possibility that a degree attained as a mother might result from an educational programme that was initiated long before the child was born.[150] If there are differences in the likelihood of entering motherhood while being in education between different fields of education, this might have affected our results. The only way to access the validity of our results is to estimate an interaction between the educational field in which the previous degree was attained, motherhood status and the age of the first child. If the bias (that is produced by

[150] This problem would not occur if the date when a woman started an educational programme in a different field of education was used as time of the event, instead of the date when a different degree was attained. However, our data do not contain this kind of information.

not taking into account the possibility that some educational qualifications attained by mothers might have been initiated before the first childbirth) applies to all educational fields, we should find a similar risk pattern by age of the first child across all fields of education.

Figure 6.4: Event history model for women's risk of undergoing a change in educational field - the effect of educational field in which the previous degree was attained by motherhood status and age of first child



Source: Swedish register data, own estimations

Notes: (1)) Controlled for time since attainment of previous degree (baseline), woman's current age, number of previous changes in educational field, educational level, civil status, municipality type and period. (2) Risks are given relative to the risk for childless women within each field of education. (3) For the interaction we merged child age 4-5, child age 6, and child age 7+ into one category, due to the low number of women with children at higher ages in the sample. (4) We do not show the interaction for women educated in technically oriented health care and pharmacy, or in security services, due to the very low number of women who contributed to the categories for these fields (see Appendix C, Table C. 8). (5) The full model is included in Appendix C in Table C. 4, Model 3.

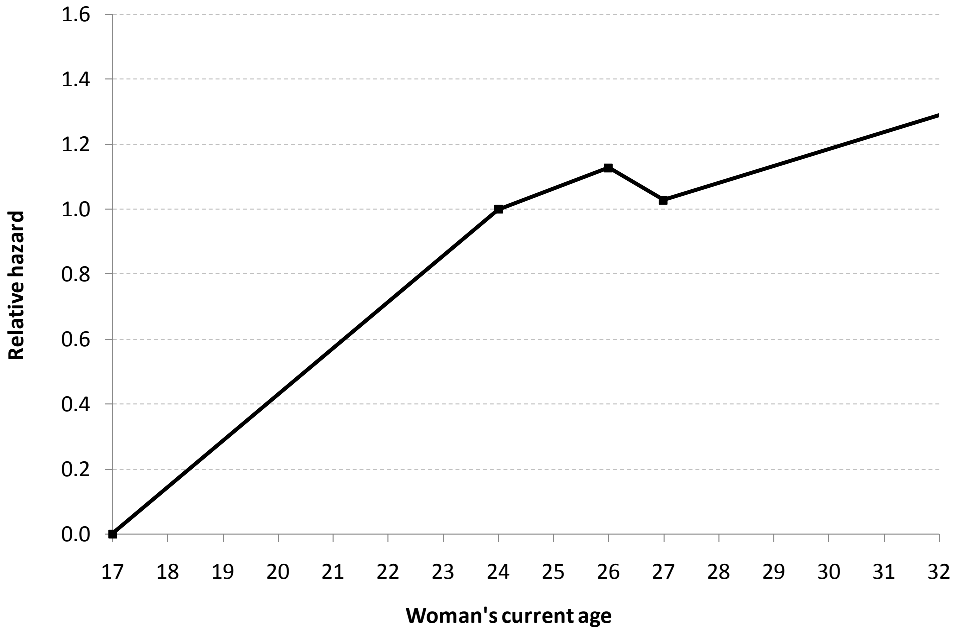
Figure 6.4 shows that, regardless of the field women are educated in, the risk of educational change is lowest for mothers with a child under age two. However, contrary to our expectations, the risk of undergoing a change in educational field does not increase continuously with an increasing age of the first child for all fields of education. For mothers with only a general educational degree, or with a degree in humanities, social sciences, journalism and law, natural sciences, or engineering and construction; the risk of educational change is higher when the child is age two to three than when the child is older. This might indicate that, in these fields of education, the proportion of women who become mothers while being in education (and who finish their degree within two to three years after the first child is born) is higher than in other educational fields. As a consequence, the bias (which occurs because we are not able to separate mothers who re-entered education after having a child from those who had re-entered before the child was born) might be stronger for these fields.

Control variables

As in our previous investigation, we controlled in our analysis of the impact of motherhood status on women's risk of educational change for a number of further covariates (results are shown in Figure 6.5 and Table 6.12). In the following, we very briefly describe our findings regarding these factors. In Figure 6.5, we first plotted a graph for the effect of a *woman's current age*. The graph shows that women's risk of attaining a further degree in a different field of education increases continuously up to age 26. After a short interruption at ages 26 to 27, the risk of educational change continues to increase up to age 32 (which is the highest age we observe).[151]

[151] In our investigation of women's risk of educational change after entering motherhood, we also found that the risk of undergoing a change in educational field increases until the early thirties (see Figure 6.2).

Figure 6.5: Event history model for women's risk of undergoing a change in educational field - the effect of woman's current age



Source: Swedish register data, own estimations
Notes: (1) Controlled for time since attainment of previous degree (baseline), educational field in which the previous degree was attained, number of previous changes in educational field, educational level, civil status, motherhood status, age of first child, municipality type and period. (2) The full model is included in Appendix C in Table C. 4, Model 1.

For *educational level*, the current investigation reveals an effect that differs from the one we observed in our analysis of women's risk of educational change after entering motherhood (for the effect of educational level in our previous investigation see Table 6.6, p. 174). Instead of women with an upper secondary degree, those with a short post secondary education show the highest risk of attaining a further degree in a different field of education. We believe the differences in the effect of educational level on women's risk of educational change can be attributed to differences in how we set up the models for the two analyses.[152] However, as in our previous investigation, we find that the risk of attaining a further degree in a different field of education is lowest for those who hold a degree from a long post-secondary educational programme. In

[152] In the previous investigation, we only analysed first changes in educational field, whereas the effect of educational level in the current investigation results from a repeated event model. Women probably attain multiple short post-secondary degrees more frequently than multiple upper secondary degrees. Therefore, in a repeated event model those with a short post secondary level of education have the highest risk of educational change. In addition, differences in the samples used (see footnote 144, p. 187) might be responsible for the different effect of educational level on women's risk of educational change.

addition, our current analysis shows that women's risk of educational change decreases with an increasing *number of previous changes in educational field*.

Table 6.12: Event history model for women's risk of undergoing a change in educational field after the attainment of a first upper secondary degree - the effect of educational level, civil status, age of first child, municipality type and period

	Relative risk of change in educational field
Number of previous changes in educational field	
No previous change	1
One previous change	0.53
Two previous changes	0.35
Three or more previous changes	0.22
Educational level	
Upper secondary	1
Short post-secondary	1.22
Long post-secondary	0.14
Civil status	
Single/cohabiting	1.26
Married	1
Divorced/widowed	0.83
Municipality type	
Stockholm, Malmö, Gothenburg	0.98
Other urban municipalities	1
Sparsely populated rural municipalities	0.66
Period	
07/1990-06/1995	1.30
07/1995-06/1999	1
07/2000-06/2001	1.65
07/2001-06/2002	1.17
07/2002-06/2004	0.88

Source: Swedish register data, own estimations
Notes: (1) Controlled for time since attainment of previous degree (baseline), woman's current age, educational field in which the previous degree was attained, motherhood status and age of first child. (2) Due to the small number of women who contributed to the exposure time, we grouped widowed women together with those who are divorced. For the same reason, we also grouped women with missing information on municipality type together with those who live in Stockholm, Malmö or Gothenburg. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full model is included in Appendix C in Table C. 4, Model 1.

Although we operationalised the control variables *civil status* and *municipality type* in nearly the same way as in our previous investigation, the current analysis shows slightly different effects for the two variables (for the effect of these variables in our previous investigation see Table 6.6, p. 174). In our examination of women's risk of educational change after entering motherhood, we found that transition rates are highest among those who are married or divorced. By contrast, in our current analysis which includes childless women and mothers, the risk of change is highest among single or cohabiting women.[153] With respect to municipality type, our previous investigation for mothers only showed a clear positive relationship between population density and women's risk of educational change. However, in the current investigation, we do not observe a difference in the risk of educational change between women who live in one of Sweden's big cities and those who live in other urban municipalities. For calendar *period*, our two investigations show very similar results. We once again find that Swedish women were less likely to undergo a change in their educational career during the second half of the 1990s than during the early 1990s or after the turn of the millennium. However, while the risk of educational change strongly decreased between July 2001 and June 2004 in our second investigation, we observed a rather constant risk during this period in the first investigation (for the effect of period in the first investigation see Table 6.6, p. 174).[154] We believe that the observed differences in the effect of civil status, municipality type and period on women's risk of educational change result from the different samples used for the two empirical investigations.[155]

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[153] It is important to keep in mind that the two investigations clearly differ with respect to the women who contribute to the category "single/cohabiting". In the first analysis, which was restricted to mothers, this category presumably encompasses predominantly cohabiting women. In the second investigation, however, there are probably also a lot of single women who contribute to this category.

[154] In our first investigation, the variable period only has a single category for July 2001 to June 2004 (Table 6.6, p. 174). However, in preliminary analyses, we used a yearly specification of the period variable. Thus, we know that the risk of educational change did not vary significantly after July 2001 in our model on women's risk of educational change after entering motherhood.

[155] To test whether the observed differences can be attributed to the fact that our first investigation was restricted to mothers, we used the sample from the second investigation and estimated interactions between several covariates and motherhood status (results not shown). For civil status, municipality type and period we found interaction effects with motherhood status that are able to explain the different results that we observed. We did not find such an interaction effect for educational level. However, it might also be the case that differences in the cohorts included in the sample for the two investigations are responsible for the different effects of educational level. We refrained from further investigations in this direction.

6.5 Discussion and concluding remarks

CHAPTER 6 was devoted to an empirical investigation of the second dimension of the mutual relationship between education and fertility; namely, the impact of childbearing on women's educational trajectories. Unlike the majority of previous studies, we did not focus on the effect of (early) childbearing on the level of education a woman attains. Instead, we investigated empirically how childbearing influences women's risk of undergoing a change in educational field. In particular, we were interested in the question of whether the field of education a woman is trained in plays a decisive role in her decision to pursue a further degree in a different educational field after becoming a mother. With reference to our explanations regarding the link between education and the labour market in Chapter 3.4, we pointed out that different fields of education generate differences in labour market conditions, and, hence, different incentives to re-enter the educational system. We argued that motherhood probably increases a woman's desire for a secure, stable and family-friendly position in the labour market, and that therefore a mother whose educational background is not likely to lead to such a position should have an especially high risk of re-entering education.

In a first step, we concentrated on mothers only and estimated a model for the transition to a first change in educational field after entering motherhood. This investigation revealed that mothers with different fields of education have different risks of undergoing a change in educational field. We found low risks of change for mothers educated in fields that primarily lead to clearly female-dominated occupational areas with stable and family-friendly employment prospects (teaching, health care and welfare). The risk of attaining a further degree in an educational field that diverges from the educational background at the time of first birth turned out to be high for mothers educated in fields that lack an obvious set of occupations (humanities, general) or that tend not to lead to a reliable employment career (art and media, social sciences, journalism and law, natural sciences).[156] Contrary to our expectations, we observed an

[156] By the expression "educational fields that tend not to lead to a reliable employment career" we mean fields of education that lead to occupational areas in which employment is often marked by temporary contracts or freelance work and the need for spatial mobility. A further characteristic of these fields is that graduates often manage to reach a reasonably stable position in the labour market only relatively late in life.

average, rather than an elevated, risk of change for mothers educated in fields that have a high propensity to lead to a clearly male-dominated occupational sector (engineering and construction).[157] After discussing the empirical findings of our first investigation, we raised concerns about the explanatory power of our results. We considered the possibility that a high or low risk of change after entering motherhood in certain fields of education might in fact simply be the result of an overall high or low risk of change in these fields, regardless of whether a woman is a mother.

In a second step, we therefore also included childless women, and estimated a repeated event model for the impact of motherhood status on women's risk of educational change. To figure out whether field-specific differences in mothers' risk of educational change really are caused by a different effect of motherhood on women's risk of returning to education, or if these differences only result from a high or low general risk of change in certain fields of education, we computed an interaction between motherhood status and the educational field in which the previous degree was attained. This interaction revealed that there are strong differences in the impact of motherhood status on women's risk of educational change between women educated in different fields of education. For educational fields that primarily lead to clearly female-dominated occupational areas with stable and family-friendly employment prospects (teaching, health care and welfare), we observed a strong depressing effect of motherhood on women's risk of educational change. We did not find evidence for a weak depressing effect of motherhood on women's risk of change for graduates of fields that have a high propensity to lead to a clearly male-dominated occupational sector (engineering and construction). For women educated in fields that lack an obvious set of occupations (humanities, general), or that tend not to lead to a reliable employment career (art and media, social sciences, journalism and law, natural

[157] It could be that in Sweden - a country well known for its egalitarian and family-friendly institutional context - male-dominated occupational areas today do not differ that much from more gender-equal occupational areas in terms of work norms and the availability and acceptance of family friendly work arrangements. Another explanation could be that those who have chosen (and managed) to receive a degree in a clearly male-dominated field might be less willing to "throw away" their hard-earned educational achievements, and are more inclined or more able to convince their partners to take their fair share of the child care. However, it is also possible that women educated for jobs in clearly male-dominated occupational areas select themselves into certain sub-areas that are more gender equal. Likewise, it could be the case that mothers who have been educated for a male-dominated field do not work in that field, but have instead managed to find work in a different occupational area without participating in any kind of re-education.

sciences) we expected to find only a weak depressing effect of motherhood on women's risk of educational change. However, the interaction carried out produced very mixed results. For graduates of humanities programmes or social sciences, journalism and law programmes, we found that mothers have a higher, not a lower, risk of attaining a further degree in a different field of education than childless women. This finding contradicted our assumption of a generally lower risk of changing after entering motherhood. However, it supported our reasoning that, for women educated in fields in which it is difficult to get established in the labour market, giving birth to a child might be an event that leads them to seek to earn a degree in a field that offers more stable and family-friendly employment prospects. Contrary to our expectations, we found not a weak, but rather an average depressing effect of having children on women's risk of educational change for graduates of natural sciences or art and media programmes. For those with general educational degrees, we even found a strong depressing effect of motherhood on the risk of attaining a further degree in a different field of education (for a possible explanation of the latter finding see footnote 149, p. 193). Given the findings of our first investigation, we therefore conclude that mothers with general educational degrees and mothers with degrees in art and media or natural sciences have a risk of change that is high relative to mothers with other educational backgrounds. Nevertheless, their risk of undergoing a change in educational field is much lower than that of their childless counterparts.

The investigations carried out in this chapter confirmed that childbearing does have an impact on women's educational careers. Unfortunately, the data that we had at our disposal were far from ideal for conducting an investigation of this sort (for a description of the main disadvantages of our data see Chapter 6.3.1). We thought very thoroughly about the ways in which certain aspects of our data might have influenced our results. In particular, we were concerned about the possibility that our finding of high risks of educational change for mothers relative to childless women in fields like humanities or social sciences, journalism and law might result from the fact that we are not able to separate tertiary-level programme students from those who study on a course-by-course basis (for students who take courses in two fields of education, our data might include events, even though no "real" change in education has taken place; for more detailed information see Chapter 6.3.1). Presumably, the proportion of students who pursue course studies at the tertiary level is higher in fields like humanities, social sciences, natural sciences or business and administration than in fields like health care or teaching. As a result, we may have overestimated differences in the risk of educational change between fields of education in our analyses. However, in a comparison of mothers with childless women within one field of education (which is what we have done on the left-hand side of Table 6.11), this issue should be of negligible importance, since within educational fields the bias is the same for all women. Another drawback of our data that probably did influence our results regarding the effect of motherhood on women's risk of educational change within educational fields is that we only have information on the year in which educational degrees were attained, but not on when these educational programmes were started. In our second investigation, we therefore were not able to control for the fact that a degree attained as a mother might result from an educational programme that was initiated long before the child was born (see Chapter 6.4.2, p. 194). In general, it would have been advisable to have modelled the transition into an education in a different educational field, instead of the attainment of a degree. However, individual-level data on the start of educational qualifications usually are only available in survey data.[158] In a study based on survey data, we would probably also encounter fewer problems with educational changes that are not "real" changes. However, the sample sizes of survey data are normally too small to allow us to carry out investigations like the ones presented here.

In addition to the data limitations mentioned above, there are also some methodological aspects that need to be considered. In our analysis, we neglect the possibility that women – who, due to their educational background, face difficulties in finding a stable and family-friendly position in the labour market - might end up in an occupation totally different from the one they were trained for without undergoing any form of re-education. In addition, we do not account for the fact that educational changes that are related to childbearing probably do not exclusively take place after women became mothers. Instead, some women might seek to change their educational

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[158] Statistics Sweden is now also able to provide access to register data on registrations in educational programmes (year and month of registration and type of education registered in). Unfortunately, we only learned about this option after we finished our empirical investigation. We have not yet had the chance to check the suitability of these data, but it might be worth considering this option in future research.

qualifications in anticipation of future childbearing. We are thus well aware of the fact that our analyses only account for a fraction of the educational dynamics that are related to childbearing. However, we view the investigations carried out in this chapter as a very important first step towards gaining a better understanding of the interrelation of fertility transitions and educational trajectories.

CHAPTER 7

The simultaneous impact of unobserved characteristics on educational trajectories and childbearing behaviour

7.1 Introduction

In our discussion of the theoretical linkages between education and fertility, we addressed the possibility that common and usually unobserved factors - such as social class, parental resources, preferences or personal traits - might simultaneously affect women's childbearing behaviour and educational trajectories. We argued that researchers interested in the effects that education and childbearing have on each other should control for spurious factors that simultaneously influence both processes, since they may bias the results (see Chapter 2.4). In this third empirical chapter, we will carry out an analysis to prove the joint determination of women's educational choices and childbearing behaviour. We structured our investigation in the following way. In Section 7.2 we briefly review previous research findings. In addition, we specify the research strategy we have chosen for our empirical analysis and we formulate our working hypothesis. Section 7.3 includes a detailed description of the method used, as well as an overview of the sample selection and the variables included in the analysis. We present the results of our empirical investigation in Section 7.4 and briefly discuss the main findings of this third empirical part in Section 7.5.

7.2 Previous empirical findings and research hypothesis

In recent years, researchers have increasingly paid attention to the interrelation of life course trajectories and to the joint determination of events in multiple life domains due to common (mostly unobserved) determinants. In the area of family and fertility research, quite a number of studies have been carried out on the interrelation of union formation and childbearing (e.g. Brien et al. 1999; Upchurch et al. 2002; Le Goff 2002; Baizán et al. 2003, 2004; Kantorová 2004; Koytcheva 2006).[159] Another prominent area of research has been the interrelation of premarital cohabitation and marital dissolution (e.g. Lillard et al. 1995; Brüderl et al. 1997; Woods and Emery 2002; Svarer 2004; Kulu and Boyle 2010).[160] With respect to women's educational trajectories and events in the childbearing domain, researchers have for decades assumed endogeneity (e.g. Rindfuss et al. 1980; Buchmann 1989: 105; Liefbroer 1999; Kravdal 2001, 2007). However, only since the application of the econometric concept of simultaneous equations to hazard models by Lillard (1993) at the beginning of the 1990s have demographers started to explicitly account for the interrelation of education and fertility in their empirical investigations.

In a study on the determinants of non-marital childbearing in the U.S., Upchurch et al. (2002) modelled the risk of conceiving non-maritally jointly with several other life course processes (progression in school, marriage formation, marriage dissolution, marital fertility). In general, they found that each of the life course processes considered

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[159] Studies on the interrelation of union formation and childbearing have predominantly shown that entering a union and entering parenthood are part of the same family building process, and that individuals who are more likely to experience one of the events are also more prone to go through the other one.

[160] From a theoretical viewpoint, premarital cohabitation is assumed to be associated with a lower risk of marital separation since it enables couples to gather information about their match quality, with only good matches evolving into marriage. However, in the past the majority of empirical studies showed an elevated risk of divorce for couples who cohabited prior to marriage compared to those who married directly (Svarer 2004). A very prominent explanation of this theoretically counter-intuitive finding is self-selection; meaning that those who cohabit prior to marriage more often possess unobserved characteristics that make them more prone to separation, such as less conventional attitudes about marriage, higher expectations about the quality of unions, or worse relationship skills (Kulu and Boyle 2010). In studies that accounted for this self-selection by jointly modelling the risk of premarital cohabitation and the risk of marital separation, the negative effect of premarital cohabitation on marital stability disappeared (e.g. Lillard et al. 1995; Woods and Emery 2002; Steele et al. 2006), or even turned into a positive one (e.g. Brüderl et al. 1997; Svarer 2004; Kulu and Boyle 2010).

directly affects the risk of conceiving outside marriage. In addition, they showed that the life course processes are jointly determined due to unmeasured factors that affect more than one outcome. With respect to education, the study of Upchurch et al. (2002) indicated that there are unobserved characteristics that simultaneously increase women's propensity to have a non-marital conception and reduce their propensity to continue in school.

Panis et al. (1995) focused on the impact of family formation on women's educational progression in the U.S., and found that women who become pregnant while being enrolled in school are considerably less likely to continue in school than women who postpone childbearing until after they have graduated. However, the authors also showed that the negative effect of childbearing on women's likelihood of progressing in school is substantially overestimated if self-selection into childbearing (e.g. due to unobserved preferences regarding education and childbearing, or due to unobserved family background characteristics) is not taken into account.

In a comparative study of 11 Western European countries, Billari and Philipov (2004) estimated simultaneous hazard models for the transition out of education and the transition to a conception ending in a first birth. Their investigation showed that, in the Nordic countries (e.g. Norway, Sweden) and in Southern European countries (e.g. Italy, Spain), becoming a mother while studying has the effect of prolonging education; while in conservative continental countries (e.g. Belgium, France, Germany), becoming a mother speeds up the end of education, and is thus likely to result in a lower level of educational attainment (as is usually found for the U.S. and Great Britain).[161] Billari and Philipov (2004) also looked at the correlation between unobserved factors that simultaneously affect both transitions. For the majority of countries, they found a positive correlation (unobserved factors that speed up the transition to motherhood are related to those that accelerate the exit from school), and the correlation appeared to be stronger in countries with a low level of welfare support for combining motherhood and educational enrolment, and in countries with a low degree of destandardisation of life

[161] According to Billari and Philipov (2004), the finding of a lower hazard of leaving education for mothers than for childless women in the Nordic countries can be attributed to the generous welfare support in these countries, which facilitates the combining of motherhood and education, and enables mothers to postpone finishing their education. For Southern European countries, Billari and Philipov assume that family resources allow young mothers to prolong their educational careers.

course trajectories. By contrast, for the Nordic countries, which exhibit very high levels of welfare support and the highest levels of life course destandardisation, the study showed no correlation or even a negative one (unobserved factors that speed up the transition to motherhood are related to those prolonging educational enrolment).

Using the same method, Martín-García and Baizán (Martín-García and Baizán 2006; Baizán and Martín-García 2007; Martín-García 2009) analysed the joint determination of entering parenthood and leaving the educational system for women and men in Spain, France and West Germany. With respect to women, their studies confirmed the findings of Billari and Philipov (2004). For all three countries, their estimations revealed a significant positive correlation between the unmeasured factors that affect both processes. For men, the authors found a positive correlation for France and West Germany that was, however, weaker than the correlation for women, and they were not able to find any correlation for Spain. In general, the results of these studies imply that men make decisions in the domain of education and fertility more independently of each other than women do.

To sum up, previous research yields strong evidence for an interrelation of women's educational trajectories and women's childbearing behaviour. In addition, several studies have shown that events in both life domains are jointly determined by unobserved factors, i.e. by individual-level characteristics that are not included in the data.[162] So far, studies on the interrelation of education and fertility and on the simultaneous impact of unobserved characteristics on both life domains have exclusively focused on two dimensions of education: educational enrolment (e.g. entry into motherhood and exit from school) and educational level (e.g. childbearing and progression in school). What has been largely neglected in the past is that a woman's childbearing behaviour might also be interrelated with her choices regarding the field in which she is educated. Moreover, also decisions about educational field and fertility might be jointly determined due to unobserved factors.

[162] In the case of educational trajectories and fertility decisions, one may, for example, think of aspects related to the parental family and to the social origin of individuals; or of individual-level characteristics, such as aspirations, expectations and preferences towards children and education (for a detailed discussion see Chapter 2.4).

Our previous empirical chapters already contain some analyses regarding the interrelation of educational field and fertility. Among other things, we have shown that a woman's field of education has a decisive impact on her childbearing behaviour (see CHAPTER 5); and, conversely, that childbearing influences a woman's risk of undergoing a change in educational field (see CHAPTER 6). In the present chapter, we will investigate whether women's childbearing behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics that simultaneously affect both life domains. As we explained in detail in Chapter 2.4, both women's childbearing behaviour and women's choices of educational fields could be related to their social background, to their personal traits and interests, and to their future goals regarding employment and fertility. In Sweden - a country where the participation of women in the labour market (not only by single women, but also by married women and mothers) is socially expected and politically supported - those women with a strong preference for children are probably very likely to choose a field of education that leads to an occupational area in which the degree of compatibility of work and family life is high. Thus, unobserved characteristics, such as individual preferences, might simultaneously affect women's likelihood of having children and women's risk of choosing a specific field of education. To investigate this issue, we estimate a simultaneous hazard model for the transition to a first, second and third child; and for the transition to a degree in a particular field of education. We concentrate on fields of education that primarily prepare students for working with or caring for "others" (people, nature, animals), and that normally lead to occupational sectors with family-friendly working conditions and a low wage penalty for employment interruptions (teacher training, health care and welfare, agriculture, forestry and animal health).[163] With respect to the role of unobserved characteristics in women's choices of educational fields and fertility behaviour, we expect to find the following relationship:

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[163] In our previous investigations, we viewed "teacher training" and "health care and welfare" as fields that primarily prepare students for working with or caring for others, and that have a high probability of leading to an occupational sector with family-friendly working conditions. However, our analyses have shown that graduates with degrees in agriculture, forestry and animal health have rates of continued childbearing that are as high as (or even higher than) those of women educated for teaching, or health care and welfare occupations (see Chapter 5.5.2). We also found that the risk of undergoing a change in educational field after becoming a mother is of a similarly low level for graduates with degrees in all three fields (see Chapter 6.4). We therefore concluded that those who enrol in agriculture, forestry and animal health might have the same interest in caring for others as those who

H7: We assume that women's childbearing behaviour and women's choices of educational fields are jointly determined by unobserved characteristics. We expect to find a significant positive correlation between unobserved factors that affect women's risk of conceiving a first, second or third child; and unobserved factors that affect women's risk of attaining a degree in a field that is directed towards working with or caring for others, and that normally leads to an occupational sector with family-friendly working conditions and a low wage penalty for employment interruptions (teacher training, health care and welfare, agriculture, forestry and animal health).

7.3 Method, sample selection and variables

Discussion of method

To investigate whether women's childbearing behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics, we apply the simultaneous hazard equation approach outlined by Lillard (1993). To capture women's childbearing behaviour, we estimate event history models for the transition to a first, second and third conception with a common woman-specific term for unobserved heterogeneity. The childbearing equations to be estimated can be formalised as:

$$\ln \mu_i^{C1}(t) = y^{C1}(t) + z_k^{C1}(u_{ik} + t) + \sum_n \beta_n^{C1} w_{in}(t) + \varepsilon_i^C$$
$$\ln \mu_i^{C2}(t) = y^{C2}(t) + z_k^{C2}(u_{ik} + t) + v_l^{C2}(u_{il}) + \sum_n \beta_n^{C2} w_{in}(t) + \varepsilon_i^C$$
$$\ln \mu_i^{C3}(t) = y^{C3}(t) + z_k^{C3}(u_{ik} + t) + v_l^{C3}(u_{il}) + \sum_n \beta_n^{C3} w_{in}(t) + \varepsilon_i^C$$

where $\mu_i^{C1}(t)$, $\mu_i^{C2}(t)$ and $\mu_i^{C3}(t)$ denote the hazard of conception of the first, second and third child for individual *i* at process time *t*.[164]

For women's choices of educational fields, we use event history methods to model the transition to a first degree in a field of education that normally leads to an occupational area with family-friendly working conditions (teacher training, health

opt for teacher training or health care and welfare. In addition, graduates with degrees in agriculture, forestry and animal health probably also have good chances of finding a stable and family-friendly position in the labour market. For that reason, we also consider transitions to a degree in "agriculture, forestry and animal health" in our current investigation.

164 The childbearing models used here correspond to the ones described in detail in Chapter 5.3. We therefore do not give further explanations on the equations for the transition to a first, second and third conception.

care/welfare, or agriculture/forestry/animal health).[165] As in our previous investigations, we imputed June as the month for all educational attainments. The equation to be estimated has the following general mathematical form:

$$\ln \mu_i^E(t) = y^E(t) + \sum_n \beta_n^E w_{in}(t) + \varepsilon_i^E$$

where $\mu_i^E(t)$ denotes the hazard of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health for individual *i* at process time *t*. $y^E(t)$ represents a piecewise linear spline (for time since age 16) that captures the impact of the baseline duration on the hazard.[166] The parameter $w_{in}(t)$ symbolises a time-varying variable whose values can change only at discrete times (e.g. municipality type). In our model on educational choices, we censor if the women emigrate, die or do not attain a first degree in teacher training, health care and welfare or agriculture, forestry and animal health until June 2004. In addition, we censor women if there is a period with missing information on educational field. In our educational choice model, we also include a woman-specific term for unobserved heterogeneity. The terms for unobserved heterogeneity in the childbearing model (ε_i^C) and in the educational choice model (ε_i^E) are intended to include all unobserved factors that we believe have an influence on the processes under study, and that are constant during the part of the life course considered here. We assume that the heterogeneity components follow a joint bivariate normal distribution:

$$\begin{pmatrix} \varepsilon_i^C \\ \varepsilon_i^E \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{\varepsilon^C}^2 & \rho_{\varepsilon^C \varepsilon^E} \\ \rho_{\varepsilon^C \varepsilon^E} & \sigma_{\varepsilon^E}^2 \end{pmatrix} \right)$$

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165 We are well aware of the fact that, from a logical point of view, choices of educational fields should be studied in a competing risk model set-up, e.g. the risk of choosing a field of group A (“family-friendly”) vs. the risk of choosing a field of group B (“not family-friendly”). In addition, it should be taken into account that individuals have the opportunity to choose between different fields of education several times during their educational career. In Sweden, for example, individuals can choose a specific field of education for the first time at the upper secondary school level. However, nearly half of all students opt for an upper secondary degree in a general (academically oriented) programme and postpone committing to a specific field of education until the start of post-secondary education. The consideration of all of these aspects would result in a very complex estimation procedure. For the purposes of this analysis, we decided to refrain from taking on this challenge and therefore have chosen the more simplified modelling strategy outlined above.

166 We start to observe women from age 16 onwards since Swedish women normally finish compulsory schooling at that age, and from that point onwards are at risk of choosing a specific field of education.

where $\sigma^2_{\varepsilon^C}$ and $\sigma^2_{\varepsilon^E}$ denote the standard deviations of the person-specific residuals and $\rho_{\varepsilon^C \varepsilon^E}$ is the correlation between the residuals.[167] A non-zero correlation would indicate that there are unobserved factors that simultaneously affect women's childbearing behaviour and women's choices of educational fields, and the sign of the correlation signifies the aggregate effect. A positive sign would indicate that there are unobserved individual-level characteristics in the data that simultaneously increase women's risk of conceiving a first, second and third child and women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health. The model was implemented in aML (Lillard and Panis 2003), and the parameters were obtained using maximum-likelihood estimation. In the final model, we set the number of integration points to 12.

Sample selection for the analyses

To carry out a simultaneous hazard analysis of women's childbearing behaviour and women's choices of educational fields, we use Swedish register data that we described in detail in Chapter 4.2. The samples for the transition to a first, second and third conception correspond to the ones used in our investigation of the impact of education on childbearing in CHAPTER 5 (see Table 5.1, p. 104). We therefore only briefly repeat information about the sample sizes and some important characteristics of the individuals included. In general, the samples used for the analysis of first, second and third conceptions include women born between 1960 and 1985 who are of Swedish origin, and who were domiciled in Sweden at age 16. Due to the restriction of our childbearing models to the period June 1990 to March 2005, we only include those

[167] In our childbearing model, identification is attained through within-person replication (women who contribute to more than one birth transition model). In our educational choice model, we only consider the first transition to a degree in teacher training, health care and welfare or agriculture, forestry and animal health; which means that we do not observe more than one event per individual. Some researchers have argued that, in this situation, the standard deviation of the unobserved heterogeneity component cannot be identified, and therefore recommended fixing it to a certain value (see for example Baizán et al. 2003; Billari and Philipov 2004; Martín-García and Baizán 2006; Baizán and Martín-García 2007). We ran two kinds of simultaneous hazard models: one in which the standard deviation of the educational choice model was allowed to be estimated, and a second in which the standard deviation of the educational choice model was fixed to 1.0. Both models converged, and neither the effects of our covariates nor the estimated correlation between the residuals differed in any meaningful way. What we present in the following are the results from the model in which the standard deviation of the educational choice process was allowed to be estimated.

women who have not already experienced the observed event (e.g. first conception in the first conception model) before June 1990 (for more detailed information see Chapter 5.3). In total, we use a sample of 262,820 female respondents in our analysis of first conceptions, a sample of 141,516 women in the analysis of second conceptions, and a sample of 116,494 women in the analysis of third conceptions.

In our investigation of women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health, we also concentrate on women who are of Swedish origin and who were domiciled in Sweden at age 16. For the analysis of educational choices, we need full educational histories starting at age 16. Since our data only include information on education for the years 1990 to 2004, we concentrate on women aged 16 or younger in 1990 (birth cohorts 1974 to 1985). We therefore excluded women born before 1974 from this analysis. In addition, we omitted a small number of cases for which our data reported the attainment of a degree in teacher training, health care and welfare or agriculture, forestry and animal health before age 16.[168] Since our main interest is in the field in which a woman is educated, we also had to exclude cases for which our data do not contain information on educational field at the start of the process time (age 16).[169] Our final sample for the analysis of women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health consists of 134,618 women. For more details on the sample selection see Table 7.1.

A specific feature of our simultaneous hazard analysis is that the models we estimate are not based on an identical sample. Not all women who contribute to our childbearing models also contribute to our educational choice model (e.g. women born between 1960 and 1973). Similarly, there might be women who are included in our sample for the analysis of educational choices, but excluded from the analysis of women's childbearing behaviour (e.g. women who conceived the first child before age

[168] In Sweden, a degree in one of these fields can be attained in the upper secondary school (from which most students graduate at age 18 or 19) or within the tertiary system.

[169] For some women information on educational field is not available at age 16, but at a higher age. We decided to include in our analysis those women for which information on educational field is available before age 20 (and assume that the year of attainment of that degree corresponds to the year it was registered in the data), but exclude those for whom the field of education is registered for the first time at age 20 or above.

16).[170] To verify that our results, especially the estimated correlation between the residuals, are not affected by this feature, we carried out the same analysis based on an identical sample.[171] This test fully supported our findings, and we therefore see no good reason not to use the already estimated and detailed discussed models on childbearing (see CHAPTER 5) for our simultaneous hazard approach.

Table 7.1: Description of the number of included and excluded cases for the analysis of women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health

Number of individuals in original sample	1,196,749
Number of individuals excluded from the analyses	1,062,131
Number of individuals included in the analyses	134,618
Number of events	36,315
reason for exclusion:	
(1) Sex (male)	612,572
(2) Birth country (not Sweden)	126,234
(3) Individuals were born before 1974	316,050
(4) Individuals were not domiciled in Sweden at age 16 (death/emigration)	5,176
(5) Individuals already attained a degree in teacher training, health care and welfare, or agriculture, forestry and animal health before age 16	18
(6) No information on educational field/ information only available for ages 20+	2,081

Source: Swedish register data

Covariates in the analyses

In the following, we only briefly describe the covariates that are included in our model on women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health. An overview of the composition of the sample for the analysis of educational choices with measures of exposures and

[170] In our models on women's transition to a first, second and third child, we excluded those who started childbearing before age 16.

[171] More precisely, we estimated childbearing models based on the same sample that we use for the analysis of educational choices. Since this is a rather young sample (women born between 1974 and 1985), we only modelled the transition to a first and second conception with a woman-level factor for unobserved heterogeneity. We then estimated the correlation between the residuals of the childbearing process and the educational choice process.

occurrences within the categories of each covariate is given in Appendix D in Table D. 1. A detailed description of the covariates that are included in our childbearing models can be found in Chapter 5.3.

Our data contain only a limited number of variables that are useful in an investigation of women's choices of educational fields. In addition to a woman's age, which serves as the baseline duration in our model, we include a woman's **civil status** as a time-varying categorical variable with the following three categories:

single/cohabiting,
married and
divorced/widowed.[172]

In addition, we control for a woman's **motherhood status** by including a time-varying categorical variable that distinguishes between:

childless,
one child and
two or more children.

We also control for settlement size by including **municipality type** as a time-varying categorical variable. As in our previous investigations, we distinguish between the following three types of municipalities:

Stockholm, Malmö, Gothenburg;
other urban municipalities; and
sparsely populated rural municipalities.

To avoid any bias of our results due to the change in the coding of educational qualifications that took place in the year 2000, we include a time-varying categorical variable for calendar **period** into our model that simply distinguishes between:

the years 1990 to 1999 and 2001 to 2004, and
the year 2000.[173]

[172] Due to the rather young sample, only a very small number of women contribute to the exposure time of widowed women (see Appendix D, Table D. 1). We therefore decided to group widowed women together with those who are divorced.

7.4 Empirical findings

In the following, we present the results of our investigation of the simultaneous impact of unobserved characteristics on women's educational trajectories and women's childbearing behaviour. Before we discuss our findings regarding the correlation of the standard deviation of the unobserved heterogeneity terms, we will briefly describe the results of our analysis of women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health. The results of the analyses of women's risk of conceiving a first, second and third child have been described and discussed in detail in Chapter 5.4 and Chapter 5.5 and therefore will not be shown again.

Women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health

To capture women's choices of educational fields, we estimated an event history model for the transition to a first degree in teacher training, health care and welfare or agriculture, forestry and animal health with a woman-specific term for unobserved heterogeneity. In our analysis, the standard deviation of this unobserved heterogeneity term equals 0.64, and is significantly different from zero (see Table D. 2 in Appendix D). This means that there are unobserved characteristics of the women in the data that affect their risk of attaining a degree in a field that is directed towards working with or caring for others, and that primarily leads to an occupational area with family-friendly working conditions.[174]

We start our presentation of the results of our event history analysis on women's risk of attaining a first degree in teacher training, health care and welfare or agriculture,

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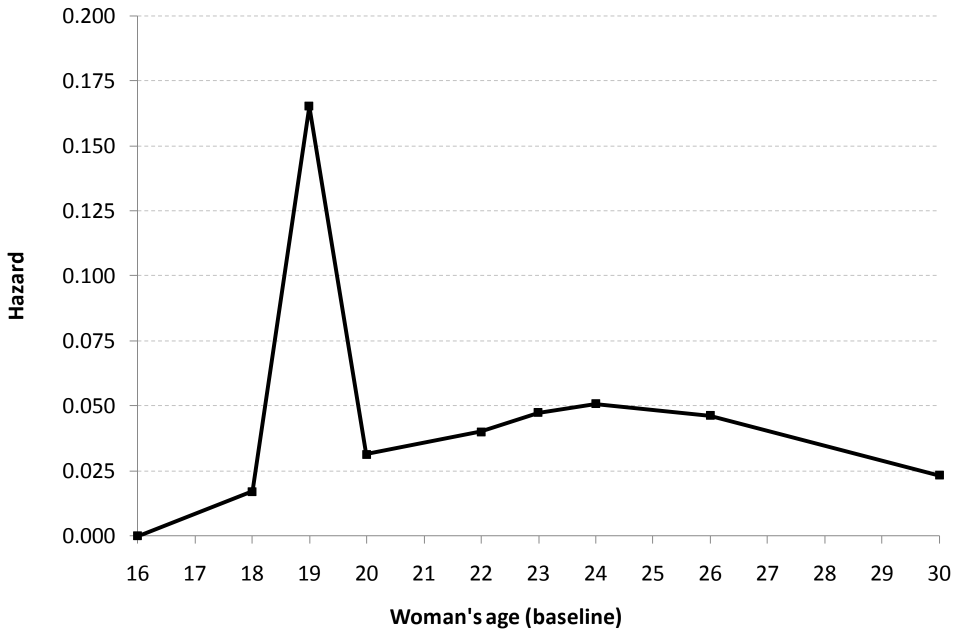
[173] The period variable only serves to control for any bias that might occur due to the change from SUN to SUN 2000. In preliminary analyses, we also included more detailed categories for period to see whether there was a certain pattern in women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health over time. We did not, however, find such a pattern.

[174] Compared to a model that does not include an unobserved heterogeneity term, the model that controls for unobserved heterogeneity yields slightly different results for nearly all variables. However, the effect does not change markedly for any of the variables. We therefore only show the results from the model in which unobserved heterogeneity is controlled for.

forestry and animal health with a description of the effect of the baseline duration, which is *woman's age*.

Figure 7.1: Event history model for women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health - the effect of woman's age (baseline)



Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's civil status, motherhood status, municipality type and period. (2) The full model is included in Appendix D in Table D. 2; separate models for childbearing and education.

The graph plotted in Figure 7.1 shows a very typical pattern of the relationship between age and the attainment of post-compulsory educational qualifications in Sweden.[175] Women's risk of attaining a first degree in one of the fields considered reaches a peak at age 19 (the age when Swedish pupils normally graduate from upper secondary school; in our analysis it is the child and recreation programme, the health care programme or the natural resource use programme) and decreases strongly thereafter. Between ages 20 and 24, women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health increases again, followed by a slight decrease up to age 26, and a more intense decline at higher ages. In general, we can say that women who earn their first degree in teacher training,

[175] Probably we also would have found a very similar age-pattern for other fields of education.

health care and welfare or agriculture, forestry and animal health at the post-secondary level, mostly do so between the ages 22 to 27, which are the typical ages in Sweden for attaining a bachelor's degree, a master's degree or a professional degree.[176]

The effects of the other covariates included in the analysis of women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health are listed in Table 7.2.

Table 7.2: Event history model for women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health - the effect of civil status, motherhood status, municipality type and period

	Relative risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health
Civil status	
Single/cohabiting	1.01
Married	1
Divorced/widowed	0.85
Motherhood status	
Childless	1
One child	0.39
Two or more children	0.33
Municipality type	
Stockholm, Malmö, Gothenburg	0.65
Other urban municipalities	1
Sparsely populated rural municipalities	1.17
Period	
Years 1990-1999 and 2001-2004	1
Year 2000	1.03

Source: Swedish register data, own estimations
Notes: (1) Controlled for woman's age (baseline). (2) Due to the small number of women who contributed to the exposure time, we grouped widowed women together with those who are divorced. For the same reason, we also grouped women with missing information on municipality type together with those who live in Stockholm, Malmö or Gothenburg. (3) Effects with a p-value higher than 0.1 are printed in grey. (4) The full model is included in Appendix D in Table D. 2; separate models for childbearing and education.

[176] Women who attain their first degree in teacher training, health care and welfare or agriculture, forestry and animal health at the post-secondary level must have taken their upper secondary degree in a programme that is not directed towards teaching, health care or nature (e.g. in an academically oriented programme, such as the social science programme or a vocationally oriented programme other than the child and recreation programme, the health care programme or the natural resource use programme).

With respect to women's *civil status*, we do not find any difference in the risk of attaining a first degree in a field that primarily leads to care-oriented and family-friendly occupational areas between single or cohabiting women and married women. Those who are divorced or widowed do show a reduced risk, but this does not necessarily mean that they are more inclined to choose other fields of education. The lowered risk may simply reflect the fact that they are less likely to participate in education and to attain an educational degree.[177]

Moreover, mothers generally participate less often in education than childless women do. As anticipated, our *motherhood status* variable therefore shows a lowered risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health for those who already have children.

Regarding *municipality type*, we observe that the risk of attaining a first degree in a field that is directed towards working with or caring for others, and that primarily leads to family-friendly occupational areas, increases with decreasing population density. Since in Sweden rates of educational participation probably are not likely to be higher in sparsely populated rural municipalities than in metropolitan areas (the relationship might indeed be the opposite), there has to be another explanation for this finding. We can think of two mechanisms that might be at work. First, lower rates of attaining a degree in teacher training, health care and welfare or agriculture, forestry and animal health among women who live in one of Sweden's big cities than among women who live in less dense populated areas might result from the greater range of alternative educational opportunities that women in metropolitan areas have. Second, it might also be the case that the proportion of women with a strong preference for family and children, and, thus, a greater interest in educational programmes that lead to family-friendly occupational areas, is higher in rural areas or small cities than in Stockholm, Malmö or Gothenburg.

The dummy variable for calendar *period*, which we included to control for any bias resulting from the change in the coding of educational qualifications in the year 2000, does not show any interesting pattern.

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[177] The lack of significance of the effect for divorced or widowed women probably results from the fact that, in our model, only a comparatively small number of women contributed to this category.

The simultaneous impact of unobserved characteristics on educational trajectories and childbearing behaviour

The main aim of this third empirical chapter is to investigate whether women's childbearing behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics, such as the parental background or attitudes and preferences towards work and family. We therefore estimate whether there is a correlation between the woman-specific unobserved heterogeneity term that we included in our model on childbearing, and the woman-specific unobserved heterogeneity term that we included in our model on educational choices. The results are presented in Table 7.3.

As expected, we find a significant positive correlation between the unobserved heterogeneity component of our childbearing model and the unobserved heterogeneity component of our educational choice model, with a value of 0.69. This finding indicates that there are unobserved characteristics in the data that simultaneously increase women's risk of conceiving a first, second and third child and women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health. We thus prove that women's childbearing behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics.[178]

Table 7.3: The simultaneous impact of unobserved characteristics on educational trajectories and childbearing behaviour

	Estimate (β)
Standard deviation of the unobserved heterogeneity terms	
ε_i^C - childbearing	0.44
ε_i^E - educational choice	0.83
Correlation of the unobserved heterogeneity terms	0.69

Source: Swedish register data, own estimations
Note: The full model is included in Appendix D in Table D. 2, simultaneous model.

[178] Using the same method, we also estimated a simultaneous hazard equation for women's risk of conceiving a first, second and third child; and women's risk of attaining a first degree in art and media or in humanities. With respect to the unobserved heterogeneity components, we expected to find a significant negative correlation; meaning that there are unobserved characteristics in the data that simultaneously decrease women's risk of childbearing and increase their risk of attaining a degree in humanities or art and media. Our estimation supported this expectation by showing a significant, but weak negative correlation with a value of -0.09 (results not shown).

The joint estimation of women's childbearing behaviour and educational choices did not lead to any substantial change in the effects of the covariates on women's risk of conceiving a first, second and third child; or on women's risk of attaining a first degree in a field that is directed towards working with or caring for others, and that primarily leads to family-friendly occupational areas (see Table D. 2 in Appendix D). Our interpretation of the model estimates might therefore stay unchanged. The only notable difference between separate models for educational choices and childbearing and a joint model for both processes is that the simultaneous hazard approach leads to slightly lower risks of becoming a mother or continuing childbearing for those educated in teacher training, health care and welfare or agriculture, forestry and animal health. To some extent, the observed high risks of childbearing among women educated in these fields, thus, result from a selection of "fertility-prone" women into fields of education that prepare for working with or caring for others, and that lead to stable and family-friendly occupational areas. However, the general pattern of the impact of educational field on transition rates to a first, second and third child remains unchanged, and can thus be attributed to a causal effect of educational field on women's childbearing behaviour.

7.5 Discussion and concluding remarks

CHAPTER 7 was devoted to an empirical investigation of the third dimension of the relationship between education and fertility; namely, the simultaneous impact of unobserved characteristics (e.g. parental background, preferences) on women's childbearing behaviour and educational trajectories. Previous studies related to this topic mainly focused on the joint determination of educational enrolment or educational level and events in the childbearing domain. We, however, concentrated on women's field of education, and investigated whether women's childbearing behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics that simultaneously affect both life domains. We argued that individual characteristics such as the parental background or preferences and personal traits might influence a woman's risk of childbearing, as well as her choice of educational field; and we assumed that unobserved factors that make some women more prone to have children may also increase their risk of choosing an educational field that prepares for working with or caring for others, and leads to an occupational area in which the degree of compatibility of work and family life is high.

To investigate this issue, we carried out a simultaneous hazard analysis of women’s transition to a first, second and third child; and women’s transition to a first degree in a field of education that is directed towards working with or caring for others, and that primarily leads to occupational areas with family-friendly working conditions and a low wage penalty for employment interruptions (teacher training; health care and welfare; agriculture, forestry and animal health). Our investigation revealed that there are unobserved characteristics in the data that simultaneously influence women’s childbearing behaviour and women’s choices of educational fields. We also confirmed that unobserved characteristics that increase a woman’s likelihood of conceiving a first, second and third child are positively related to those that increase her likelihood of attaining a degree in a field that leads to care-oriented and family-friendly occupational areas.

CHAPTER 8

Summary and conclusion

8.1 Introduction

The aim of this study was to investigate the dynamic interrelations between education and childbearing, two life domains that are of special importance to women as they have strong and lasting effects on the roles women occupy over the course of their lives. In the past, women's education has often been treated as an exogenous factor which influences women's decisions about whether and when to become a mother, and the ultimate number of children they have. However, we argued that, from a theoretical point of view, women's education should not be seen as exogenous to fertility choices. Instead, research should take into account the possibility that childbearing might also lead to changes in a woman's educational career, and that decisions about education and fertility might be correlated due to common determinants that simultaneously affect the two life domains. In the course of this study, we systematically discussed and analysed all three aspects of the link between a woman's educational trajectory and her childbearing behaviour. With respect to the educational domain, we asserted that, in addition to educational enrolment and educational level, there is a further dimension of education – namely, educational field - that has to be taken into account to fully understand the complex interplay between women's educational careers and fertility.

The study was divided into two major parts. In the first part (CHAPTER 2 and CHAPTER 3), we elaborated the theoretical concepts that are available to explain the impact of education on women's childbearing behaviour. In addition, we discussed mechanisms through which childbearing might influence women's educational careers, and we outlined factors that potentially affect educational trajectories and fertility transitions of women simultaneously. We also pointed out that understanding the relationship between women's education and fertility requires a careful consideration of the institutional context within which women live and make decisions related to childbearing and education. The second part (CHAPTER 5 to CHAPTER 7) was devoted to an empirical investigation of the three different aspects of the link between women's education and childbearing in Sweden. The estimations were done by means of event history methods, using longitudinal Swedish register data for the years 1990 to 2004. In addition to conventional event history methods, we also made use of more advanced techniques, such as the simultaneous hazard equation approach with potentially correlated unobserved heterogeneity.

The purpose of the present chapter is to summarise key findings for each aspect of the link between education and fertility and to link the empirical findings to the theoretical discussion. In addition, some critical aspects of the research design, as well as opportunities for future research will be discussed.

8.2 The impact of education on women's childbearing behaviour

In the past decades, all Western societies have witnessed marked improvements in women's educational qualifications, a strong postponement of the entry into motherhood and a general decline in overall fertility levels. Due to the simultaneity in the change in women's educational patterns and women's childbearing behaviour, there has been extensive interest in explaining how women's education influences childbearing. In the theoretical part of this thesis, we reviewed two classical theoretical approaches often used in studies on the impact of women's education on fertility; namely, the notion of social-structural or cultural changes (Chapter 2.2.3) and the standard economic view (Chapter 2.2.1). We also briefly outlined arguments raised in economic theories of fertility timing (Chapter 2.2.2), discussed aspects that become apparent when educational careers and childbearing are viewed from the life course perspective (Chapter 2.2.4), and looked at several alternative explanations for the impact of women's education on fertility that have been put forward in recent years (Chapter 2.2.5). In addition, we emphasised that decisions about education and childbearing, as well as the impact of one life domain on the other, might be shaped by institutional factors, such as the configuration of the welfare state (Chapter 3.2), the structure of the educational system (Chapter 3.3) or the link between education and the labour market (Chapter 3.4). In the following, we briefly summarise those theoretical arguments and institutional factors we found to be relevant in explaining the impact of educational enrolment, educational level and educational field on women's childbearing behaviour in a modern Western welfare state, such as that of Sweden. For all three educational dimensions, we also highlight the most important empirical findings that we observed in our investigation of the multi-dimensional impact of women's education on first, second and third conception risks in Sweden (Chapters 5.4, 5.5 and 5.6).

Educational enrolment

In seeking to explain the effect of educational enrolment on fertility, it is useful to view individual lives from the *life course perspective*, which emphasises that individual behaviour is not just influenced by biographical and historical time, but also by social time; i.e. by age-graded institutions, or by age-related norms on the proper timing and sequencing of events (Elder 1994; Dykstra and van Wissen 1999). We pointed out that, in most societies, enrolment in education and childrearing is regarded as incompatible, either for practical reasons (monetary constraints, time constraints) or because of normative expectations that students should not become parents before they have finished their education. We also noted that the Swedish parental leave system, in which parental benefits are dependent on the individual's prior earnings, provides additional incentives for postponing childbearing until education has been completed and a period of successful labour market participation has been absolved. We therefore expected to find that educational enrolment is connected to lower risks of childbearing in Sweden.

Our empirical investigations supported this assumption by showing that Swedish women who are enrolled in education have lower first, second and third conception risks than women who are currently not enrolled. Educational enrolment was found to impede childbearing most strongly among childless women, and to a much lesser extent among those who already had one or two children. In an effort to explain this finding, we proposed that mothers who participate in education might already have defied social norms on the proper sequencing of education and childbearing, which indicates that they do not care that much about meeting social expectations. Continuing childbearing while being in education might also be motivated by the desire to have children who are close in age. Another explanation for a weaker negative effect of educational enrolment on further childbearing might be that mothers already have gained experience with having a child while participating in education and might have found an effective way to handle this situation. We also considered the possibility that women with children who participate in education often do so at a higher level, where the negative effect of enrolment in education on childbearing has been found to be less strong.

Educational level

Studies dealing with the impact of women's level of education on the risk of childbearing quite often use the *economic theory*, or the notion of *social-structural or cultural changes* (second demographic transition), as their theoretical baseline. Both frameworks predict lower levels of fertility for highly educated women. According to economists (e.g. Schultz 1969; Becker 1993: 145-154), this can be attributed to higher opportunity costs of childbearing and higher direct costs of having children for highly educated women, whereas proponents of the second demographic transition (e.g. Lesthaeghe 1983, 1995; van de Kaa 1987, 1994, 2002) view low fertility levels among highly educated women as a consequence of their greater range of possible lifestyles and opportunities, and their stronger desire for independence and personal fulfilment. However, we pointed out that in quite a number of studies (especially for Northern and Western European countries), the effect of educational level on transition rates to a second or third child (and sometimes even on the risk of entering motherhood) has been estimated to be positive (e.g. Lappegård and Rønsen 2005; Kravdal 2007; Gerster et al. 2007; Kreyenfeld and Konietzka 2008). These findings challenge both theoretical frameworks as convincing and universally valid explanations for the role of female education in fertility decisions in contemporary societies. We described a number of different explanations that have been proposed to explain the paradoxical research findings, such as, for example, that the observed positive relationship between educational level and continued childbearing might be the result of a *time-squeeze effect*, a *partner effect* and/or a *selection effect*. We noted that these effects have attracted a lot of attention in recent years, but that empirical investigations have so far been unable to confirm them conclusively.

We also discussed whether existing theoretical frameworks provide explanations for the effect of women's level of education on the timing of becoming a mother. Based on *life course perspective*, which stresses the incompatibility of educational enrolment and childbearing, we argued that highly educated women are probably older when they enter motherhood due to the longer time they have spent in the educational system. Once their education is finished, highly educated women might become mothers faster than their less educated counterparts due to their advanced age, and their awareness that they have a relatively short amount of time left to have their desired number of children. However, we also pointed out that highly educated women are often assumed to have a special interest in turning their significant investments in education into a successful career before starting a family, which would suggest that the average period of time between finishing education and entering motherhood would be longer for those with high levels of education. By reviewing arguments related to *economic theories of fertility timing* (presented, for example, in Mincer and Polachek 1974, 1978; Happel et al. 1984; Cigno and Ermisch 1989; Hotz et al. 1997; Gustafsson 2001), we tried to find an answer to the question of whether postponing births is more or less economically advantageous for women with higher qualification levels than for women with lower qualification levels. We concluded that economic theories of fertility timing do not provide a clear answer to this question. These theories predict, for example, that postponement is advantageous if the parental leave period is long, if rates of human capital investment decrease with increasing age, and/or if there are high rates of skill depreciation during the absence (but no complete skill loss). Given that highly educated women tend to take shorter periods of leave, but often experience more pronounced shifts from high rates of human capital investment at young ages to low rates at higher ages, as well as higher rates of skill depreciation during their absences from work, we determined that the answer to the question of which educational group benefits the most from the postponement of motherhood basically depends on how much the duration of parental leave varies relative to the profile of human capital investments and the rate of skill depreciation during absences from work. We argued that, in Sweden, the parental leave system, together with strong norms about how small children should be cared for, probably diminishes differences in the length of the parental leave taken by women with different levels of education. Against this background, we concluded that, in Sweden, highly educated women should have stronger economic incentives to postpone childbearing than less educated women.

Our empirical analyses of the impact of women's level of education on childbearing in Sweden supported this view by showing a strong postponing effect of educational level on women's risk of entering motherhood.[179] We found that, although highly educated Swedish women tend to become mothers at higher ages, they are not less likely to have a first child. In fact, we found a u-shaped relationship between women's level of education and the transition to a first child, caused by a negative effect of educational level on the risk of conceiving a first child for women in their teens and early twenties, and a positive effect for women aged 30 or older. Regarding the risk of conceiving a second or third child, we found a positive effect of educational level, and thus confirmed previous research findings for the Nordic countries. Further investigations have shown that, in the case of Sweden, elevated risks of continuing childbearing among highly educated women cannot be explained by a time-squeeze effect or by a selection effect. In addition, we argued that, in Sweden, high second and third birth intensities among the highly educated do not appear to be attributable to a partner effect. To understand the positive relationship between educational level and higher order childbearing in Sweden, we advised to consider the possibility that, in some welfare states, the economic opportunity cost argument might no longer hold. In line with Kravdal (2007), we argued that, in countries where the institutional and cultural background strongly supports the compatibility of female employment and childrearing, as is the case in Sweden, the *sum of opportunity costs might be*

[179] Unfortunately, we were not able to investigate whether the postponement of childbearing to higher ages among highly educated Swedish women results only from their longer stay in the educational system, or also from a longer period of time spent on getting established in a stable career track. To disentangle this issue it would have been necessary to look at the risk of entering motherhood by educational level and time since finishing education. However, we only have yearly information on educational qualifications, and our data on educational enrolment are also not as precise as we would have liked. We therefore refrained from including time since finishing education into our analysis of the effect of education on women's risk of conceiving a first child.

independent of education, or even smallest for the better educated, since they are more likely to have flexible jobs that make it easier to combine motherhood and employment. We explained that, even if opportunity costs are still higher for highly educated women, the effect probably is small, and might be outweighed by a higher income, which the highly educated presumably no longer solely use to spend more on each child, but also to have as many children as they desire (while less educated women have to come to terms with the number of children they can afford). In addition, highly educated women may view having more than the average number of children as a chance to distinguish themselves from others, and to show that they are able to manage both a successful career and a large family.

Educational field

Theories used to explain the impact of educational level or educational enrolment on women's childbearing behaviour turned out to be of little help when it comes to establishing the link between educational field and fertility. In order to understand differences in the childbearing behaviour of women educated in different fields of education, *arguments of preference theorists* (e.g. Hakim 2000: 157-192; 2003) and *institutional aspects* have to be taken into account. We compiled and structured the arguments made by other scientists (e.g. Hoem et al. 2006a; Martín-García and Baizán 2006), and determined that explanations of the link between a woman's type of education and her fertility behaviour are basically of three kinds. First, women are assumed to be heterogeneous in terms of preferences and priorities regarding work lifestyles and family models. Women's choices regarding their field of education can thus be seen as an indicator of their preferences or orientations concerning future roles. For example, women who are interested in social relationships and in people are probably more likely to opt for education in a field in which they can work closely with people, such as teaching, health care or social work. At the same time, they might also be more inclined to have children than women who are less interested in personal relationships and in people. In addition, those with favourable values and attitudes towards family and fertility are probably also more likely to invest in fields of study that will make it easier for them to fulfil simultaneously their desire for gainful employment and motherhood. Since female-dominated sectors often offer a more family-friendly work environment, it is likely that women with strong preferences for children tend to choose educational programmes that primarily lead to female-dominated occupations. Second, enrolment in different fields of education is supposed to be accompanied by different socialisation effects, which may in turn influence attitudes towards childbearing. A female-dominated educational environment provides young girls with more opportunities to socialise with other girls. They have better options for “doing gender”, and may thus be more likely to develop a life plan that includes marriage and motherhood than girls who are enrolled in a male-dominated educational field. And third, the choice of an educational field is assumed to influence women’s fertility behaviour through the link between education and the labour market. By choosing a particular type of education, women largely determine their future labour market options (e.g. how easy it becomes to find a suitable position, job stability and income opportunities), the conditions of their employment (e.g. the options for combining family life and labour market activities) and the consequences that a work interruption due to childbirth will have for their future labour market career (e.g. earnings loss, skill depreciation). All these aspects are very likely to have a significant influence on women’s decisions about whether and when to have children.

Having considered these arguments, we expected to find that women educated in different fields of education exhibit different transition rates to a first, second and third child. Our analyses supported this assumption by showing that, in Sweden, educational field strongly affects the risk of entering motherhood and the transition to a third child. Also second conception risks differed among graduates from different types of education, but the effects were found to be much less pronounced. We attributed this to the fact that the two-child norm is well established in Sweden, which probably reduces field-specific differences in second conception risks. In line with our expectations, the risk of childbearing turned out to be high among women educated in fields in which the main characteristic is working with or caring for others, that are clearly female-dominated and/or that are marked by a tight link between education and the labour market (health care and welfare; teacher training; agriculture, forestry and animal health).[180] Contrary to our expectations, we did not observe particularly low fertility rates among women with degrees in fields that are clearly male-dominated, such as engineering and construction. This finding might indicate that, in Sweden today, male-dominated occupational areas do not differ greatly from more gender-equal occupational areas in terms of work norms and the availability and acceptance of family-friendly work arrangements. Another explanation could be that those who have chosen (and managed) to receive a degree in a clearly male-dominated field of study are more inclined and/or more able to convince their partners to take on their fair share of the child care. In addition, a predominance of men during education and in the workplace might increase women's probability of having children, as it provides them with numerous opportunities to meet a suitable partner. However, it is also possible that women who are educated for jobs in clearly male-dominated occupational areas actually work in certain sub-areas that are more gender-equal, or even in occupational areas totally different from the ones for which they were educated. Our assumption of low risks of childbearing among women with qualifications in fields that do not lead to a reliable employment career (art and media) or that lack an obvious set of occupations (general education, humanities) has only been proven for the transition to a first and second child. With respect to the risk of having a third child, these women were found to have an average risk, or even one of the highest risks. As an explanation of the surprisingly average to high third birth intensities among women with general educational qualifications, or a degree in art and media or humanities, we proposed that the women who graduated from one of these programmes and had already had two children might be among the "lucky ones" who managed to establish themselves in the labour market, despite their unfavourable educational background. We also believe it is possible that these women found partners who serve as good providers, and who compensate for their own insecure employment opportunities. As for educational level, we did not find that the observed relationship between educational field and higher order childbearing can be explicitly attributed to a selection effect.[181]

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[180] For women educated as teachers, we observed a high risk of entering motherhood, but only average transition rates to a second and third child. Unfortunately, we were not able to explain why graduates of teacher training programmes did not also show a high probability of continuing childbearing.

[181] For more details regarding our assumption that selection effects might play a role in the observed relationship between educational field and higher order childbearing see Chapter 5.6.

8.3 The impact of childbearing on women’s educational trajectories

Research on the interrelation between education and childbearing typically seeks to explore how a woman’s education affects her childbearing behaviour. Less attention has been paid to the possibility that it is not just the education of a woman that influences her childbearing behaviour; but that, conversely, the birth of a child might also lead to changes in a woman’s educational career. We noticed that previous studies on the impact of fertility on women’s educational outcomes had mainly focused on the effect of (early) childbearing on the level of education a woman attains (e.g. Waite and Moore 1978; Marini 1984; Klepinger et al. 1995, 1999; McElroy 1996; Hofferth et al. 2001; Berthoud and Robson 2001). A general conclusion drawn in these studies is that becoming a mother is detrimental to young women, as they often drop out of school early, rarely return to school later in life, and therefore usually end up with less education than those who stay childless or postpone motherhood to higher ages. We outlined several explanations for the negative impact of early childbearing on a woman’s level of education, such as the incompatibility of the student role and motherhood duties for structural or normative reasons, or a selection of women with low educational ambitions into early motherhood (see Chapter 2.3).

Supported by studies of Hoem (1995b) Henz (1999) and Kravdal (2007), we pointed out that low re-entry rates into the educational system among those who started childbearing early do not necessarily indicate that women in general do not experience changes in education after becoming mothers. In CHAPTER 3, we highlighted some institutional aspects (e.g. generous policies towards families with children, a high degree of flexibility of the educational system, a general acceptance of shifts in educational and/or occupational careers) as important conditions that allow women to adjust their educational background to changes in their needs and interests and to developments in their family life. In our review of the institutional context of Sweden, we have shown that the Swedish welfare state strongly promotes women’s participation in the labour market (regardless of their marital or motherhood status), provides comprehensive support to families with children (e.g. extensive public childcare, a generous and highly flexible parental leave system) and actively encourages the process of lifelong learning (e.g. a flexible educational system with few dead ends, a strong tradition of adult education, the right to take educational leave with a guaranteed return to previous employment, no tuition fees in all public institutions, and financial support of students regardless of the economic circumstances of the student's parents or spouse). We therefore concluded that the institutional context of Sweden supports women who want to pursue further training or retraining after becoming a mother.

Unlike the majority of previous studies, our empirical investigation of the impact of childbearing on women's educational trajectories did not focus on the effect of (early) motherhood on the level of education a woman attains. Instead, we analysed how childbearing influences a woman's risk of undergoing a change in educational field. In particular, we were interested in the question of whether the field of education a woman initially was trained in plays a major role in her decision to pursue a further degree in a different field after becoming a mother. We pointed out that different fields of education generate differences in labour market conditions and, thus different incentives to return to the educational system. We argued that motherhood probably increases a woman's desire for a secure, stable and family-friendly position in the labour market; and that, therefore, a mother whose educational background is not likely to lead to such a position should have an especially high risk of re-entering education.

Our analyses (presented in Chapter 6.3 and Chapter 6.4) have shown that, in Sweden, the effect of motherhood on women's risk of pursuing further training in a different field of education varies strongly depending on the field in which women were initially trained. For most types of education, we observed a lower probability of change for mothers than for childless women. Especially among women with qualifications in fields that primarily lead to female-dominated occupational areas with stable and family-friendly employment prospects (teacher training, health care and welfare), being a mother was found to be connected to a significantly lower risk of educational change. Contrary to our expectations, we did not find a high risk of pursuing further training in a different field of education for mothers educated in engineering and construction, a field that has a high propensity to lead to a clearly male-dominated occupational sector. In addition, our assumption of a high risk of educational change for mothers educated in fields that lack an obvious set of occupations, or that do not tend to lead to reliable employment careers, has only been proven partly by our research results. Mothers with a degree in humanities, for example, were found to have a very high risk of pursuing further training in a different field of education, both in comparison to mothers with other educational backgrounds, and even in comparison to childless women educated in humanities. This finding supported our reasoning that, for women educated in fields in which it is difficult to get established in the labour market, giving birth to a child might be an event that leads them to pursue further training in a field that offers more stable and family-friendly employment prospects. However, our results have not been as clear for all educational fields with poor or unstable employment prospects. For mothers with general educational qualifications or a degree in art and media, for example, we observed a risk of change that was high in comparison to that of mothers with other educational backgrounds, but which was nevertheless much lower than the risk of their childless counterparts.

8.4 The joint determination of educational trajectories and childbearing decisions due to unobserved factors

Research that seeks to understand the interplay between two life domains has to take into account that, in addition to the mutual impact of events experienced in one life domain on events related to the other life domain, there might also be a correlation in the events due to common factors that simultaneously affect both life domains. In our discussion of the theoretical linkages between education and fertility, we outlined aspects related to the parental family and to the social origin of individuals, as well as individual-level characteristics - such as aspirations, expectations and preferences towards children and education - as factors that might simultaneously affect the fertility transitions and educational trajectories of women (Chapter 2.4). We pointed out that data used for demographic analysis often provide no or only insufficient information regarding these factors, and stressed that it is important to control for unobserved factors, since they might lead to biased estimates of the impact of education and childbearing on each other.

In Chapter 4.1, we introduced the simultaneous equation approach developed by Lillard (Lillard 1993; Lillard and Panis 2003) as a common procedure that enables scientists to control for unmeasured factors, which simultaneously influence two or more processes under study. By reviewing previous research on the interrelation of education and fertility, we found strong evidence for a joint determination of events in both life domains (Chapter 7.2). However, we noticed that empirical studies have so far focused exclusively on the joint determination of educational enrolment or educational level and childbearing (e.g. Upchurch et al. 2002; Billari and Philipov 2004; Martín-García and Baizán 2006). We argued that unobserved characteristics, such as the parental background or individual preferences and personal traits, probably also simultaneously affect women's fertility behaviour and women's choices of educational fields.

To investigate empirically whether women's childbearing behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics, we estimated a simultaneous hazard equation model for women's transition to a first, second and third child; and women's transition to a first degree in a field that is directed towards working with or caring for others, and that primarily leads to occupational areas in which the degree of compatibility of work and family life is high (teacher training; health care and welfare; agriculture, forestry and animal health). Our investigation revealed that there are unobserved characteristics in the data that simultaneously increase women's risk of childbearing and women's risk of attaining a degree in teacher training, health care and welfare or agriculture, forestry and animal health (see Chapter 7.4). Thus, we demonstrated that women's fertility behaviour and women's choices of educational fields are jointly determined due to unobserved characteristics, which we believe are most probably individual preferences, personal traits and factors related to a woman's parental or social background.

8.5 Major research contributions, critical reflection and future research perspectives

In this study, we very thoroughly investigated the complex relationships between the educational trajectories and the fertility transitions of women. We carefully discussed and analysed how educational enrolment and educational level influence women's childbearing behaviour. We also explained through which mechanisms becoming a mother might affect women's enrolment in education and educational level, and we pointed out that women's decisions about educational enrolment or educational level and childbearing might be correlated due to common and usually unobserved factors (e.g. preferences, social background) that simultaneously affect both life domains. However, the main contribution of the present study concerns the inclusion of educational field as a further dimension of education in the investigation of all three aspects of the interplay between women's educational careers and fertility.

We do not claim to be the first researcher who considered the type of education as an important predictor of women's fertility behaviour. However, to our knowledge, no other study has looked into the impact of educational field on women's childbearing behaviour as systematically and in as much detail as we have. From a theoretical point of view, this study contributes to previous research on the impact of educational field on fertility by providing a comprehensive overview of the mechanisms through which a woman's field of education might be linked to her childbearing behaviour. With respect to empirical findings, we extend previous studies by demonstrating that field-specific differences in fertility behaviour not only exist for the risk of entering motherhood, but also for the risk of continued childbearing.[182] Regarding the impact of childbearing on women's educational careers, this study is the first that emphasises that becoming a mother might not only have consequences for a woman's participation in education and educational level, but might also induce changes in the field a woman is trained in. We argued that becoming a mother might lead women to return to the educational system in

[182] Previous empirical studies on the link between educational field and fertility have mainly focused on how a woman's type of education is related to the risk of entering motherhood (Lappegård and Rønsen 2005; Martín-García and Baizán 2006), or to the probability of motherhood postponement (Van Bavel 2010). There are also two studies that addressed the impact of educational field on higher order fertility (Martín-García 2006; Stanfors 2009). However, while in the first study a much too broad categorisation of educational fields was used, probably due to small sample sizes (see footnote 62, p. 96); the second study only concentrated on a very specific part of the population (PhDs, lawyers, medical doctors). In addition, two studies of Hoem et al. (2006a, 2006b) provided detailed insights into the relationship between educational field and fertility (childlessness and ultimate fertility). However, these studies concentrated only on the final outcome of the childbearing process and its relationship to women's final educational attainment. The authors themselves admitted that they were thus only able to discern a pale reflection of the dynamics that constitute the connection between education and childbearing, and that an event history method would have been a much more suitable technique (Hoem et al. 2006a: 375). For a detailed review of previous research regarding the impact of educational field on fertility see Chapter 5.2.

order to adapt their educational background to changes in the demands of their family life, and we provided a first example of how these dynamics can be studied empirically. In addition, this study enriches previous research on the correlation of events in the educational domain and in the fertility domain by showing that unobserved factors (e.g. preferences, social background) also simultaneously affect women’s childbearing behaviour and choices of educational fields. To sum up, by focusing on a woman’s field of education - as a factor that influences childbearing, that is influenced by childbearing, and that is jointly determined together with childbearing due to common and often unobserved determinants - this study provides new and valuable insights into the complex interplay between women’s educational careers and fertility.

However, the research design of our investigations is not perfect. We had to deal with data limitations and methodological problems that restricted our empirical studies, and weakened the explanatory power of some of our analyses. We will briefly address these issues now as they also suggest interesting and important opportunities for future research.

In our investigation of the multidimensional impact of women’s education on fertility in Sweden (Chapters 5.4, 5.5 and 5.6), we very thoroughly investigated how women’s educational level and educational field influence the risk of entering motherhood and the risk of higher order childbearing. However, with respect to the effect of educational enrolment on fertility, we have drawn only a very general picture. We would have liked to have analysed the effect of different kinds of educational enrolment on childbearing (e.g. enrolment at different levels/in different fields), but refrained from doing so, as our data do not contain very exact information on educational enrolment (for more information see Chapter 5.3). For the same reason, we also did not control for time since finishing education in our analyses of women’s childbearing behaviour, although this factor certainly is an important determinant of women’s risk of entering motherhood.[183] A further drawback of our data has been that

[183] In particular, we would have liked to have investigated whether there are differences in the effect of time since finishing education on the risk of becoming a mother for women with different levels and fields of education. This would have provided answers to the question of whether women with high levels of education and women with certain educational backgrounds (e.g. a degree in humanities) are more likely than others to postpone childbearing, including after they have finished their education, in order to become established on the labour market.

they only include information regarding he time when individuals attained a degree, but no information on when these educational programmes were started. This lack of information in particular turned out to be a problem in our investigation of the effect of motherhood on women's risk of undergoing a change in educational field (Chapter 6.4), as we were not able to control for the possibility that a degree attained as a mother might have resulted from the completion of an educational programme that was initiated long before the child was born. For that reason, our results regarding field-specific differences in women's risk of educational change after becoming a mother have to be viewed with caution. We hope that future research, on the basis of more suitable data, will provide more reliable estimates of the effect of childbearing on women's risk of pursuing further training in a different field of education.

A task for the future is also to disentangle more clearly the mechanisms that are responsible for field-specific differences in fertility. In this study, we outlined three explanations for the impact of educational field on women's childbearing behaviour.[184] However, our investigations of the impact of educational field on first, second and third birth risks in Sweden (Chapters 5.4, 5.5 and 5.6) did not allow us to clearly separate out these mechanisms. Thus, we are not able to draw conclusions regarding the question of whether all three or just one of the described mechanisms are at work. Our simultaneous equation analysis of educational choices and childbearing (Chapter 7.4) did provide support for the assumption that women's choices of educational fields and women's behaviour in the fertility domain are jointly determined by personal traits, interests and preferences. By concentrating on the following three areas of research, future studies will probably contribute to an even better understanding of how educational field is related to childbearing.

First, future research on educational field and fertility should be extended to men. In general, analysing fertility from a male perspective has received relatively little attention in the past. However, as was pointed out by Martín-García (2009), understanding the determinants of male fertility is an important and interesting research

[184] The explanations are: (1) women's choices of educational fields are influenced by their personal traits, interests and preferences, which also affect their fertility behaviour; (2) enrolment in different fields involves different socialisation effects, which in turn may influence childbearing attitudes; and (3) women's choices of educational fields influence their fertility behaviour through the link between education and the labour market (for a more detailed description see p. 229).

challenge in its own right. In societies in which the proportion of women in the labour market is high, men increasingly want and are expected to actively participate in family life, and to share tasks related to the household and children (providing an income is important, but not enough anymore). The extent to which men are able to meet these demands probably depends on their situation in the labour market, and thus on their educational background. Also for men the field of education might therefore be an important determinant of their childbearing behaviour. Estimating models for the impact of educational field on fertility for men might also be a way to test whether field-specific differences in women's fertility behaviour really can be attributed to socialisation effects. If a high risk of childbearing among women educated in clearly female-dominated fields of study indeed results from their higher probability of meeting others with positive attitudes towards children, their greater opportunities to exchange views about children, and thus their higher chances of developing a life course ideal that includes marriage and parenthood; then men educated in clearly female-dominated fields may also exhibit high risks of fertility.[185]

Second, future studies on educational field and fertility should more directly account for an individual's position in the labour market. By including meaningful labour market characteristics in investigations of the impact of educational field on fertility, future research might be able to show more clearly to what extent field-specific

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[185] However, future research on men needs to discuss whether socialisation into parenthood really can be assumed to work in the same way for men as for women. In addition, research on men has to take into account that in many countries female-dominated fields of education often lead to occupational areas with comparatively low wages (especially at low to medium levels of education). As economic resources (e.g. a high income, a high level of education as an indicator for a high earning potential) have been found to be positively related to men's fertility levels (e.g. Heckman and Walker 1990; Kravdal 2007), a finding of only medium or even low fertility rates among men who were educated in clearly female-dominated fields of education, does not necessarily mean that there is no socialisation effect for men (and, given that socialisation is assumed to work equally for men and women, also no socialisation effect for women). It simply might be the case that, among men, the socialisation effects are balanced out by the comparatively low wage structure in female-dominated sectors. A first study on field-specific differences in fertility among men has been carried out by Martín-García (2009). The author showed that Spanish men educated in fields related to care and/or interpersonal skills (e.g. teacher training, health care, arts, humanities) have a much lower risk of entering fatherhood than men with other educational backgrounds, a result that is in sharp contrast to the effects found for Spanish women (Martín-García and Baizán 2006). However, as has been noted before (see footnote 62, p. 96) both studies used a very broad categorisation of educational fields, and the reported findings might be a mixture of quite different mechanisms at work (e.g. low first birth risks among men educated in humanities or art as a result of their difficult situation in the labour market, high first birth risks among men educated in teacher training or health care due to their "socialisation into fatherhood" by a female-dominated environment).

differences in fertility among women (and, of course, also among men) can be attributed to certain aspects of the link between an individual's field of education and her situation in the labour market. If low risks of childbearing among women with degrees in certain fields of education really result from their greater difficulties in getting established in the labour market, or from the fact that they have fewer options to combine family duties with gainful employment, the observed effects of educational field on the risk of childbearing should disappear, or at least diminish once labour market characteristics are controlled for. In this context, it certainly is not sufficient to simply include a variable for an individual's employment status. Instead, very specific indicators need to be considered that efficiently capture various aspects of an individual's employment situation that might be important for her childbearing behaviour (e.g. employed in the public sector vs. employed in the private sector, employed full-time vs. employed part-time, having a temporary work contract vs. having an unlimited work contract, having a job that corresponds to an individual's level/field of education vs. having a job that does not correspond to an individual's level/field of education and the time elapsed between graduation and getting the first job).

Third, future research should investigate the relationship between educational field and fertility for other countries as well, and carry out comparisons across countries. In this study we focused on Sweden, a country whose institutional background strongly supports the compatibility of female productive and reproductive work, and thus reduces differences in the opportunity costs of childbearing among women with different educational backgrounds. Nevertheless, we observed strong variations in the fertility behaviour of women educated in different fields. It would be interesting to see whether educational field is an equally strong predictor for women's childbearing behaviour in countries in which the institutional context provides women with less favourable opportunities to combine gainful employment and family life.[186] Country comparisons could also be used to investigate whether the interrelation of women's choices of educational fields and women's childbearing behaviour due to unobserved factors (preferences, social background) that we observed for Sweden depends on the context in which women live and make decisions about education and fertility. To be able to carry out such analyses, researchers need further data sets that include detailed information on the educational field of individuals, and that are comparable across countries.[187]

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[186] When comparing the effect of educational field on women's childbearing behaviour across countries, there are two questions that one should look at. First, are there differences in the patterns observed; i.e. do women with degrees in a certain field of education show a low/high risk of childbearing in one country, but not in the other one? In general, we would expect to find for other countries as well a pattern that is similar to the one we observed for Sweden. However, there might also be some country-specific differences in the effect of certain educational fields on fertility. For example, in Sweden we did not observe a particularly low risk of childbearing for women educated in fields that lead to clearly male-dominated fields of occupation. One (out of several) explanations that we offered for this finding was that, in Sweden, male-dominated fields of occupation might not differ that much from more gender-equal occupational areas in terms of work norms and the availability and acceptance of family friendly work arrangements. This certainly is not the case in all countries. Having earned a degree in a male-dominated field might therefore be related to a low risk of childbearing for women in other countries, while we observed average transition rates for Swedish women with these educational backgrounds. In addition, country comparisons should investigate whether there are differences in the extent to which the field of education affects women's risk of childbearing; i.e. whether, at a given level of education, field-specific differences in fertility behaviour are more pronounced in some countries than in others.

[187] Data currently collected within the Generations and Gender Programme (GGP) might meet these demands. The GGP is a system of national Generations and Gender Surveys (GGS) and contextual databases covering European and some non-European countries (for a detailed description see Vikat et al. 2007). The GGS is planned with at least three waves. Currently, data from the first wave are available for 11 countries. However, within the first wave only the respondent's highest attained level of education at interview, the time when it was attained, and its main subject matter has been recorded. In addition, data on the main subject matter have only been collected for seven countries (Austria, Bulgaria, France, Georgia, Norway, Romania and Russia). Retrospective information on education is supposed to be recorded in the second wave of the GGS, which will be available soon for the first countries.

Appendices

Appendix A: Description of data work

Appendix B: To CHAPTER 5 - The multidimensional impact of women's education on fertility

Appendix C: To CHAPTER 6 - The impact of childbearing on women's risk of educational change

Appendix D: To CHAPTER 7 - The simultaneous impact of unobserved characteristics on educational trajectories and childbearing behaviour

Appendix A

Description of data work

Data review and data preparation

At the beginning of the process of data editing, we transferred the various data files from SQL to Stata format by using an ODBC driver (Open Database Connectivity) and stored all information as a compact Stata data file. Afterwards, the original information and the additionally delivered yearly information on civil status and civil status changes, as well as on municipality and municipality changes, were merged.[188] For individuals who never changed their civil status or municipality, and for whom the original data therefore provided no information on changes in these variables, civil status and municipality at birth (birth cohorts 1968 to 1985), or as of the beginning of the year 1968 (birth cohorts 1950 to 1967) were imputed. Thus, there is now information on civil status history and municipality history for nearly all individuals in the data.

In a further step, we checked the quality of information on civil status and municipality changes. For all individuals with one or several recorded changes, we controlled whether the civil status and municipality after change number "x" corresponded to the civil status and municipality before change number "x+1". In some cases, the compared variables did not match. This indicated lags in the recording of information on changes in civil status and municipality. The data were rearranged and the lags were filled with a code for missing information (see Table A. 1). All in all, 3.9 per cent of the individuals had at least one lag regarding their municipality, 0.1 per cent concerning their civil status.

[188] Original and additionally provided forms of information had to be merged because the second were less accurate. The yearly information revealed only one change per year and only the year of change, while the original data provided monthly information on all changes that had appeared.

Table A. 1: Elimination of inconsistencies concerning civil status and municipality changes (using the example of municipality changes)

<u>Original data</u>

Change	Municipality before change	Municipality after change	Year of change
1	0827	0880	1970
2	0880	1667	1982
3	1667	1166	1990
4	1166	1182	1991
5	1182	**1167**	1995
6	**1277**	1292	2003

<u>Corrected data</u>

Change	Municipality before change	Municipality after change	Year of change
1	0827	0880	1970
2	0880	1667	1982
3	1667	1166	1990
4	1166	1182	1991
5	1182	1167	1995
6	**1167**	**1277**	**9999**
7	1277	1292	2003

In addition to lags in the registration of civil status and community changes, the data checks also showed some inconsistencies concerning migration events. For some individuals, two consecutive immigrations (0.11 per cent of all individuals) or two emigrations (0.01 per cent of all individuals) were reported. In most cases, there were no or only a few months' difference between the two dates of international migration, and the individual was recorded as having migrated in 1968 or 1969.[189] We handled the problem as follows: in the case of two consecutive immigration records, we used the second immigration date; while in the case of two consecutive emigration records we used the first emigration date.[190]

Finally, a substantial recoding of variables concerning educational level and educational field had to be done. This was necessary because in the year 2000 the Swedish system of educational classification underwent a revision in order to adapt the Swedish standard to the international standard for classification of education (ISCED 1997). Until 2000, educational level and orientation were recorded in a five-digit numerical code (SUN). Since 2000, the Swedish educational classification (SUN 2000) has been composed of two modules: a levels module with three digits and an

[189] Apparently there were some mistakes in recording migration events at the beginning of registration within the "Register över totalbefolkningen".

[190] In our analyses, we will censor individuals at the time of their first emigration at age 16 or higher, and drop them in case of immigration at age 16 or higher. Keeping the second immigration and the first emigration date ensures that the individual really has been in the country.

orientations module with four digits. Both are hierarchical in structure, which allows aggregation to higher levels. In the data provided by Statistics Sweden, there is information on individuals' education at the end of each year from 1990 to 2004. While the information is given in SUN codes for the years 1990 to 1999, it is given in SUN 2000 codes for the years 2000 to 2004. In order to achieve comparability with future studies, we decided to use the SUN 2000 classification throughout. Statistics Sweden placed a translation guide from SUN to SUN 2000 at our disposal.[191] In a first step, we had to revise some of the SUN codes in the data, because of minor changes in SUN codes over time and a translation guide from SUN to SUN 2000 that is based on the SUN codes of 1999. In a second step, we recoded the five-digit numerical SUN codes for the years 1990 to 1999 into SUN 2000 codes. This means that, after recoding, we had a three-digit code for educational level and a four-digit code for educational orientation for each individual in the data for all the years from 1990 to 2004.

Conversion of yearly information on education into continuous event history data[192]

To allow for continuous-time event history analyses, we used the yearly information on education to generate for all individuals variables on educational level and educational field at the end of 1990, changes in educational level and field between end of 1990 and end of 2004, and the corresponding dates of change. In case of a missing record in 1990 (e.g. because the person was younger than age 16 in 1990), we used the first year in which the educational level/field was not missing. Missing records in between (between first and last recorded level/field) were handled as follows. If the educational level or field was the same before and after the missing record, we assumed that there was no change in between. Thus, we deleted the record when the level or field was missing together with the following record and moved all of the other records two steps forward. If the educational level or field were different before and after the missing record, we kept the record with an indicator for missing information. Table A. 2 exemplifies the change of yearly information into event history data.

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[191] Hans Odelholm from Statistics Sweden was very helpful in giving us additionally information that we used in order to update the translation guide.

[192] Software instructions on how to change yearly information into event history data in Stata have been published as an internal research document at the Max Planck Institute for Demographic Research (Teschner and Böttcher 2007).

Table A. 2: Converting yearly information on educational level and field into event history data using the example of educational level (a "dot" indicates a missing value)

<u>**Yearly information**</u>

Educational level	200	200	200	200	312	312	.	312	312	312	312	.	.	425	425
Calender year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004

<u>**Event history data**</u>

Step 1: yearly information into event history data						
Educational level	200	312	.	312	.	425
Calender year	1990	1994	1996	1997	2001	2003
Step 2: handling of missings between two equal or unequal levels						
Educational level	200	312	.	425		
Calender year	1990	1994	2001	2003		

We imputed June as the month for all educational changes since June is in Sweden the most common month for receiving a diploma or a degree for a completed education. Thus, we were able to construct a time-varying variable for educational level and a time-varying variable for educational field for each individual for the period June 1990 to June 2005.[193]

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193 The educational level and field recorded at the end of 2004 is assumed to be valid at least until May 2005.

Appendix B

To CHAPTER 5 - The multidimensional impact of women's education on fertility

Table B. 1: Composition of the sample for the event history analyses of the impact of women's education on first births in Sweden

Time-varying covariates:	Exposures			Occurrences
	PY	in %	N_{PY}	N
Educational level				
Missing	35,689	1.7	62,452	424
Primary/lower secondary	552,194	25.7	164,554	14,032
Upper secondary	1,020,722	47.5	213,832	65,688
Short post-secondary	478,466	22.2	96,009	35,250
Long post-secondary	63,554	3.0	16,047	7,426
Educational field				
Missing	76,870	3.6	68,095	3,070
General	877,553	40.8	187,368	26,469
Teacher training	81,227	3.8	20,421	10,360
Art and media	67,498	3.1	17,169	2,796
Humanities	68,222	3.2	18,154	2,657
Social sciences, journalism and law	91,401	4.2	25,973	4,865
Business and administration	321,445	14.9	52,774	24,477
Natural sciences	51,666	2.4	12,552	3,062
Engineering and construction	79,646	3.7	15,217	5,128
Manufacturing and processing	21,723	1.0	3,784	1,719
Agriculture, forestry and animal health	23,679	1.1	5,026	1,711
Health care and welfare	270,187	12.6	53,251	26,910
Tech. oriented health care and pharmacy	11,463	0.5	2,367	1,067
Personal services	105,178	4.9	19,762	8,188
Security services	2,867	0.1	648	341
Educational status				
Missing	124	0.0	19	0
Not enrolled	1,019,748	47.4	218,920	93,180
Enrolled	1,063,600	49.5	206,989	24,857
Systematic missing	67,153	3.1	138,229	4,783
Civil status				
Missing	262	0.0	24	2
Single/cohabiting	2,036,194	94.7	257,100	93,958
Married	96,171	4.5	39,749	27,201
Divorced	17,567	0.8	4,222	1,636
Widowed	431	0.0	92	23

Table B. 1: (continued)

Time-varying covariates:	PY	Exposures in %	N_{PY}	Occurrences N
Municipality type				
Missing	241	0.0	23	3
Stockholm, Malmö, Gothenburg	484,927	22.5	89,113	27,684
Other urban municipalities	1,565,045	72.8	226,382	89,559
Sparsely populated rural municipalities	100,413	4.7	21,838	5,574
Period				
1990	66,811	3.1	138,229	4,762
1991	135,718	6.3	145,516	9,177
1992-1997	861,740	40.1	203,097	48,307
1998-2005.25	1,086,356	50.5	195,568	60,574
Sample size				
Total exposures (person years at risk)	2,150,626			
Total number of individuals in the data set	262,753			
Total occurrences	122,820			

Source: Swedish register data

Notes: (1) PY=person years at risk, N_{PY}=number of individuals that contributed to PY. (2) For the covariate educational status, we initially also created the category "systematically missing" for the following reason. The period under observation is June 1990 to March 2004. Since the data on education and occupation delivered by Statistics Sweden only covers the years 1990 to 2004, there is no information on whether an individual received financial aid for students during the preceding calendar year for the period June 1990 to December 1990. Thus, for all individuals born between 1950 and 1974 (aged 16 or older in 1990), the first spell of the variable educational status is "systematically missing", and the length of that spell varies between one month (for individuals born in November 1974) and six months (for individuals born in June 1974 or before). We merged the categories "missing" and "systematically missing" in all our analyses. (3) For the variable period - which will be included in our event history model as a piece-wise linear duration spline - Table B. 1 only provides the approximate distribution of exposures and occurrences across spline segments.

Table B. 2: Composition of the sample for the event history analyses of the impact of women's education on second births in Sweden

Time-constant covariates:	Exposures N	Exposures in %		Occurrences N
Age at previous birth				
≤ 23	39,314	27.8		29,798
24-28	59,275	41.9		45,205
29-33	34,612	24.5		22,511
34-38	7,491	5.3		3,322
39+	824	0.6		125
Time-varying covariates:	**Exposures PY**	**Exposures in %**	**N_{PY}**	**Occurrences N**
Educational level				
Missing	1,236	0.3	904	127
Primary/lower secondary	65,099	14.8	17,794	10,434
Upper secondary	255,501	58.3	82,081	57,225
Short post-secondary	99,952	22.8	40,370	27,532
Long post-secondary	16,711	3.8	8,266	5,463
Educational field				
Missing	8,811	2.0	3,678	1,835
General	109,894	25.1	32,512	20,290
Teacher training	29,871	6.8	12,749	9,033
Art and media	7,575	1.7	2,944	1,476
Humanities	7,071	1.6	3,097	1,567
Social sciences, journalism and law	12,035	2.7	5,618	2,900
Business and administration	89,506	20.4	29,505	21,277
Natural sciences	7,943	1.8	3,397	2,098
Engineering and construction	15,892	3.6	6,019	4,006
Manufacturing and processing	6,585	1.5	2,106	1,395
Agriculture, forestry and animal health	5,028	1.1	1,934	1,309
Health care and welfare	96,576	22.0	34,139	24,903
Tech. oriented health care and pharmacy	3,298	0.8	1,272	955
Personal services	37,202	8.5	11,042	7,453
Security services	1,211	0.3	401	284

Table B. 2: (continued)

Time-varying covariates:	Exposures PY	in %	N_{PY}	Occurrences N
Educational status				
Missing	206	0.0	71	0
Not enrolled	376,373	85.8	133,353	89,459
Enrolled	51,202	11.7	30,418	7,734
Systematic missing	10,717	2.4	24,887	3,588
Civil status				
Missing	6	0.0	2	2
Single/cohabiting	290,510	66.3	98,049	57,754
Married	125,221	28.6	56,210	40,941
Divorced	22,291	5.1	5,611	2,047
Widowed	470	0.1	107	37
Municipality type				
Missing	22	0.0	4	3
Stockholm, Malmö, Gothenburg	78,681	17.9	29,722	15,749
Other urban municipalities	338,620	77.2	113,348	79,856
Sparsely populated rural municipalities	21,174	4.8	8,052	5,173
Period				
1990	10,711	2.4	24,887	3,516
1991	23,155	5.3	30,633	7,312
1992-1996	135,405	30.9	64,990	35,557
1997-2005.25	269,226	61.4	94,224	54,396
Sample size				
Total exposures (person years at risk)	438,497			
Total number of individuals in the data set	141,516			
Total occurrences	100,781			

Source: Swedish register data
Notes: See Table B. 1.

Table B. 3: Composition of the sample for the event history analyses of the impact of women's education on third births in Sweden

Time-constant covariates:	Exposures N	Exposures in %		Occurrences N
Age at previous birth				
≤ 20	1,588	1.4		1,023
21-24	20,014	17.2		9,745
25-28	40,943	35.1		13,855
29-34	45,225	38.8		9,388
35+	8,724	7.5		881
Time-varying covariates:	**Exposures PY**	**Exposures in %**	**N_{PY}**	**Occurrences N**
Educational level				
Missing	905	0.1	571	127
Primary/lower secondary	78,149	11.1	14,245	10,434
Upper secondary	430,928	61.0	71,460	57,225
Short post-secondary	170,704	24.2	34,711	27,532
Long post-secondary	25,402	3.6	6,556	5,463
Educational field				
Missing	7,623	1.1	2,369	1,835
General	149,460	21.2	26,501	20,290
Teacher training	56,817	8.0	11,855	9,033
Art and media	6,531	0.9	1,607	1,476
Humanities	7,630	1.1	2,176	1,567
Social sciences, journalism and law	14,689	2.1	4,241	2,900
Business and administration	155,577	22.0	25,506	21,277
Natural sciences	12,020	1.7	2,726	2,098
Engineering and construction	24,666	3.5	4,919	4,006
Manufacturing and processing	9,618	1.4	1,801	1,395
Agriculture, forestry and animal health	7,373	1.0	1,508	1,309
Health care and welfare	183,348	26.0	32,017	24,903
Tech. oriented health care and pharmacy	6,504	0.9	1,184	955
Personal services	62,188	8.8	10,342	7,453
Security services	2,042	0.3	357	284

Table B. 3: (continued)

Time-varying covariates:	Exposures PY	in %	N_{PY}	Occurrences N
Educational status				
Missing	301	0.0	104	0
Not enrolled	629,735	89.2	114,141	89,459
Enrolled	67,446	9.6	29,016	7,734
Systematic missing	8,606	1.2	18,826	3,588
Civil status				
Missing	6	0.0	2	2
Single/cohabiting	284,126	40.2	59,354	57,754
Married	374,008	53.0	69,611	40,941
Divorced	46,852	6.6	11,137	2,047
Widowed	1,094	0.2	255	37
Municipality type				
Missing	11	0.0	3	3
Stockholm, Malmö, Gothenburg	80,786	11.4	17,199	15,749
Other urban municipalities	588,247	83.3	98,435	79,856
Sparsely populated rural municipalities	37,042	5.2	7,379	5,173
Period				
1990	8,606	1.2	18,826	1,056
1991	20,421	2.9	24,601	2,429
1992-1995	129,328	18.3	51,668	9,890
1996-2005.25	547,732	77.6	102,816	21,451
Sample size				
Total exposures (person years at risk)	706,087			
Total number of individuals in the data set	116,494			
Total occurrences	34,826			

Source: Swedish register data
Notes: See Table B. 1.

Table B. 4: Comparison of our classification of educational levels with those in ISCED 1997, SUN and SUN 2000

Level		ISCED 1997	SUN	SUN 2000	Our grouping
Primary education	1 year	1	1	1	1
	2 years				
	3 years				
	4 years				
	5 years				
	6 years				
Lower secondary education	7 years	2	2	2	
	8 years				
	9 years +				
Upper secondary education	< 2 years	3C	3	31	2
	2 years			32	
	3 years +	3A	4	33	
Post-secondary education	< 2 years	4	5	41	3
	2 years	5B		52	
	3 years	5A	6	53	
	4 years			54	4
	5 years +			55	
Postgraduate education	Licentiate	6	7	62	
	Doctorate			64	

Source: Statistics Sweden (2000: 98)

Table B. 5: Comparison of the classification of educational fields proposed by ISCED 1997 (first digit) with the classification used in the analyses of first, second and third births in Sweden

ISCED 1997/ SUN 2000 (first digit)	Educational fields used
General	General
Teacher training and education science[1]	Teacher training
Humanities and art	Art and media
	Humanities
Social sciences, journalism, business and law	Social sciences, journalism and law[1]
	Business and administration
Natural sciences	Natural sciences[2]
Engineering, manufacturing and construction	Engineering and construction
	Manufacturing and processing
Agriculture, forestry and animal health	Agriculture, forestry and animal health
Health and welfare	Health care and welfare
	Tech. oriented health care and pharmacy
Services[2]	Personal services
	Security services

Notes: (1) Educational programmes in the area of educational science were moved from "teacher training and education science" to "social sciences, journalism and law". (2) Educational programmes in environmental protection (except for cleaning and waste disposal) were regrouped from "services" to "natural sciences". See also comments below.

Explanations regarding the subdivision of educational fields according to the first two digits of the ISCED 1997-code

(1) **Humanities and art**: In our analyses we include separate categories for women educated in the area of "art and media" and women who graduated from an education in "humanities". We expect to find low birth risks for both educational fields, but for different reasons (no obvious set of occupations in the case of "humanities", no reliable employment career in the case of "art and media"). By separating these fields, we can verify whether both characteristics are connected to a lower childbearing risk.

According to ISCED 1997 and SUN 2000, "humanities" also includes educational programmes in theology or in pastoral, missionary or parish welfare work. We are well aware of the fact that these educational programmes lead more directly to a definite occupational field than all other educational programmes in humanities (e.g. studies in history, literature, languages, philosophy). We nevertheless kept religious educational programmes within “humanities” since (i) the number of women who enrol in these programmes is too small to make a separate category for them, and (ii) in our view, there is no other educational field in which religious educational programmes would fit.

(2) **Social sciences, journalism, business and law**: The educational group “social science, journalism, business and law” comprises a multitude of different educational lines. Since this field of education is also rich in a numerical sense (a high percentage of individuals receive an education related to one of these educational lines), we decided to subdivide this group. We kept educational programmes in “social sciences, journalism and law” in one category, but created a separate one for educational programmes in “business and administration”. Our main motivation for this distinction is related to differences between these two groups of educational fields in terms of the time that graduates usually need to reach an adequate and stable position in the labour market. Graduates with degrees from educational programmes in the area of business and administration generally have good employment prospects (they can choose between numerous potential employers) and high chances of reaching a permanent position quickly, even if they only hold a short post-secondary degree. For graduates with degrees in social sciences, journalism or law, however, the situation is different. In all three disciplines, graduates often face a very competitive situation on the labour market (good positions are scarce and potential candidates often have to wait several years until a suitable position is available). Graduates with degrees in these disciplines often go through a series of unpaid or low-paid temporary contracts, and a substantial number of graduates do not manage to get a suitable position at all, which means that they end up in jobs that are less rewarded (in terms of money and occupational status). Out of curiosity, we also ran models with separate categories for each of the groups “social sciences”, “journalism” and “law”. However, the effects for these three types of education were quite similar, and we therefore combined them into a single category in our final analyses.

(3) **Engineering, manufacturing and construction**: We separated women educated in “engineering and construction” from women educated for jobs in “manufacturing and processing” since we believe that these two groups of fields differ in their gender structure. Nearly all educational lines within “engineering and construction” are clearly male-dominated during education and in the labour market.

Within "manufacturing and processing", however, there are several educational lines that are more gender-equal (e.g. manufacturing and handling of food) or even female-dominated (e.g. manufacturing of textiles and clothing).

(4) **Health and welfare**: We constructed separate categories for women educated in "technically oriented health care and pharmacy" and for women educated for general "health and welfare professions". In doing so we followed the argumentation of Hoem et al. (2006a), who pointed out that these two groups differ substantially in the nature of their work and their workplace situations. We also believe that biomedical analysts, dental laboratory technicians or pharmacists are not concerned with patients or clients directly the way nurses, physicians and social workers are.

(5) **Services**: We distinguish between educational programmes for "personal services" (e.g. hotel services, restaurant services, household services, hair and beauty care, transport services) and educational programmes for "security services" (which is mainly police work). In Sweden, women educated for "security services" are very likely to be employed in the public sector, while women educated in "personal services" predominantly work in the private sector. Since the public sector often offers a more family-friendly work environment and more stable employment prospects, we expect to find higher birth risks for women educated in "security services" than for women educated for jobs in the area of "personal services".

Explanations regarding the regrouping of some educational lines into a different higher order group of educational fields

(1) **Education science**: We separated women educated to work as a teacher from women educated in "education science", and grouped the latter together with women educated in "social sciences, journalism and law". We believe that the field "education science" has much more in common with "social science, journalism and law" than with "teaching" in terms of employment prospects, employment conditions and the nature of work.

(2) **Environmental protection**: Normally educational programmes in the area of environmental protection are included in the educational field "services" (which we have split into "personal services" and "security services"). We decided not to group educational programmes in environmental protection into one of the two services

groups, but rather to group them together with the “natural sciences” for many of the same reasons as those specified in (1). The only exceptions are educational programmes in the area of cleaning and waste disposal. They also belong to “environmental protection”, but we have allocated them to the field of “personal services” because this fits better with the nature of the work that these educational programmes lead to.

Table B. 6: Overview of the educational lines included in each educational field by level of education

<table>
<tr><th rowspan="2">Educational field
(SUN 2000 code)</th><th colspan="3">Educational level[1]
(SUN 2000 code)</th></tr>
<tr><th>Upper secondary[2]
(310-337)</th><th>Short post-secondary
(410-537)</th><th>Long post-secondary
(540-640)</th></tr>
<tr><td>General
(010a-090z)</td><td>Study oriented programmes:[3]
• Social science programme
• Natural science programme</td><td>-</td><td>-</td></tr>
<tr><td>Teacher training
(140z, 143a-149x)</td><td>-</td><td>• Teaching for pre-school and after school activities
• Primary school teaching
• Vocational school teaching (most)</td><td>• Subject teaching
• Vocational school teaching (some)</td></tr>
<tr><td>Art and media
(210z-219z)</td><td>• Arts program
• Media program</td><td colspan="2">• Fine arts (e.g. drawing, sculpture)
• Performing arts (e.g. music, dance, drama)
• Graphic and audio-visual arts (e.g. film, radio and TV production, printing and publishing, graphic design, advertising, photography)
• Design (e.g. fashion design, interior design, industrial and product design)
• Craft skills</td></tr>
<tr><td>Humanities
(220z-229z)</td><td>-</td><td colspan="2">• Pastoral, missionary and parish welfare work (short post-secondary)
• Theology (long post-secondary)
• Foreign languages and cultures
• Swedish and comparative literature
• History and archaeology
• Philosophy and logic</td></tr>
</table>

Table B. 6: (continued)

Educational field (SUN 2000 code)	**Educational level**[1] (SUN 2000 code) Upper secondary[2] (310-337)	Short post-secondary (410-537)	Long post-secondary (540-640)
Social sciences, journalism and law (142z, 310a-329z, 380a-380x)	-	• Teaching methods • Social and behavioral sciences, general • Sociology, ethnology and human geography • Political science • Economics • Journalism and media studies • Law and jurisprudence (legal secretary, paralegal)	• Teaching methods • Psychology • Sociology, ethnology and human geography • Political science • Economics • Libary and information science • Documentation and information science • Law and jurisprudence (lawyer)
Business and administration (340a-349z)	• Business and administration programme	• Business studies • Marketing • Accounting and taxation • Management and administration	• Business studies
Natural sciences (420z-489z, 850z-852z, 859z)	• Technology programme[4]	• Biology and environmental sciences • Physics, chemistry and earth sciences • Mathematics and statistics • Computing • Environmental protection	
Engineering and construction (520a-529x, 580a-589z)	• Construction programme • Electricity programme • Energy programme • Vehicle programme • Industry programme[4] • Technology programme[4]	• Mechanical engineering • Energy technology and electrical engineering • Electronics, computer engineering and automation • Chemical technology and biotechnology • Vehicle engineering • Structural engineering and construction technology • Town planning and architecture	

Table B. 6: (continued)

Educational field (SUN 2000 code)	**Educational level**[1] (SUN 2000 code)		
	Upper secondary[2] (310-337)	Short post-secondary (410-537)	Long post-secondary (540-640)
Manufacturing and processing (540a-549z)	• Handicraft programme • Food programme • Industry programme[4] • Technology programme[4]	• Food technology • Textile technology • Wood technology	• Materials technology • Rock and mineral engineering
Agriculture, forestry and animal health (620z-640a)	• Natural resource use program	• Agricultural and rural management • Horticultural management and technology • Forest management and forest technology	• Agricultural science • Horticultural science • Forestry and forest science • Veterinary medicine
Health care and welfare (720z-724d, 724x, 726a-726x, 729z, 760z-769z)	• Health care program • Child and recreation program	• Nursing • Dental services (e.g. dental assisting, dental hygienist) • Physiotherapy • Occupational therapy • Diatary treatment • Care of children and adolescents • Social work and guidance	• Human medicine • Midwifery • Dentistry • Logopedics
Technically oriented health care and pharmacy (724e, 725a-725x, 727a-727x)	-[5]	• Optician • Audiology technics • Orthopaedic engineering • Biomedical analysis • Radiology nursing • Pharmaceutical assistence	• Hospital physics • Pharmacy

Table B. 6: (continued)

Educational field (SUN 2000 code)	**Educational level**[1] (SUN 2000 code)		
	Upper secondary[2] (310-337)	Short post-secondary (410-537)	Long post-secondary (540-640)
Personal services (810z-840x, 853z)	• Hotel and restaurant programme • Handicraft programme • Home economics programme[6]	• Hotels, restaurants and institutional housekeeping • Tourism, travel and recreation • Sport and physical welfare • Home economics	-
Security services (860z-869z)	-	• Security in civil society (police work) • Work environment and occupational safety • Military programme	-

Notes: *(1) The category "primary or lower secondary education" has not been included in this table since at this stage of the educational system there is no subdivision into educational fields (all respondents with a primary or lower secondary level of education have the educational field "general").*

(2) The division of upper secondary education into national programmes changed frequently during the past (number of available programmes as well as duration and content of programmes). Moreover, there were multiple changes regarding the grouping of upper secondary programmes into educational fields. All technical programmes for example were originally grouped into "engineering and construction" or "manufacturing and processing". From the mid 1990s until the year 2000, they were seen as a branch of natural sciences and grouped into "general programmes". From 2000 onwards, the existing variety of technical programmes was merged into the technology programme which is grouped into the field "engineering and architecture" or "manufacturing and processing". The codes have not been updated by Statistics Sweden. Since the structure of the upper secondary educational system as well as the grouping of upper secondary programmes into educational fields changed so frequently in the past, we did not try to adjust codes. In the table we mainly use the current structure of upper secondary education to indicate which kind of programme a person might have done to reach an upper secondary degree in the specified field.

(3) Includes also former theoretical lines such as humanities or economics.

(4) The upper secondary industry programme and technology programme are grouped into "engineering and architecture" or "manufacturing and processing" depending on the specialisation a student has choosen in year two and three. Technology programmes with a special focus on computer technology are grouped into "natural sciences".

(5) In the past, there were several upper secondary programmes that led to an occupation in the area of technically oriented health care and pharmacy (e.g. educations for pharmacy techicians). Today, most of these occupations require at least some tertiary education.

(6) Former upper secondary programme.

Table B. 7: Summary of event history models for the transition to a first child

Model 1: Main effects of all variables.

Model 2: Effects of educational level and educational field only for those who are not enrolled in education.

Model 3: Effects of educational level and educational field only for those who are not enrolled in education, and effect of educational level by woman's age.

Model 4: Effects of educational level and educational field only for those who are not enrolled in education, and effect of educational level by woman's age and civil status.

Model 5: Effect of educational field by women's educational level for those who are not enrolled in education.

	Model 1			Model 2			Model 3			Model 4			Model 5		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Woman's age in years (ls)															
Constant	-4.53	0.00		-4.35	0.00		-4.25	0.00		-4.49	0.00		-4.38	0.00	
16-20	0.51	0.00		0.47	0.00		0.46	0.00		0.47	0.00		0.47	0.00	
20-26	0.12	0.00		0.13	0.00		0.11	0.00		0.13	0.00		0.13	0.00	
26-30	0.05	0.00		0.05	0.00		0.04	0.00		0.05	0.00		0.04	0.00	
30-37	-0.12	0.00		-0.12	0.00		-0.15	0.00		-0.15	0.00		-0.12	0.00	
37-41	-0.37	0.00		-0.37	0.00		-0.33	0.00		-0.32	0.00		-0.37	0.00	
41-45	-0.64	0.00		-0.63	0.00		-0.68	0.00		-0.68	0.00		-0.63	0.00	
Period (ls)															
1990.5-1991	(1.69	0.00)		(1.66	0.00)		(1.66	0.00)		(1.65	0.00)		(1.66	0.00)	
1991-1992	0.03	0.16		0.03	0.23		0.02	0.30		0.02	0.40		0.03	0.26	
1992-1998	-0.05	0.00		-0.05	0.00		-0.05	0.00		-0.05	0.00		-0.05	0.00	
1998-2005.25	0.04	0.00		0.04	0.00		0.04	0.00		0.04	0.00		0.04	0.00	

Table B. 7: (continued)

	Model 1			Model 2			Model 3			Model 4			Model 5		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational level	Ages 16-45			Ages 16-45			Ages 16-24						Ages 16-45		
Missing	-0.79	0.00	0.45	-1.21	0.00	0.30	-0.66	0.00	0.52	*Effect of educational level by women's age and civil status for women who are not enrolled in education (see Table B 8).*			*See below.*		
Primary/lower secondary	0.40	0.00	1.49	0.16	0.00	1.18	0.55	0.00	1.73						
Upper secondary	0		1	0		1	0		1						
Short post-secondary	-0.05	0.00	0.95	0.05	0.00	1.05	-0.27	0.00	0.76						
Long post-secondary	0.08	0.00	1.09	0.09	0.00	1.10									
							Ages 25-30								
Missing							-2.79	0.00	0.061						
Primary/lower secondary							-0.17	0.00	0.847						
Upper secondary							0		1						
Short post-secondary							0.026	0.02	1.026						
Long post-secondary							-0.06	0.00	0.944						
							Ages 31-45								
Missing							-2.48	0.00	0.084						
Primary/lower secondary							-0.39	0.00	0.677						
Upper secondary							0		1						
Short post-secondary							0.281	0.00	1.324						
Long post-secondary							0.472	0.00	1.60						

Table B. 7: (continued)

	Model 1			Model 2			Model 3			Model 4			Model 5		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field															
Missing	0.09	0.00	1.10	0.05	0.03	1.05	0.03	0.24	1.03	0.02	0.33	1.02	*Effect of educational field by women's educational level for women who are not enrolled in education (see Table B 10).*		
General	-0.34	0.00	0.71	-0.24	0.00	0.79	-0.24	0.00	0.79	-0.24	0.00	0.79			
Teacher training	0.38	0.00	1.46	0.25	0.00	1.28	0.25	0.00	1.29	0.25	0.00	1.28			
Art and media	-0.25	0.00	0.78	-0.23	0.00	0.80	-0.25	0.00	0.78	-0.24	0.00	0.78			
Humanities	-0.37	0.00	0.69	-0.37	0.00	0.69	-0.37	0.00	0.69	-0.36	0.00	0.70			
Social sciences, journalism and law	-0.16	0.00	0.85	-0.09	0.00	0.92	-0.09	0.00	0.91	-0.09	0.00	0.92			
Business and administration	0		1	0		1	0		1	0		1			
Natural sciences	-0.12	0.00	0.89	-0.05	0.04	0.95	-0.05	0.04	0.95	-0.04	0.06	0.96			
Engineering and construction	-0.13	0.00	0.88	-0.07	0.00	0.93	-0.05	0.01	0.95	-0.05	0.01	0.95			
Manufacturing and processing	0.08	0.00	1.09	0.03	0.26	1.03	0.03	0.27	1.03	0.03	0.27	1.03			
Agriculture, forestry and animal health	0.05	0.02	1.05	0.00	0.91	1.00	-0.01	0.65	0.99	-0.02	0.53	0.98			
Health care and welfare	0.32	0.00	1.37	0.22	0.00	1.24	0.21	0.00	1.24	0.21	0.00	1.24			
Tech. oriented health care, pharmacy	0.12	0.00	1.13	0.06	0.09	1.06	0.07	0.06	1.07	0.06	0.09	1.06			
Personal services	0.08	0.00	1.08	0.01	0.40	1.01	0.01	0.40	1.01	0.01	0.48	1.01			
Security services	0.32	0.00	1.38	0.23	0.00	1.26	0.22	0.00	1.25	0.22	0.00	1.25			
Educational status															
Missing	0.40	0.00	1.50	0.39	0.00	1.48	0.36	0.00	1.43	0.65	0.00	1.92	0.40	0.00	1.49
Not enrolled	0		1												
Enrolled	-0.65	0.00	0.52	-0.71	0.00	0.49							-0.70	0.00	0.50
Enrolled: Ages 16-24							-0.93	0.00	0.40	-2.03	0.00	0.13			
Enrolled: Ages 25-30							-0.54	0.00	0.58	-1.57	0.00	0.21			
Enrolled: Ages 31-45							-0.05	0.03	0.95	-1.00	0.00	0.37			

Table B. 7: (continued)

	Model 1			Model 2			Model 3			Model 4			Model 5		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Civil status															
Missing	-3.20	0.00	0.04	-3.31	0.00	0.04	-3.30	0.00	0.04	*See above.*			-3.35	0.00	0.03
Single/cohabiting	-1.34	0.00	0.26	-1.34	0.00	0.26	-1.34	0.00	0.26				-1.34	0.00	0.26
Married	0		1	0		1	0		1				0		1
Divorced	-0.99	0.00	0.37	-0.98	0.00	0.37	-0.97	0.00	0.38				-0.98	0.00	0.38
Widowed	-1.45	0.00	0.23	-1.42	0.00	0.24	-1.35	0.00	0.26				-1.42	0.00	0.24
Municipality type															
Missing	-0.06	0.92	0.94	-0.60	0.27	0.55	-0.56	0.30	0.57	-2.20	0.00	0.11	-0.59	0.27	0.56
Stockholm, Malmö, Gothenburg	-0.19	0.00	0.83	-0.22	0.00	0.80	-0.23	0.00	0.79	-0.24	0.00	0.79	-0.22	0.00	0.80
Other urban municipalities	0		1	0		1	0		1	0		1	0		1
Sparsely populated rural municipalities	0.08	0.00	1.09	0.10	0.00	1.10	0.09	0.00	1.10	0.10	0.00	1.10	0.10	0.00	1.10
Log-likelihood of model	-721,837.10			-723,441.74			-721,615.88			-724,522.70			-723,588.79		

Notes: (1) ls=linear spline.

(2) For the period spline, we set nodes at the beginning of 1991, 1992 and 1998. Our models show an exceedingly strong positive gradient for the period July 1990 to January 1991. However, we believe that this effect is caused by our data/model structure, rather than by real demographic behavior. During this time period, the educational status of all women in the data is "missing" (for an explanation see note 2 in Table B. 1). If we exclude the variable educational status from the model, the strong positive gradient of the first period spline segment disappears.

(3) Models 2, 3, 4 and 5 show the effects of educational level and educational field only for women who are out of education.

(4) In model 3 and 4, we combined the categories "short post-secondary" and "long post-secondary" level of education for women aged 16 to 24.

Table B. 8: First birth, Model 4 - the effect of educational level by women's age and civil status for women who are not enrolled in education

	Civil status											
	Missing			Single/cohabiting			Married			Divorced/Widowed		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational level - ages 16-24												
N.e.: Missing	-1.758	0.00	0.17									
N.e.: Primary/lower secondary				-0.56	0.00	0.57	0.40	0.00	1.48	0.14	0.33	1.15
N.e.: Upper secondary				-1.14	0.00	0.32	0		1	-0.58	0.00	0.56
N.e.: Short/long post-secondary				-1.54	0.00	0.21	0.37	0.00	1.45	-0.61	0.11	0.55
Educational level - ages 25-30												
N.e.: Missing	-3.871	0.00	0.02									
N.e.: Primary/lower secondary				-1.23	0.00	0.29	-0.58	0.00	0.56	-0.85	0.00	0.43
N.e.: Upper secondary				-1.15	0.00	0.32	0.00		1	-0.99	0.00	0.37
N.e.: Short post-secondary				-1.23	0.00	0.29	0.30	0.00	1.35	-0.91	0.00	0.40
N.e.: Long post-secondary				-1.46	0.00	0.23	0.36	0.00	1.43	-1.22	0.00	0.30
Educational level - ages 31-45												
N.e.: Missing	-3.451	0.00	0.03									
N.e.: Primary/lower secondary				-1.45	0.00	0.24	-0.64	0.00	0.53	-1.01	0.00	0.36
N.e.: Upper secondary				-1.10	0.00	0.33	0		1	-0.83	0.00	0.44
N.e.: Short post-secondary				-0.82	0.00	0.44	0.26	0.00	1.29	-0.52	0.00	0.59
N.e.: Long post-secondary				-0.71	0.00	0.49	0.59	0.00	1.81	-0.37	0.00	0.69

Notes: (1) The full model is included in Table B 7, Model 4.
(2) For women aged 16 to 24, we merged the categories "short post-secondary" and "long post-secondary" level of education due to small case numbers. For the same reason, we merged the categories "divorced" and "widowed".

Table B. 9: First birth, Model 4 - distribution of the exposure time and number of women who contributed to the exposure time by educational level (age specific) and civil status for women who are not enrolled in education

	Civil status														
	Missing		Single/cohabiting			Married			Divorced			Widowed		
	PY	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}
N.e.: All women	50	6	927,356	91.0	211,072	77,282	7.6	34,588	14,681	1.4	3,947	378	0.0	92
Educational level - ages 16-24														
N.e.: Missing	10,536	5,318												
N.e.: Primary/lower sec.			81,331	97.8	48,613	1,592	1.9	1,077	227	0.3	178	1	0.0	1
N.e.: Upper secondary			269,518	97.6	115,345	6,066	2.2	5,299	417	0.2	370	4	0.0	3
N.e.: Short post-sec.			29,623	96.0	24,981	1,195	3.9	1,538	45	0.1	61	4	0.0	5
N.e.: Long post-sec.			564	93.9	1,062	36	6.0	86	1	0.1	2	0	0.0	0
Educational level - ages 25-30														
N.e.: Missing	2,111	1,572												
N.e.: Primary/lower sec.			27,322	89.8	9,520	2,375	7.8	1,242	716	2.4	368	19	0.1	9
N.e.: Upper secondary			191,124	90.6	68,158	16,918	8.0	10,618	2,758	1.3	1,341	49	0.0	23
N.e.: Short post-sec.			105,172	88.9	45,343	11,980	10.1	9,570	1,118	0.9	674	21	0.0	10
N.e.: Long post-sec.			25,269	85.8	11,742	3,930	13.3	3,252	261	0.9	164	2	0.0	1
Educational level - ages 31-45														
N.e.: Missing	1,921	818												
N.e.: Primary/lower sec.			17,532	81.5	3,530	2,750	12.8	730	1,238	5.8	287	84	0.4	16
N.e.: Upper secondary			92,422	81.8	21,434	15,793	14.0	4,974	4,732	4.2	1,293	122	0.1	35
N.e.: Short post-sec.			57,528	81.0	16,812	11,029	15.5	4,795	2,470	3.5	810	72	0.1	24
N.e.: Long post-sec.			15,705	79.5	5,142	3,387	17.1	1,819	659	3.3	236	2	0.0	2

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Percentages sum up to 100 per cent within rows (excluding the porportion of women with missing information).
(3) Table does not include enrolled women and women with missing information on educational status.

Table B. 10: First birth, Model 5 - the effect of educational field by educational level for women who are not enrolled in education

	Educational level														
	N.e.: Missing			N.e.: Primary/lower secondary			N.e.: Upper secondary			N.e.: Short post-secondary			N.e.: Long post-secondary		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field															
N.e.: Missing	-0.144	0.00	0.87												
N.e.: General				-0.06	0.00	0.94	-0.23	0.00	0.80	-0.57	0.32	0.56	-	-	-
N.e.: Teacher training				-	-	-	0.01	0.94	1.01	0.32	0.00	1.38	0.26	0.00	1.30
N.e.: Art and media				-	-	-	-0.24	0.00	0.78	-0.10	0.08	0.91	0.01	0.95	1.01
N.e.: Humanities				-	-	-	-0.13	0.77	0.88	-0.32	0.00	0.72	-0.12	0.16	0.89
N.e.: Social sciences, journalism and law				-	-	-	-0.34	0.45	0.71	-0.08	0.00	0.92	0.11	0.00	1.12
N.e.: Business and administration				-	-	-	0.00		1	0.11	0.00	1.11	0.00	0.98	1.00
N.e.: Natural sciences				-	-	-	0.01	0.81	1.01	0.02	0.43	1.02	-0.01	0.77	0.99
N.e.: Engineering and construction				-	-	-	-0.13	0.00	0.88	-0.02	0.43	0.98	0.11	0.00	1.12
N.e.: Manufacturing and processing				-	-	-	0.05	0.09	1.05	0.02	0.90	1.02	0.04	0.78	1.04
N.e.: Agriculture, forestry and animal health				-	-	-	0.02	0.54	1.02	0.06	0.58	1.06	0.07	0.31	1.08
N.e.: Health care and welfare				-	-	-	0.24	0.00	1.28	0.24	0.00	1.27	0.34	0.00	1.40
N.e.: Tech. oriented health care and pharmacy				-	-	-	0.09	0.28	1.10	0.14	0.00	1.15	0.01	0.89	1.01
N.e.: Personal services				-	-	-	0.02	0.22	1.02	0.12	0.02	1.13	0.75	0.20	2.12
N.e.: Security services				-	-	-	-0.10	0.66	0.91	0.31	0.00	1.36	0.72	0.46	2.04

Note: The full model is included in Table B 7, Model 5.

Table B. 11: First birth, Model 5 - distribution of the exposure time and number of women that contributed to the exposure time by educational field and educational level for women who are not enrolled in education

	Educational level									
	N.e.: Missing		N.e.: Primary/ lower secondary		N.e.: Upper secondary		N.e.: Short post-secondary		N.e.: Long post-secondary	
	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}
Educational field										
N.e.: Missing	38,174	12,509								
N.e.: General			135,197	52,063	140,330	42,564	57	48	-	-
N.e.: Teacher training			-	-	279	49	44,522	12,208	7,705	2,440
N.e.: Art and media			-	-	25,078	8,711	4,463	1,695	1,320	328
N.e.: Humanities			-	-	78	22	20,645	7,608	1,358	444
N.e.: Social sciences, journalism and law			-	-	95	40	22,940	9,690	9,770	2,838
N.e.: Business and administration			-	-	173,786	31,595	40,058	9,831	6,396	2,020
N.e.: Natural sciences			-	-	5,636	977	11,863	4,071	5,550	1,706
N.e.: Engineering and construction			-	-	13,720	2,750	18,416	5,061	10,117	2,814
N.e.: Manufacturing and processing			-	-	13,555	2,746	718	207	480	116
N.e.: Agriculture, forestry and animal health			-	-	12,184	3,173	780	272	1,536	428
N.e.: Health care and welfare			-	-	121,910	28,388	43,629	12,416	4,753	1,557
N.e.: Tech. oriented health care and pharmacy			-	-	997	228	5,329	1,325	763	233
N.e.: Personal services			-	-	69,736	14,227	3,379	1,116	17	12
N.e.: Security services			-	-	198	38	2,219	525	13	7

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Categories where N_{PY} is smaller than 50 are printed in grey.

Table B. 12: Comparison between a first birth model in which civil status is included as a control variable and a first birth model in which civil status is excluded

	Model 3 with civil status			Model 3 without civil status		
	β	p-value	exp(β)	β	p-value	exp(β)
Woman's age in years (ls)						
Constant	-4.25	0.00		-5.55	-1.18	
16-20	0.46	0.00		0.47	0.00	
20-26	0.11	0.00		0.14	0.00	
26-30	0.04	0.00		0.08	0.00	
30-37	-0.15	0.00		-0.13	0.00	
37-41	-0.33	0.00		-0.31	0.00	
41-45	-0.68	0.00		-0.66	0.00	
Period (ls)						
1990.5-1991	1.66	0.00		1.64	0.00	
1991-1992	0.02	0.30		0.03	0.00	
1992-1998	-0.05	0.00		-0.06	0.00	
1998-2005.25	0.04	0.00		0.03	0.00	
Educational level		Ages 16-24			Ages 16-24	
Missing	-0.66	0.00	0.52	-0.64	0.00	0.53
Primary/lower secondary	0.55	0.00	1.73	0.57	0.00	1.77
Upper secondary	0		1	0		1
Short/long post-secondary	-0.27	0.00	0.76	-0.25	0.00	0.78
		Ages 25-30			Ages 25-30	
Missing	-2.79	0.00	0.06	-2.87	0.00	0.06
Primary/lower secondary	-0.17	0.00	0.85	-0.18	0.00	0.84
Upper secondary	0		1	0		1
Short post-secondary	0.03	0.00	1.03	0.08	0.00	1.08
Long post-secondary	-0.06	0.00	0.94	0.06	0.00	1.07
		Ages 31-45			Ages 31-45	
Missing	-2.48	0.00	0.08	-2.67	0.00	0.07
Primary/lower secondary	-0.39	0.00	0.68	-0.42	0.00	0.66
Upper secondary	0		1	0		1
Short post-secondary	0.28	0.00	1.32	0.33	0.00	1.40
Long post-secondary	0.47	0.00	1.60	0.57	0.00	1.77

Table B. 12: (continued)

	Model 3 with civil status			Model 3 without civil status		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	0.03	0.00	1.03	0.01	0.00	1.01
General	-0.24	0.00	0.79	-0.23	0.00	0.79
Teacher training	0.25	0.00	1.29	0.27	0.00	1.31
Art and media	-0.25	0.00	0.78	-0.24	0.00	0.79
Humanities	-0.37	0.00	0.69	-0.40	0.00	0.67
Social sciences, journalism and law	-0.09	0.00	0.91	-0.11	0.00	0.90
Business and administration	0		1	0		1
Natural sciences	-0.05	0.00	0.95	-0.09	0.00	0.91
Engineering and construction	-0.05	0.00	0.95	-0.05	0.00	0.95
Manufacturing and processing	0.03	0.00	1.03	0.03	0.00	1.03
Agriculture, forestry and animal health	-0.01	0.00	0.99	-0.04	0.00	0.96
Health care and welfare	0.21	0.00	1.24	0.23	0.00	1.25
Tech. oriented health care, pharmacy	0.07	0.00	1.07	0.05	0.00	1.05
Personal services	0.01	0.00	1.01	0.00	0.00	1.00
Security services	0.22	0.00	1.25	0.13	0.00	1.14
Educational status						
Missing	0.36	0.00	1.43	0.37	0.00	1.45
Not enrolled						
Enrolled: Ages 16-24	-0.93	0.00	0.40	-0.93	0.00	0.40
Enrolled: Ages 25-30	-0.54	0.00	0.58	-0.57	0.00	0.57
Enrolled: Ages 31-45	-0.05	0.00	0.95	-0.11	0.00	0.89
Civil status						
Missing	-3.30	0.00	0.04			
Single/cohabiting	-1.34	0.00	0.26			
Married	0		1			
Divorced	-0.97	0.00	0.38			
Widowed	-1.35	0.00	0.26			
Municipality type						
Missing	-0.56	0.00	0.57	-2.24	0.00	0.11
Stockholm, Malmö, Gothenburg	-0.23	0.00	0.79	-0.28	0.00	0.75
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.09	0.00	1.10	0.09	0.00	1.09
Log-likelihood of model		-721,615.88			-735,160.74	

Notes: (1) ls=linear spline
(2) Model 3 shows the effects of educational level and educational field only for women who are not enrolled in education.

Table B. 13: First birth - distribution of the exposure time and number of women who contributed to the exposure time by educational field and civil status for women who are not enrolled in education

	Civil status															
	Missing		Single/cohabiting			Married			Divorced			Widowed		
	PY	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}
N.e.: All women	50	6	927,356	90.9	211,072	77,282	7.6	34,588	14,681	1.4	3,947	378	0.0	92
Educational field														
N.e.: Missing	38,177	12,480												
N.e.: General			256,018	93.0	85,953	15,499	5.6	5,994	3,897	1.4	1,066	163	0.1	36
N.e.: Teacher training			45,075	85.9	13,206	6,582	12.5	3,536	815	1.6	274	34	0.1	9
N.e.: Art and media			28,749	93.2	10,242	1,735	5.6	890	374	1.2	128	2	0.0	1
N.e.: Humanities			19,591	88.8	7,430	2,109	9.6	1,169	369	1.7	143	6	0.0	2
N.e.: Social sciences, journalism and law			28,492	86.9	11,239	3,684	11.2	2,170	626	1.9	224	3	0.0	1
N.e.: Business and administration			199,180	90.5	39,774	17,867	8.1	8,005	3,156	1.4	818	42	0.0	12
N.e.: Natural sciences			20,621	89.5	5,977	2,107	9.1	1,154	319	1.4	106	2	0.0	1
N.e.: Engineering and construction			37,238	88.2	9,507	4,267	10.1	2,212	733	1.7	223	15	0.0	4
N.e.: Manufacturing and processing			13,306	90.2	2,929	1,141	7.7	466	306	2.1	75	11	0.1	1
N.e.: Agriculture, forestry and animal health			13,467	92.9	3,670	888	6.1	397	134	0.9	46	42	0.3	19
N.e.: Health care and welfare			153,447	90.1	38,605	14,307	8.4	6,646	2,498	1.5	717	0	0.0	0
N.e.: Tech. oriented health care and pharmacy			6,216	87.7	1,585	786	11.1	423	86	1.2	32	1	0.0	1
N.e.: Personal services			67,095	91.8	14,809	4,929	6.7	1,847	1,054	1.4	274	56	0.1	11
N.e.: Security services			2,149	88.4	536	187	7.7	110	95	3.9	20	0	0.0	0

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Percentages sum up to 100 per cent within rows (excluding the porportion of women with missing information).
(3) Table does not include enrolled women and women with missing information on educational status.

Table B. 14: Summary of event history models for the transition to a second child

Model 1: Main effects of all variables.

Model 2: Effects of educational level and educational field only for those who are not enrolled in education.

Model 3: Effects of educational level and educational field only for those who are not enrolled in education and age at previous birth as categorical variable.

Model 4: Effect of educational field by women's educational level for those who are not enrolled in education.

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Time since previous birth (ls)												
Constant	-5.74	0.00		-5.77	0.00		-5.92	0.00		-5.79	0.00	
<=0.5 years	6.42	0.00		6.42	0.00		6.43	0.00		6.42	0.00	
0.5-1.0 years	2.57	0.00		2.57	0.00		2.57	0.00		2.57	0.00	
1.0-1.5 years	0.60	0.00		0.60	0.00		0.60	0.00		0.60	0.00	
1.5-2.0 years	-0.40	0.00		-0.41	0.00		-0.41	0.00		-0.40	0.00	
2.0-2.5 years	0.02	0.50		0.02	0.50		0.02	0.51		0.02	0.48	
2.5-4.0 years	-0.37	0.00		-0.37	0.00		-0.37	0.00		-0.37	0.00	
4.0-6.0 years	-0.31	0.00		-0.31	0.00		-0.31	0.00		-0.31	0.00	
6.0-10.0 years	-0.19	0.00		-0.19	0.00		-0.19	0.00		-0.19	0.00	
10.0-15.0 years	-0.19	0.00		-0.18	0.00		-0.18	0.00		-0.18	0.00	
Age at previous birth (ls)												
<=24	0.00	0.40		0.01	0.00		0.23	0.00	1.26	0.01	0.00	
24-29	-0.03	0.00		-0.04	0.00		0.17	0.00	1.19	-0.04	0.00	
29-34	-0.05	0.00		-0.05	0.00		0.00	0.00	1.00	-0.05	0.00	
34-39	-0.16	0.00		-0.16	0.00		-0.45	0.00	0.64	-0.16	0.00	
39+	-0.27	0.00		-0.27	0.00					-0.27	0.00	

Table B. 14: (continued)

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Period (ls)												
1990.5-1991	(1.31	0.00)		(1.26	0.00)		(1.26	0.00)		(1.26	0.00)	
1991-1992	0.15	0.00		0.14	0.00		0.14	0.00		0.14	0.00	
1992-1997	-0.05	0.00		-0.05	0.00		-0.05	0.00		-0.05	0.00	
1997-2005.25	0.02	0.00		0.02	0.00		0.02	0.00		0.02	0.00	
Educational level												
Missing	-0.67	0.00	0.51	-0.61	0.00	0.55	-0.64	0.00	0.53	*Effect of educational field by women's educational level for women who are not enrolled in education (see Table B. 15).*		
Primary/lower secondary	-0.28	0.00	0.76	-0.29	0.00	0.75	-0.30	0.00	0.74			
Upper secondary	0		1	0		1	0		1			
Short post-secondary	0.25	0.00	1.28	0.25	0.00	1.29	0.24	0.00	1.27			
Long post-secondary	0.41	0.00	1.51	0.40	0.00	1.49	0.37	0.00	1.45			
Educational field												
Missing	-0.07	0.01	0.93	-0.05	0.05	0.95	-0.04	0.13	0.96			
General	-0.01	0.68	1.00	0.01	0.65	1.01	0.01	0.68	1.01			
Teacher training	0.00	0.80	1.00	-0.01	0.64	0.99	0.01	0.68	1.01			
Art and media	-0.19	0.00	0.82	-0.17	0.00	0.84	-0.17	0.00	0.85			
Humanities	-0.17	0.00	0.84	-0.14	0.00	0.87	-0.14	0.00	0.87			
Social sciences, journalism and law	-0.12	0.00	0.89	-0.09	0.00	0.91	-0.09	0.00	0.91			
Business and administration	0		1	0		1	0		1			
Natural sciences	-0.03	0.20	0.97	-0.02	0.41	0.98	-0.01	0.55	0.99			
Engineering and construction	-0.06	0.00	0.94	-0.06	0.00	0.94	-0.05	0.00	0.95			
Manufacturing and processing	-0.05	0.09	0.95	-0.07	0.02	0.94	-0.07	0.02	0.94			
Agriculture, forestry and animal health	0.08	0.01	1.08	0.08	0.01	1.08	0.08	0.01	1.08			
Health care and welfare	0.05	0.00	1.05	0.05	0.00	1.05	0.05	0.00	1.05			
Tech. oriented health care, pharmacy	0.04	0.17	1.05	0.02	0.56	1.02	0.02	0.53	1.02			
Personal services	-0.10	0.00	0.91	-0.09	0.00	0.91	-0.09	0.00	0.91			
Security services	-0.09	0.14	0.92	-0.09	0.14	0.92	-0.09	0.12	0.91			

Table B. 14: (continued)

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational status												
Missing	0.51	0.00	1.66	0.48	0.00	1.61	0.47	0.00	1.61	0.49	0.00	1.62
Not enrolled	0		1									
Enrolled	-0.25	0.00	0.78	-0.23	0.00	0.79	-0.23	0.00	0.79	-0.22	0.00	0.80
Civil status												
Missing	0.72	0.85	2.06	0.66	0.85	1.94	0.61	0.90	1.84	0.68	0.84	1.97
Single/cohabiting	-0.41	0.00	0.67	-0.41	0.00	0.66	-0.41	0.00	0.66	-0.41	0.00	0.66
Married	0		1	0		1	0		1	0		1
Divorced	-0.67	0.00	0.51	-0.68	0.00	0.51	-0.68	0.00	0.51	-0.68	0.00	0.51
Widowed	-1.02	0.00	0.36	-1.02	0.00	0.36	-1.03	0.00	0.36	-1.03	0.00	0.36
Municipality type												
Missing	-0.92	0.14	0.40	-0.93	0.13	0.39	-0.90	0.13	0.41	-0.92	0.14	0.40
Stockholm, Malmö, Gothenburg	-0.12	0.00	0.89	-0.12	0.00	0.89	-0.13	0.00	0.88	-0.12	0.00	0.88
Other urban municipalities	0		1	0		1	0		1	0		1
Sparsely populated rural municipalities	0.067	0.00	1.07	0.07	0.00	1.07	0.07	0.00	1.07	0.07	0.00	1.07
Log-likelihood of model	-464,536.65			-464,672.52			-466,646.44			-464,674.56		

Notes: (1) ls=linear spline.

(2) For the period spline, we set nodes at the beginning of 1991, 1992 and 1997. Our models show an exceedingly strong positive gradient for the period July 1990 to January 1991. However, we believe that this effect is caused by our data/model structure, rather than by real demographic behavior. During this time period, the educational status of all women in the data is "missing" (for an explanation see note 2 in Table B. 1). If we exclude the variable educational status from the model, the strong positive gradient of the first period spline segment disappears.

(3) Models 2, 3 and 4 show the effects of educational level and educational field only for women who are out of education.

(4) In model 3, we inserted age at previous birth as a time-constant categorcial variable instead of a linear spline. The age categories are: 16-23, 24-28, 29-33, 34+.

Table B. 15: Second birth, Model 4 - the effect of educational field by educational level for women who are not enrolled in education

	Educational level														
	N.e.: Missing			N.e.: Primary/lower secondary			N.e.: Upper secondary			N.e.: Short post-secondary			N.e.: Long post-secondary		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field															
N.e.: Missing	-0.082	0.00	0.92												
N.e.: General				-0.28	0.00	0.76	0.01	0.29	1.01	0.30	0.58	1.35	-	-	-
N.e.: Teacher training				-	-	-	0.16	0.35	1.18	0.26	0.00	1.29	0.38	0.00	1.46
N.e.: Art and media				-	-	-	-0.15	0.00	0.86	0.08	0.19	1.09	0.13	0.23	1.14
N.e.: Humanities				-	-	-	0.16	0.73	1.17	0.11	0.00	1.11	0.33	0.00	1.39
N.e.: Social sciences, journalism and law				-	-	-	-0.42	0.44	0.66	0.19	0.00	1.21	0.27	0.00	1.30
N.e.: Business and administration				-	-	-	0.00		1	0.29	0.00	1.33	0.47	0.00	1.59
N.e.: Natural sciences				-	-	-	0.01	0.80	1.01	0.27	0.00	1.31	0.30	0.00	1.35
N.e.: Engineering and construction				-	-	-	-0.08	0.01	0.92	0.18	0.00	1.20	0.40	0.00	1.50
N.e.: Manufacturing and processing				-	-	-	-0.05	0.14	0.96	0.02	0.85	1.02	0.28	0.13	1.33
N.e.: Agriculture, forestry and animal health				-	-	-	0.08	0.01	1.09	0.39	0.00	1.47	0.46	0.00	1.59
N.e.: Health care and welfare				-	-	-	0.07	0.00	1.07	0.27	0.00	1.32	0.49	0.00	1.64
N.e.: Tech. oriented health care and pharmacy				-	-	-	0.02	0.86	1.02	0.29	0.00	1.34	0.37	0.00	1.44
N.e.: Personal services				-	-	-	-0.09	0.00	0.91	0.34	0.00	1.40	0.25	0.79	1.28
N.e.: Security services				-	-	-	-0.15	0.48	0.86	0.18	0.00	1.20	-0.34	0.86	0.71

Note: The full model is included in Table B 14, Model 4.

Table B. 16: Second birth, Model 4 - distribution of the exposure time and number of women that contributed to the exposure time by educational field and educational level for women who are not enrolled in education

	Educational level									
	N.e.: Missing		N.e.: Primary/ lower secondary		N.e.: Upper secondary		N.e.: Short post-secondary		N.e.: Long post-secondary	
	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}
Educational field										
N.e.: Missing	7,197	3,397								
N.e.: General			52,222	15,891	37,756	14,391	11	12	-	-
N.e.: Teacher training			-		102	43	22,848	9,945	3,322	1,722
N.e.: Art and media			-		4,435	1,957	1,228	571	524	201
N.e.: Humanities			-		24	12	4,381	2,266	344	186
N.e.: Social sciences, journalism and law			-		28	13	5,922	3,205	3,006	1,421
N.e.: Business and administration			-		66,914	21,785	13,651	5,784	1,105	686
N.e.: Natural sciences			-		1,787	639	3,456	1,661	1,472	766
N.e.: Engineering and construction			-		5,900	1,850	5,227	2,328	2,936	1,483
N.e.: Manufacturing and processing			-		5,403	1,834	272	104	113	59
N.e.: Agriculture, forestry and animal health			-		3,661	1,462	248	126	478	235
N.e.: Health care and welfare			-		60,047	21,559	21,515	9,346	2,017	1,104
N.e.: Tech. oriented health care and pharmacy			-		527	176	2,165	891	254	120
N.e.: Personal services			-		31,709	9,917	1,007	503	6	4
N.e.: Security services			-		151	35	990	350	11	5

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Categories in which N_{PY} is smaller than 50 are printed in grey.

Table B. 17: Comparison between a second birth model that includes civil status as a control variable and a second birth model where civil status is excluded

	Model 2 with civil status			Model 2 without civil status		
	β	p-value	exp(β)	β	p-value	exp(β)
Time since previous birth (ls)						
Constant	-5.77	0.00		-6.11	0.00	
<=0.5 years	6.42	0.00		6.45	0.00	
0.5-1.0 years	2.57	0.00		2.59	0.00	
1.0-1.5 years	0.60	0.00		0.61	0.00	
1.5-2.0 years	-0.41	0.00		-0.40	0.00	
2.0-2.5 years	0.02	0.00		0.02	0.58	
2.5-4.0 years	-0.37	0.50		-0.38	0.00	
4.0-6.0 years	-0.31	0.00		-0.32	0.00	
6.0-10.0 years	-0.19	0.00		-0.19	0.00	
10.0-15.0 years	-0.18	0.00		-0.18	0.00	
Age at previous birth (ls)						
<=24	0.01	0.00		0.02	0.00	
24-29	-0.04	0.00		-0.02	0.00	
29-34	-0.05	0.00		-0.05	0.00	
34-39	-0.16	0.00		-0.16	0.00	
39+	-0.27	0.00		-0.27	0.00	
Period (ls)						
1990.5-1991	1.26	0.00		1.25	0.00	
1991-1992	0.14	0.00		0.11	0.00	
1992-1997	-0.05	0.00		-0.06	0.00	
1997-2005.25	0.02	0.00		0.02	0.00	
Educational level						
Missing	-0.61	0.00	0.55	-0.57	0.00	0.56
Primary/lower secondary	-0.29	0.00	0.75	-0.33	0.00	0.72
Upper secondary	0		1	0		1
Short post-secondary	0.25	0.00	1.29	0.32	0.00	1.37
Long post-secondary	0.40	0.00	1.49	0.53	0.00	1.70

Table B. 17: (continued)

	Model 2 with civil status			Model 2 without civil status		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	-0.05	0.05	0.95	-0.09	0.00	0.92
General	0.01	0.65	1.01	0.01	0.64	1.01
Teacher training	-0.01	0.64	0.99	-0.04	0.01	0.96
Art and media	-0.17	0.00	0.84	-0.19	0.00	0.83
Humanities	-0.14	0.00	0.87	-0.15	0.00	0.86
Social sciences, journalism and law	-0.09	0.00	0.91	-0.11	0.00	0.90
Business and administration	0		1	0		1
Natural sciences	-0.02	0.41	0.98	-0.04	0.14	0.96
Engineering and construction	-0.06	0.00	0.94	-0.07	0.00	0.93
Manufacturing and processing	-0.07	0.02	0.94	-0.08	0.00	0.92
Agriculture, forestry and animal health	0.08	0.01	1.08	0.04	0.17	1.04
Health care and welfare	0.05	0.00	1.05	0.02	0.01	1.02
Tech. oriented health care, pharmacy	0.02	0.56	1.02	0.01	0.69	1.01
Personal services	-0.09	0.00	0.91	-0.12	0.00	0.89
Security services	-0.09	0.14	0.92	-0.13	0.02	0.87
Educational status						
Missing	0.48	0.00	1.61	0.47	0.00	1.60
Not enrolled						
Enrolled	-0.23	0.00	0.79	-0.24	0.00	0.78
Civil status						
Missing	0.66	0.85	1.94			
Single/cohabiting	-0.41	0.00	0.66			
Married	0		1			
Divorced	-0.68	0.00	0.51			
Widowed	-1.02	0.00	0.36			
Municipality type						
Missing	-0.93	0.13	0.39	-0.56	0.33	0.57
Stockholm, Malmö, Gothenburg	-0.12	0.00	0.89	-0.13	0.00	0.88
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.07	0.00	1.07	0.05	0.00	1.05
Log-likelihood of model		-464,672.52			-466,646.44	

Notes: (1) ls=linear spline
(2) Model 2 shows the effects of educational level and educational field only for women who are out of education.

Table B. 18: Second birth - distribution of the exposure time and number of women that contributed to the exposure time by educational level and civil status for women who are not enrolled in education

	Civil status														
	Missing		Single/cohabiting			Married			Divorced			Widowed			
	PY	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	
Educational level															
N.e.: Missing	805	785													
N.e.: Primary/lower sec.			39,905	76.4	12,982	8,845	16.9	3,771	3,429	6.6	1,032	43	0.1	15	
N.e.: Upper secondary			156,002	69.5	57,278	57,702	25.7	26,060	10,659	4.7	3,077	178	0.1	50	
N.e.: Short post-sec.			43,756	52.6	20,702	35,403	42.5	18,263	3,914	4.7	1,288	139	0.2	32	
N.e.: Long post-sec.			5,812	37.3	3,251	9,150	58.7	5,186	600	3.8	240	32	0.2	6	

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Percentages sum up to 100 per cent within rows (excluding the porportion of women with missing information).
(3) Table does not include enrolled women and women with missing information on educational status.

Table B. 19: Summary of event history models for the transition to a third child

Model 1: Stepwise model - time since first birth (baseline), and educational field at first birth

Model 2: Stepwise model - time since first birth (baseline), women's current age, and educational field at first birth

Model 3: Stepwise model - time since first birth (baseline), women's current age, educational field at first birth, and educational level

Model 4: Stepwise model - time since first birth (baseline), women's current age, educational field at first birth, educational level, civil status, number of children, municipality type, and period

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Time since first birth (ls)												
Constant	-5.35	0.00		-7.63	0.44		-7.10	0.47		-7.33	0.45	
<=1 year	-0.47	0.00		-0.47	0.00		-0.47	0.00		-0.49	0.00	
1-2 years	0.39	0.00		0.37	0.00		0.38	0.00		0.48	0.00	
2-5 years	0.15	0.00		0.16	0.00		0.16	0.00		0.21	0.00	
5-6 years	0.31	0.00		0.34	0.00		0.33	0.00		0.28	0.00	
6-7 years	0.11	0.21		0.14	0.11		0.14	0.13		0.10	0.25	
7-8 years	0.02	0.80		0.07	0.48		0.06	0.56		-0.02	0.81	
8-9 years	-0.06	0.52		-0.02	0.79		-0.03	0.76		-0.06	0.48	
9+ years	0.05	0.16		0.10	0.01		0.09	0.01		0.11	0.00	
Women's current age (ls)												
<=18				1.28	0.82		1.25	0.82		1.27	0.00	
18-19				0.88	0.64		0.89	0.64		0.86	0.00	
19-20				-1.21	0.15		-1.30	0.12		-1.24	0.00	
20-21				-0.92	0.11		-1.05	0.07		-1.25	0.00	
21-23				0.41	0.01		0.34	0.03		0.54	0.00	
23-31				0.04	0.00		0.04	0.00		0.24	0.00	
31-45				-0.07	0.00		-0.06	0.00		-0.14	0.00	
45+				-0.15	0.01		-0.15	0.01		0.19	0.00	

Table B. 19: (continued)

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Period (ls)												
1990.5-1991	[1.71	0.00]		[1.71	0.00]		[1.70	0.00]		[1.71	0.00]	
1991-1992	0.12	0.01		0.12	0.01		0.12	0.01		0.12	0.01	
1992-1996	-0.15	0.00		-0.15	0.00		-0.15	0.00		-0.15	0.00	
1996-2005.25	0.02	0.00		0.02	0.00		0.02	0.00		0.02	0.00	
Educational level												
Missing	-0.06	0.66	0.94	0.24	0.13	1.27	0.34	0.03	1.41	*Effect of educational field by women's educational level for women who are not enrolled in education (see TableB. 20).*		
Primary/lower secondary	0.04	0.12	1.04	0.04	0.15	1.04	0.11	0.00	1.12			
Upper secondary	0		1	0		1	0		1			
Short post-secondary	0.29	0.00	1.33	0.31	0.00	1.36	0.27	0.00	1.31			
Long post-secondary	0.69	0.00	2.00	0.69	0.00	2.00	0.63	0.00	1.88			
Educational field												
Missing	0.16	0.00	1.17	0.14	0.01	1.15	0.19	0.00	1.21			
General	0.16	0.00	1.17	0.15	0.00	1.17	0.15	0.00	1.16			
Teacher training	0.14	0.00	1.15	0.12	0.00	1.13	0.15	0.00	1.16			
Art and media	0.14	0.01	1.15	0.14	0.02	1.15	0.15	0.01	1.17			
Humanities	0.18	0.00	1.20	0.24	0.00	1.27	0.24	0.00	1.27			
Social sciences, journalism and law	-0.02	0.61	0.98	0.02	0.70	1.02	0.03	0.53	1.03			
Business and administration	0		1	0		1	0		1			
Natural sciences	-0.01	0.88	0.99	-0.01	0.79	0.99	0.00	0.93	1.00			
Engineering and construction	0.07	0.04	1.07	0.06	0.10	1.06	0.08	0.03	1.08			
Manufacturing and processing	0.17	0.00	1.19	0.18	0.00	1.20	0.20	0.00	1.22			
Agriculture, forestry and animal health	0.47	0.00	1.60	0.48	0.00	1.61	0.49	0.00	1.64			
Health care and welfare	0.18	0.00	1.19	0.18	0.00	1.19	0.19	0.00	1.21			
Tech. oriented health care, pharmacy	0.04	0.51	1.04	0.04	0.55	1.04	0.05	0.47	1.05			
Personal services	0.11	0.00	1.12	0.11	0.00	1.11	0.12	0.00	1.13			
Security services	-0.03	0.78	0.97	-0.06	0.62	0.94	-0.07	0.57	0.94			

Table B. 19: (continued)

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational status												
Missing	0.52	0.00	1.68	0.69	0.00	1.99	0.71	0.00	2.04	0.70	0.00	2.01
Not enrolled	0	0	1									
Enrolled	-0.10	0.00	0.90	0.13	0.00	1.14	0.17	0.00	1.19	0.14	0.00	1.15
Civil status												
Missing	0.55	0.53	1.72	0.51	0.56	1.67	0.66	0.45	1.94	0.62	0.47	1.86
Single/cohabiting	-0.18	0.00	0.84	-0.18	0.00	0.84	-0.16	0.00	0.85	-0.18	0.00	0.84
Married	0		1	0		1	0		1	0		1
Divorced	0.38	0.00	1.47	0.38	0.00	1.46	0.39	0.00	1.48	0.38	0.00	1.46
Widowed	-0.05	0.78	0.96	-0.05	0.78	0.96	-0.05	0.75	0.95	-0.04	0.80	0.96
Municipality type												
Missing	1.45	0.12	4.24	1.49	0.11	4.45	1.43	0.13	4.16	1.46	0.11	4.32
Stockholm, Malmö, Gothenburg	-0.07	0.00	0.93	-0.07	0.00	0.93	-0.09	0.00	0.92	-0.07	0.00	0.93
Other urban municipalities	0		1	0		1	0		1	0		1
Sparsely populated rural municipalities	0.16	0.00	1.17	0.16	0.00	1.17	0.17	0.00	1.18	0.16	0.00	1.17
Log-likelihood of model	-216,310.52			-216,326.24			-216,648.41			-216,304.63		

Notes: (1) ls=linear spline.

(2) For the period spline, we set nodes at the beginning of 1991, 1992 and 1996. Our models show an exceedingly strong positive gradient for the period July 1990 to January 1991. However, we believe that this effect is caused by our data/model structure, rather than by real demographic behavior. During this time period, the educational status of all women in the data is "missing" (for an explanation see note 2 in Table B. 1). If we exclude the variable educational status from the model, the strong positive gradient of the first period spline segment disappears.

(3) Models 2, 3, and 4 show the effects of educational level and educational field only for women who are out of education.

(3) In model 3, we inserted age at previous birth as a time-constant categorcial variable instead of a linear spline. The age categories are: 16-24, 22-28, 29-34, 35+.

Table B. 20: Third birth, Model 4 - the effect of educational field by educational level for women who are not enrolled in education

	Educational level														
	N.e.: Missing			N.e.: Primary/lower secondary			N.e.: Upper secondary			N.e.: Short post-secondary			N.e.: Long post-secondary		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field															
N.e.: Missing	0.19	0.00	1.21												
N.e.: General				0.20	0.00	1.22	0.16	0.00	1.17	1.87	0.06	6.46	-	-	-
N.e.: Teacher training				-	-	-	0.60	0.04	1.81	0.43	0.00	1.54	0.84	0.00	2.33
N.e.: Art and media				-	-	-	0.18	0.01	1.19	0.55	0.00	1.74	0.50	0.01	1.65
N.e.: Humanities				-	-	-	1.00	0.00	2.71	0.55	0.00	1.74	0.86	0.00	2.35
N.e.: Social sciences, journalism and law				-	-	-	0.01	0.99	1.01	0.39	0.00	1.48	0.65	0.00	1.91
N.e.: Business and administration				-	-	-	0		1	0.34	0.00	1.41	0.84	0.00	2.31
N.e.: Natural sciences				-	-	-	0.11	0.27	1.11	0.31	0.00	1.36	0.56	0.00	1.75
N.e.: Engineering and construction				-	-	-	0.17	0.00	1.19	0.27	0.00	1.31	0.71	0.00	2.03
N.e.: Manufacturing and processing				-	-	-	0.19	0.00	1.21	0.37	0.11	1.45	0.94	0.00	2.55
N.e.: Agriculture, forestry and animal health				-	-	-	0.48	0.00	1.62	1.09	0.00	2.99	1.08	0.00	2.93
N.e.: Health care and welfare				-	-	-	0.17	0.00	1.19	0.49	0.00	1.63	1.05	0.00	2.86
N.e.: Tech. oriented health care and pharmacy				-	-	-	0.07	0.66	1.08	0.37	0.00	1.45	0.50	0.05	1.65
N.e.: Personal services				-	-	-	0.11	0.00	1.12	0.47	0.00	1.60	1.99	0.46	7.35
N.e.: Security services				-	-	-	-0.27	0.52	0.77	0.28	0.02	1.32	0.67	0.49	1.95

Note: The full model is included in Table B 19, Model 4.

Table B. 21: Third birth, Model 4 - distribution of the exposure time and number of women that contributed to the exposure time by educational field and educational level for women who are not enrolled in education

	Educational level									
	N.e.: Missing		N.e.: Primary/ lower secondary		N.e.: Upper secondary		N.e.: Short post-secondary		N.e.: Long post-secondary	
	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}
Educational field										
N.e.: Missing	6,530	2,259								
N.e.: General			67,755	13,600	63,000	13,197	6	48	-	-
N.e.: Teacher training			-	-	182	49	45,381	9,454	5,487	1,556
N.e.: Art and media			-	-	3,902	1,033	1,254	385	620	141
N.e.: Humantities			-	-	69	17	4,931	1,541	548	179
N.e.: Social sciences, journalism and law			-	-	61	18	7,238	2,430	4,197	1,053
N.e.: Business and administration			-	-	119,217	19,811	24,076	4,907	1,109	406
N.e.: Natural sciences			-	-	2,658	551	5,631	1,362	1,972	534
N.e.: Engineering and construction			-	-	9,638	1,783	7,916	1,867	4,575	1,064
N.e.: Manufacturing and processing			-	-	7,832	1,598	425	100	205	50
N.e.: Agriculture, forestry and animal health			-	-	5,559	1,188	335	92	761	188
N.e.: Health care and welfare			-	-	116,423	21,412	42,207	9,110	4,270	1,269
N.e.: Tech. oriented health care and pharmacy			-	-	1,027	189	4,585	882	408	91
N.e.: Personal services			-	-	54,472	9,752	1,315	345	4	3
N.e.: Security services			-	-	233	34	1,691	306	25	11

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Categories in which N_{PY} is smaller than 50 are printed in grey.

Table B. 22: Comparison between a third birth model that includes civil status as a control variable and a third birth model where civil status is excluded

	Model 2 with civil status			Model 2 without civil status		
	β	p-value	exp(β)	β	p-value	exp(β)
Time since previous birth (ls)						
Constant	-5.50	0.00		-5.65	0.00	
<=0.5 years	5.83	0.00		5.84	0.00	
0.5-1.0 years	1.41	0.00		1.42	0.00	
1.0-1.5 years	0.07	0.31		0.08	0.23	
1.5-2.0 years	-0.59	0.00		-0.58	0.00	
2.0-2.5 years	-0.14	0.07		-0.13	0.10	
2.5-3.0 years	0.23	0.00		0.25	0.00	
3.0-7.0 years	-0.20	0.00		-0.18	0.00	
7.0-10.0 years	-0.27	0.00		-0.26	0.00	
10.0-15.0 years	-0.24	0.00		-0.23	0.00	
Age at previous birth (ls)						
<=21	-0.06	0.09		-0.05	0.18	
21-25	-0.15	0.00		-0.15	0.00	
25-29	-0.12	0.00		-0.12	0.00	
29-35	-0.08	0.00		-0.07	0.00	
35+	-0.11	0.00		-0.10	0.00	
Period (ls)						
1990.5-1991	(1.71	0.00)		(1.70	0.00)	
1991-1992	0.12	0.01		0.12	0.01	
1992-1996	-0.15	0.00		-0.15	0.00	
1996-2005.25	0.02	0.00		0.02	0.00	
Educational level						
Missing	0.24	0.13	1.27	0.21	0.17	1.24
Primary/lower secondary	0.04	0.15	1.04	0.03	0.22	1.03
Upper secondary	0		1	0		1
Short post-secondary	0.31	0.00	1.36	0.33	0.00	1.39
Long post-secondary	0.69	0.00	2.00	0.74	0.00	2.09

Table B. 22: (continued)

	Model 2 with civil status			Model 2 without civil status		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	0.14	0.01	1.15	0.13	0.02	1.14
General	0.15	0.00	1.17	0.16	0.00	1.17
Teacher training	0.12	0.00	1.13	0.11	0.00	1.12
Art and media	0.14	0.02	1.15	0.15	0.01	1.16
Humanities	0.24	0.00	1.27	0.24	0.00	1.27
Social sciences, journalism and law	0.02	0.70	1.02	0.02	0.65	1.02
Business and administration	0		1	0		1
Natural sciences	-0.01	0.79	0.99	-0.02	0.72	0.98
Engineering and construction	0.06	0.10	1.06	0.05	0.14	1.05
Manufacturing and processing	0.18	0.00	1.20	0.18	0.00	1.20
Agriculture, forestry and animal health	0.48	0.00	1.61	0.47	0.00	1.60
Health care and welfare	0.18	0.00	1.19	0.17	0.00	1.18
Tech. oriented health care, pharmacy	0.04	0.55	1.04	0.03	0.66	1.03
Personal services	0.11	0.00	1.11	0.10	0.00	1.10
Security services	-0.06	0.62	0.94	-0.04	0.71	0.96
Educational status						
Missing	0.69	0.00	1.99	0.69	0.00	2.00
Not enrolled						
Enrolled	0.13	0.00	1.14	0.14	0.00	1.15
Civil status						
Missing	0.51	0.56	1.67			
Single/cohabiting	-0.18	0.00	0.84			
Married	0		1			
Divorced	0.38	0.00	1.46			
Widowed	-0.05	0.78	0.96			
Municipality type						
Missing	1.49	0.11	4.45	1.89	0.07	6.62
Stockholm, Malmö, Gothenburg	-0.07	0.00	0.93	-0.06	0.00	0.94
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.16	0.00	1.17	0.15	0.00	1.16
Log-likelihood of model	-216,326.24			-216,648.41		

Notes: (1) ls=linear spline
(2) Model 2 shows the effects of educational level and educational field only for women who are out of education.

Table B. 23: Third birth - distribution of the exposure time and number of women that contributed to the exposure time by educational level and civil status for women who are not enrolled in education

	Civil status														
	Missing		Single/cohabiting			Married			Divorced			Widowed			
	PY	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	PY	in %	N_{PY}	
Educational level															
N.e.: Missing	550	525													
N.e.: Primary/lower sec.			34,417	50.8	8,381	26,589	39.2	6,204	6,611	9.8	1,770	138	0.2	44	
N.e.: Upper secondary			167,595	43.0	38,177	196,792	50.5	38,754	24,775	6.4	6,790	507	0.1	123	
N.e.: Short post-sec.			45,016	30.5	12,320	94,863	64.3	21,332	7,411	5.0	2,370	279	0.2	76	
N.e.: Long post-sec.			4,996	20.7	1,659	18,035	74.6	4,941	1,118	4.6	404	42	0.2	13	

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.
(2) Percentages sum up to 100 per cent within rows (excluding the porportion of women with missing information).
(3) Table does not include enrolled women and women with missing information on educational status.

Table B. 24: First birth - comparison between a first birth model that disregards unobserved heterogeneity and a first birth model in which unobserved heterogeneity is controlled for

	Without unobserved heterogeneity			With unobserved heterogeneity		
	β	p-value	exp(β)	β	p-value	exp(β)
Woman's age in years (ls)						
Constant	-4.23	0.00		-4.19	0.00	
16-20	0.46	0.00		0.46	0.00	
20-26	0.11	0.00		0.12	0.00	
26-30	0.04	0.00		0.06	0.00	
30-37	-0.15	0.00		-0.13	0.00	
37-41	-0.33	0.00		-0.33	0.00	
41-45	-0.68	0.00		-0.68	0.00	
Period (ls)						
1990.5-1991	(1.63	0.00)		(1.58	0.00)	
1991-1992	0.02	0.42		0.03	0.17	
1992-1998	-0.05	0.00		-0.05	0.00	
1998-2005.25	0.04	0.00		0.04	0.00	
Educational level		Ages 16-24			Ages 16-24	
Missing	-0.66	0.00	0.52	-0.66	0.00	0.52
Primary/lower secondary	0.55	0.00	1.73	0.58	0.00	1.79
Upper secondary	0		1	0		1
Short/long post-secondary	-0.27	0.00	0.76	-0.30	0.00	0.74
		Ages 25-30			Ages 25-30	
Missing	-2.80	0.00	0.06	-2.87	0.00	0.06
Primary/lower secondary	-0.17	0.00	0.85	-0.14	0.00	0.87
Upper secondary	0		1	0		1
Short post-secondary	0.03	0.02	1.03	-0.01	0.25	0.99
Long post-secondary	-0.06	0.00	0.94	-0.11	0.00	0.89
		Ages 31-45			Ages 31-45	
Missing	-2.48	0.00	0.08	-2.62	0.00	0.07
Primary/lower secondary	-0.39	0.00	0.68	-0.42	0.00	0.66
Upper secondary	0		1	0		1
Short post-secondary	0.28	0.00	1.32	0.27	0.00	1.30
Long post-secondary	0.47	0.00	1.60	0.44	0.00	1.56

Table B. 24: (continued)

	Without unobserved heterogeneity			With unobserved heterogeneity		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	0.03	0.00	1.03	0.03	0.22	1.03
General	-0.24	0.00	0.79	-0.26	0.00	0.77
Teacher training	0.25	0.00	1.29	0.30	0.00	1.35
Art and media	-0.25	0.00	0.78	-0.27	0.00	0.77
Humanities	-0.37	0.00	0.69	-0.39	0.00	0.68
Social sciences, journalism and law	-0.09	0.00	0.91	-0.10	0.00	0.90
Business and administration	0		1	0		1
Natural sciences	-0.05	0.04	0.95	-0.04	0.08	0.96
Engineering and construction	-0.05	0.01	0.95	-0.04	0.03	0.96
Manufacturing and processing	0.03	0.27	1.03	0.03	0.29	1.03
Agriculture, forestry and animal health	-0.01	0.65	0.99	-0.01	0.84	0.99
Health care and welfare	0.21	0.00	1.24	0.24	0.00	1.28
Tech. oriented health care, pharmacy	0.07	0.06	1.07	0.08	0.05	1.08
Personal services	0.01	0.40	1.01	0.03	0.09	1.03
Security services	0.22	0.00	1.25	0.24	0.00	1.27
Educational status						
Missing	0.34	0.00	1.41	0.32	0.00	1.37
Not enrolled						
Enrolled: Ages 16-24	-0.93	0.00	0.40	-0.93	0.00	0.40
Enrolled: Ages 25-30	-0.54	0.00	0.58	-0.56	0.00	0.57
Enrolled: Ages 31-45	-0.05	0.03	0.95	-0.08	0.00	0.93
Civil status						
Single/cohabiting	-1.34	0.00	0.26	-1.47	0.00	0.23
Married	0		1	0		1
Divorced	-0.97	0.00	0.38	-0.99	0.00	0.37
Widowed	-1.35	0.00	0.26	-1.48	0.00	0.23
Municipality type						
Stockholm, Malmö, Gothenburg	-0.23	0.00	0.79	-0.27	0.00	0.77
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.09	0.00	1.10	0.11	0.00	1.12
Log-likelihood of model		-721,628.29			-1,402,085.10	

Notes: (1) ls=linear spline
(2) Models show the effects of educational level and educational field only for women who are out of education.
(3) Due to technical issues, we grouped those with missing information on civil status or municipality into "Single/cohabiting" and "Stockholm, Malmö, Gothenburg", respectively.

Table B. 25: Second birth - comparison between a second birth model that disregards unobserved heterogeneity and a second birth model in which unobserved heterogeneity is controlled for

	Without unobserved heterogeneity			With unobserved heterogeneity		
	β	p-value	exp(β)	β	p-value	exp(β)
Time since previous birth (ls)						
Constant	-5.76	0.00		-6.00	0.00	
<=0.5 years	6.41	0.00		6.42	0.00	
0.5-1.0 years	2.58	0.00		2.62	0.00	
1.0-1.5 years	0.60	0.00		0.70	0.00	
1.5-2.0 years	-0.41	0.00		-0.32	0.00	
2.0-2.5 years	0.02	0.50		0.10	0.00	
2.5-4.0 years	-0.37	0.00		-0.32	0.00	
4.0-6.0 years	-0.31	0.00		-0.29	0.00	
6.0-10.0 years	-0.19	0.00		-0.18	0.00	
10.0-15.0 years	-0.18	0.00		-0.17	0.00	
Age at previous birth (ls)						
<=24	0.01	0.00		0.02	0.00	
24-29	-0.04	0.00		-0.03	0.00	
29-34	-0.05	0.00		-0.04	0.00	
34-39	-0.16	0.00		-0.16	0.00	
39+	-0.27	0.00		-0.27	0.00	
Period (ls)						
1990.5-1991	(1.26	0.00)		(1.35	0.00)	
1991-1992	0.14	0.00		0.12	0.00	
1992-1997	-0.05	0.00		-0.07	0.00	
1997-2005.25	0.02	0.00		0.02	0.00	
Educational level						
Missing	-0.61	0.00	0.55	-0.64	0.00	0.53
Primary/lower secondary	-0.29	0.00	0.75	-0.29	0.00	0.75
Upper secondary	0		1	0		1
Short post-secondary	0.25	0.00	1.29	0.25	0.00	1.29
Long post-secondary	0.40	0.00	1.49	0.39	0.00	1.48

Table B. 25: (continued)

	Without unobserved heterogeneity			With unobserved heterogeneity		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	-0.05	0.05	0.95	-0.06	0.04	0.94
General	0.01	0.67	1.01	-0.01	0.70	0.99
Teacher training	-0.01	0.64	0.99	0.00	0.89	1.00
Art and media	-0.17	0.00	0.84	-0.20	0.00	0.82
Humanities	-0.15	0.00	0.86	-0.18	0.00	0.84
Social sciences, journalism and law	-0.09	0.00	0.91	-0.11	0.00	0.89
Business and administration	0		1	0		1
Natural sciences	-0.02	0.43	0.98	-0.02	0.39	0.98
Engineering and construction	-0.06	0.00	0.94	-0.06	0.01	0.95
Manufacturing and processing	-0.07	0.02	0.94	-0.06	0.04	0.94
Agriculture, forestry and animal health	0.08	0.01	1.08	0.08	0.01	1.09
Health care and welfare	0.05	0.00	1.05	0.06	0.00	1.06
Tech. oriented health care, pharmacy	0.02	0.56	1.02	0.03	0.48	1.03
Personal services	-0.09	0.00	0.91	-0.10	0.00	0.91
Security services	-0.09	0.14	0.92	-0.08	0.23	0.93
Educational status						
Missing	0.48	0.00	1.61	0.46	0.00	1.59
Not enrolled						
Enrolled	-0.23	0.00	0.79	-0.25	0.00	0.78
Civil status						
Single/cohabiting	-0.41	0.00	0.66	-0.49	0.00	0.61
Married	0		1	0		1
Divorced	-0.68	0.00	0.51	-0.70	0.00	0.50
Widowed	-1.02	0.00	0.36	-1.11	0.00	0.33
Municipality type						
Stockholm, Malmö, Gothenburg	-0.12	0.00	0.89	-0.15	0.00	0.86
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.07	0.00	1.07	0.08	0.00	1.09
Log-likelihood of model		-464,505.91			-1,402,085.10	

Notes: (1) ls=linear spline
(2) Models show the effects of educational level and educational field only for women who are out of education.
(3) Due to technical issues, we grouped those with missing information on civil status or municipality into "Single/cohabiting" and "Stockholm, Malmö, Gothenburg", respectively.

Table B. 26: Third birth - comparison between a third birth model that disregards unobserved heterogeneity and a third birth model in which unobserved heterogeneity is controlled for

	Without unobserved heterogeneity			With unobserved heterogeneity		
	β	p-value	exp(β)	β	p-value	exp(β)
Time since previous birth (ls)						
Constant	-5.49	0.00		-5.71	0.00	
<=0.5 years	5.80	0.00		5.85	0.00	
0.5-1.0 years	1.42	0.00		1.44	0.00	
1.0-1.5 years	0.07	0.33		0.10	0.12	
1.5-2.0 years	-0.59	0.00		-0.56	0.00	
2.0-2.5 years	-0.14	0.07		-0.12	0.13	
2.5-4.0 years	0.23	0.00		0.26	0.00	
4.0-6.0 years	-0.20	0.00		-0.18	0.00	
6.0-10.0 years	-0.27	0.00		-0.25	0.00	
10.0-15.0 years	-0.24	0.00		-0.22	0.00	
Age at previous birth (ls)						
<=24	-0.06	0.09		-0.05	0.16	
24-29	-0.15	0.00		-0.15	0.00	
29-34	-0.12	0.00		-0.12	0.00	
34-39	-0.08	0.00		-0.06	0.00	
39+	-0.11	0.00		-0.09	0.00	
Period (ls)						
1990.5-1991	1.71	0.00		1.73	0.00	
1991-1992	0.12	0.01		0.12	0.01	
1992-1997	-0.15	0.00		-0.18	0.00	
1997-2005.25	0.02	0.00		0.01	0.00	
Educational level						
Missing	0.24	0.14	1.27	0.24	0.15	1.28
Primary/lower secondary	0.04	0.15	1.04	0.05	0.04	1.05
Upper secondary	0		1	0		1
Short post-secondary	0.31	0.00	1.36	0.30	0.00	1.36
Long post-secondary	0.69	0.00	2.00	0.70	0.00	2.01

Table B. 26: (continued)

	Without unobserved heterogeneity			With unobserved heterogeneity		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	0.14	0.01	1.15	0.14	0.01	1.15
General	0.15	0.00	1.17	0.15	0.00	1.16
Teacher training	0.12	0.00	1.13	0.14	0.00	1.15
Art and media	0.14	0.02	1.15	0.13	0.04	1.14
Humanities	0.24	0.00	1.27	0.23	0.00	1.26
Social sciences, journalism and law	0.02	0.69	1.02	0.01	0.79	1.01
Business and administration	0		1	0		1
Natural sciences	-0.01	0.81	0.99	-0.03	0.62	0.97
Engineering and construction	0.06	0.10	1.06	0.06	0.07	1.07
Manufacturing and processing	0.18	0.00	1.20	0.19	0.00	1.21
Agriculture, forestry and animal health	0.48	0.00	1.61	0.49	0.00	1.63
Health care and welfare	0.17	0.00	1.19	0.19	0.00	1.21
Tech. oriented health care, pharmacy	0.04	0.55	1.04	0.03	0.61	1.04
Personal services	0.11	0.00	1.11	0.12	0.00	1.13
Security services	-0.06	0.62	0.94	-0.05	0.65	0.95
Educational status						
Missing	0.69	0.00	1.99	0.70	0.00	2.01
Not enrolled						
Enrolled	0.13	0.00	1.14	0.13	0.00	1.14
Civil status						
Single/cohabiting	-0.18	0.00	0.84	-0.22	0.00	0.80
Married	0		1	0		1
Divorced	0.38	0.00	1.46	0.41	0.00	1.50
Widowed	-0.04	0.79	0.96	-0.05	0.76	0.95
Municipality type						
Stockholm, Malmö, Gothenburg	-0.07	0.00	0.93	-0.09	0.00	0.91
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.16	0.00	1.17	0.17	0.00	1.19
Standard deviation of the unobserved heterogeneity term (ξ_i)				0.44	0.00	
Log-likelihood of model		-216,270.50			-1,402,085.10	

Notes: *(1) ls=linear spline*
(2) Models show the effects of educational level and educational field only for women who are out of education.
(3) Due to technical issues, we grouped those with missing information on civil status or municipality into "Single/cohabiting" and "Stockholm, Malmö, Gothenburg", respectively.

Appendix C

To CHAPTER 6 - The impact of childbearing on women's risk of educational change

Table C. 1: Composition of the sample for the event history analysis of women's risk of educational change following the transition to motherhood

Time-constant covariates:	Exposures N	Exposures in %		Occurrences N
Educational field at first birth				
General	19,152	19.5		1,746
Teacher training	9,006	9.2		79
Art and media	1,823	1.9		118
Humanities	1,534	1.6		194
Social sciences, journalism and law	3,202	3.3		198
Business and administration	22,558	23.0		980
Natural sciences	2,336	2.4		140
Engineering and construction	4,309	4.4		174
Manufacturing and processing	1,456	1.5		106
Agriculture, forestry and animal health	1,366	1.4		65
Health care and welfare	22,974	23.4		694
Tech. oriented health care and pharmacy	1,011	1.0		49
Personal services	7,083	7.2		397
Security services	331	0.3		12
Time-varying covariates:	**Exposures PY**	**Exposures in %**	**N_{PY}**	**Occurrences N**
Educational level				
Primary/lower secondary	55,859	9.5	9,261	482
Upper secondary	343,432	58.5	55,562	3,461
Short post-secondary	155,787	26.5	28,969	931
Long post-secondary	32,475	5.5	7,153	78
Civil status				
Missing	58	0.0	8	0
Single/cohabiting	308,257	52.5	65,841	2,404
Married	258,272	44.0	50,387	2,261
Divorced	20,386	3.5	6,102	283
Widowed	580	0.1	178	4
Number of children				
One child	296,072	50.4	96,362	2,192
Two children	251,054	42.7	59,941	2,335
Three children	36,725	6.3	11,491	395
Four or more children	3,701	0.6	1,369	30

Table C. 1: (continued)

Time-varying covariates:	Exposures PY	Exposures in %	Exposures N_{PY}	Occurrences N
Municipality type				
Missing	59	0.0	7	1
Stockholm, Malmö, Gothenburg	93,419	15.9	22,544	833
Other urban municipalities	465,425	79.2	80,079	3,912
Sparsely populated rural municipalities	28,649	4.9	5,739	206
Period				
01/1991-06/1993	54,793	9.3	30,509	336
07/1994-06/1999	234,432	39.9	63,160	1,249
07/2000-06/2001	67,827	11.5	70,991	845
07/2001-06/2004	230,501	39.2	91,534	2,522
Woman's current age				
≤ 17	132	0.0	175	1
18	259	0.0	380	6
19	656	0.1	1,060	8
20	1,915	0.3	3,057	6
21-22	13,117	2.2	11,363	53
23-30	237,932	40.5	70,731	1,831
31-44	324,882	55.3	75,732	3,009
45+	8,660	1.5	3,788	38
Sample size				
Total exposures (person years at risk)	587,553			
Total number of individuals in the data set	98,141			
Total occurrences	4,952			

Source: Swedish register data

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY. (2) For the covariate woman's current age - which will be included in our event history model as a piece-wise linear duration spline - Table C. 1 only provides the approximate distribution of exposures and occurrences across spline segments.

Table C. 2: Summary of event history models for women's risk of undergoing a change in educational field after entering motherhood

Model 1: Stepwise model - time since first birth (baseline) and educational field at first birth

Model 2: Stepwise model - time since first birth (baseline), woman's current age and educational field at first birth

Model 3: Stepwise model - time since first birth (baseline), woman's current age, educational field at first birth and educational level

Model 4: Stepwise model - time since first birth (baseline), woman's current age, educational field at first birth, educational level, civil status, number of children, municipality type and period

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Time since first birth (ls)												
Constant	-5.35	0.00		-7.63	0.44		-7.10	0.47		-7.56	0.44	
<=1 year	-0.47	0.00		-0.47	0.00		-0.47	0.00		-0.46	0.00	
1-2 years	0.39	0.00		0.37	0.00		0.38	0.00		0.56	0.00	
2-5 years	0.15	0.00		0.16	0.00		0.16	0.00		0.25	0.00	
5-6 years	0.31	0.00		0.34	0.00		0.33	0.00		0.24	0.00	
6-7 years	0.11	0.21		0.14	0.11		0.14	0.13		0.10	0.25	
7-8 years	0.02	0.80		0.07	0.48		0.06	0.56		-0.04	0.70	
8-9 years	-0.06	0.52		-0.02	0.79		-0.03	0.76		-0.07	0.43	
9+ years	0.05	0.16		0.10	0.01		0.09	0.01		0.13	0.00	
Woman's current age (ls)												
<=18				1.28	0.82		1.25	0.82		1.23	0.00	
18-19				0.88	0.64		0.89	0.64		0.85	0.00	
19-20				-1.21	0.15		-1.30	0.12		-1.28	0.00	
20-21				-0.92	0.11		-1.05	0.07		-1.21	0.00	
21-23				0.41	0.01		0.34	0.03		0.59	0.00	
23-31				0.04	0.00		0.04	0.00		0.27	0.00	
31-45				-0.07	0.00		-0.06	0.00		-0.13	0.00	
45+				-0.15	0.01		-0.15	0.01		0.19	0.00	

Table C. 2: (continued)

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field at first birth												
General	0.79	0.00	2.20	0.77	0.00	2.17	0.95	0.68	2.59	1.00	0.00	2.73
Teacher training	-1.47	0.00	0.23	-1.42	0.00	0.24	-0.97	0.68	0.38	-1.01	0.00	0.36
Art and media	0.92	0.00	2.52	0.98	0.00	2.68	1.05	0.00	2.87	0.98	0.00	2.66
Humanities	1.59	0.00	4.90	1.71	0.00	5.50	2.11	0.00	8.22	2.02	0.00	7.55
Social sciences, journalism and law	0.87	0.00	2.38	1.00	0.00	2.71	1.72	0.00	5.60	1.64	0.00	5.14
Business and administration	0		1	0		1	0		1	0		1
Natural sciences	0.60	0.00	1.83	0.65	0.00	1.92	1.01	0.00	2.74	0.97	0.00	2.65
Engineering and construction	0.11	0.19	1.11	0.12	0.16	1.12	0.46	0.00	1.59	0.44	0.00	1.55
Manufacturing and processing	0.64	0.00	1.90	0.62	0.00	1.85	0.58	0.00	1.78	0.57	0.00	1.77
Agriculture, forestry and animal health	0.23	0.07	1.26	0.25	0.05	1.29	0.32	0.01	1.38	0.36	0.01	1.43
Health care and welfare	-0.35	0.00	0.71	-0.35	0.00	0.70	-0.30	0.00	0.74	-0.29	0.00	0.75
Tech. oriented health care, pharmacy	0.09	0.56	1.09	0.20	0.18	1.22	0.54	0.00	1.72	0.53	0.00	1.70
Personal services	0.24	0.00	1.28	0.21	0.00	1.23	0.15	0.01	1.16	0.16	0.01	1.17
Security services	-0.15	0.61	0.86	-0.07	0.82	0.94	0.25	0.40	1.29	0.21	0.48	1.23
Educational level												
Primary/lower secondary							-0.66	0.00	0.52	-0.86	0.00	0.42
Upper secondary							0		1	0		1
Short post-secondary							-0.45	0.00	0.64	-0.38	0.00	0.68
Long post-secondary							-1.66	0.00	0.19	-1.63	0.00	0.20

Table C. 2: (continued)

	Model 1			Model 2			Model 3			Model 4		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Civil status												
Single/cohabiting										-0.14	0.00	0.87
Married										0		1
Divorced										0.10	0.12	1.10
Widowed										-0.37	0.47	0.69
Number of children												
One child										0.34	0.00	1.40
Two children										0		1
Three children										-0.07	0.19	0.93
Four or more children										-0.56	0.00	0.57
Municipality type												
Stockholm, Malmö, Gothenburg										0.09	0.02	1.09
Other urban municipalities										0		1
Sparsely populated rural municipalities										-0.17	0.02	0.84
Period												
07/1990-06/1994										0.66	0.00	1.93
07/1994-06/1999										0		1
07/2000-06/2001										0.67	0.00	1.96
07/2001-06/2004										0.55	0.00	1.73
Log-likelihood of model		-39,649.52			-39,516.78			-39,303.42			-39,038.35	

Notes: (1) ls=linear spline.

(2) Due to the small number of women who contribute to the exposure time, we grouped women with missing information on civil status together with those who are single or cohabiting. For the same reason, we also grouped women with missing information on municipality type together with those who live in Stockholm, Malmö or Gothenburg.

Table C. 3: Composition of the sample for the event history analysis of the impact of motherhood status on women's risk of undergoing a change in educational field

Time-constant covariates:	Exposures N	Exposures in %		Occurrences N
Educational field in which the previous degree was attained				
General	55,955	31.7		30,672
Teacher training	9,732	5.5		462
Art and media	10,845	6.1		2,617
Humanities	10,131	5.7		5,634
Social sciences, journalism and law	13,237	7.5		5,321
Business and administration	22,076	12.5		5,954
Natural sciences	6,233	3.5		2,826
Engineering and construction	7,438	4.2		1,725
Manufacturing and processing	1,767	1.0		275
Agriculture, forestry and animal health	2,922	1.7		298
Health care and welfare	25,913	14.7		2,986
Tech. oriented health care and pharmacy	983	0.6		96
Personal services	9,303	5.3		1,482
Security services	156	0.1		8
Number of previous changes in educational field				
No previous change	120,905	68.4		43,732
One previous change	40,372	22.8		12,944
Two previous changes	12,010	6.8		2,883
Three or more previous changes	3,404	1.9		797
Time-varying covariates:	**Exposures PY**	**Exposures in %**	**N_{PY}**	**Occurrences N**
Educational level				
Upper secondary	513,817	71.7	116,475	42,973
Short post-secondary	184,633	25.8	47,059	17,257
Long post-secondary	17,742	2.5	5,988	126
Civil status				
Missing	0	0.0	0	0
Single/cohabiting	663,611	92.7	120,273	58,850
Married	48,997	6.8	15,777	1,393
Divorced	3,511	0.5	1,412	110
Widowed	72	0.0	27	3
Motherhood status				
Childless	612,465	85.5	119,518	58,534
Mother	103,726	14.5	28,607	1,822

Table C. 3: (continued)

Time-varying covariates:	Exposures PY	in %	N_{PY}	Occurrences N
Age of first child				
childless	612,465	85.5	119,518	58,534
ages 0-1	41,508	5.8	27,601	470
ages 2-3	27,410	3.8	18,896	525
ages 4-5	16,992	2.4	12,207	385
age 6	5,812	0.8	7,281	151
ages 7+	12,004	1.7	5,738	291
Municipality type				
Missing	5	0.0	1	1
Stockholm, Malmö, Gothenburg	141,183	19.7	37,625	13,326
Other urban municipalities	539,562	75.3	106,387	45,235
Sparsely populated rural municipalities	35,442	4.9	10,720	1,794
Period				
07/1990-06/1995	116,840	16.3	43,907	10,732
07/1995-06/1999	244,600	34.2	75,318	24,698
07/2000-06/2001	69,020	9.6	69,093	6,516
07/2001-06/2002	84,187	11.8	84,269	5,432
07/2002-06/2004	201,544	28.1	106,888	12,978
Woman's current age				
≤ 23	365,860	51.1	119,247	38,039
24-25	130,738	18.3	81,990	12,393
26	51,395	7.2	64,011	3,563
27+	168,199	23.5	57,213	6,361
Sample size				
Total exposures (person years at risk)	716,191			
Total number of educational change episodes	176,691			
Total number of individuals in the data set	120,905			
Total occurrences	60,356			

Source: Swedish register data

Notes: (1) PY=person years at risk, N_{PY}=number of individuals that contributed to PY. (2) Time-constant covariates are constant within educational change episodes, but vary across the different educational change episodes of an individual. (3) The category "childless" appears in two variables (motherhood status, age of first child). In our model we will only include this category with the motherhood status variable. The effect of the age of the first child will only be estimated for those who are mothers. (4) For the variable woman's current age - which will be included in our event history model as a piece-wise linear duration spline - Table C. 1 only provides the approximate distribution of exposures and occurrences across spline segments.

Table C. 4: Summary of event history models for the impact of motherhood status on women's risk of undergoing a change in educational field

Model 1: Main effects of all variables and inclusion of woman-specific term for unobserved heterogeneity

Model 2: Model 1, but interaction between educational field in which the previous degree was attained and motherhood status

Model 3: Model 1, but interaction between educational field in which the previous degree was attained, motherhood status and age of first child

	Model 1			Model 2			Model 3		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Time since attainment of previous degree (ls)									
Constant	-6.38	0.00		-6.63	0.00		-5.70	0.00	
<=2 years	1.01	0.00		1.01	0.00		1.01	0.00	
2-3 years	-0.72	0.00		-0.72	0.00		-0.72	0.00	
3-4 years	-0.05	0.02		-0.05	0.01		-0.05	0.01	
4-5 years	-0.37	0.00		-0.37	0.00		-0.37	0.00	
5-10 years	-0.05	0.00		-0.04	0.00		-0.04	0.00	
10+ years	0.24	0.00		0.27	0.00		0.25	0.00	
Woman's current age (ls)									
<=24	0.24	0.00		0.25	0.00		0.25	0.00	
24-26	0.06	0.00		0.06	0.00		0.06	0.00	
26-27	-0.09	0.01		-0.09	0.00		-0.09	0.01	
27+	0.04	0.00		0.03	0.03		0.03	0.01	

Table C. 4: (continued)

	Model 1			Model 2			Model 3		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field in which the previous degree was attained									
General	1.50	0.00	4.48	*Effect of educational field in which the previous degree was attained by motherhood status (see Table C. 5).*			*Effect of educational field in which the previous degree was attained by motherhood status and age of first child (see Table C.7).*		
Teacher training	-1.28	0.00	0.28						
Art and media	0.43	0.00	1.53						
Humanities	1.29	0.00	3.64						
Social sciences, journalism and law	1.02	0.00	2.78						
Business and administration	0		1						
Natural sciences	1.00	0.06	2.71						
Engineering and construction	0.06	0.00	1.06						
Manufacturing and processing	-0.65	0.00	0.52						
Agriculture, forestry and animal health	-0.76	0.00	0.47						
Health care and welfare	-0.81	0.00	0.44						
Tech. oriented health care and pharmacy	-0.74	0.00	0.48						
Personal services	-0.44	0.09	0.64						
Security services	-0.60	0.00	0.55						
Number of previous changes in educational field									
No previous change	0		1	0		1	0		1
One previous change	-0.63	0.00	0.53	-0.63	0.00	0.53	-0.63	0.00	0.53
Two previous changes	-1.04	0.00	0.35	-1.05	0.00	0.35	-1.05	0.00	0.35
Three or more previous changes	-1.51	0.00	0.22	-1.52	0.00	0.22	-1.53	0.00	0.22
Educational level									
Upper secondary	0		1	0		1	0		1
Short post-secondary	0.20	0.00	1.22	0.20	0.00	1.22	0.19	0.00	1.21
Long post-secondary	-1.98	0.00	0.14 #	-1.97	0.00	0.14 #	-1.98	0.00	0.14
Civil status									
Single/cohabiting	0.23	0.11	1.26	0.25	0.00	1.28	0.25	0.00	1.28
Married	0.00		1	0		1	0		1
Divorced/widowed	-0.19	0.07	0.83	-0.18	0.10	0.84	-0.17	0.11	0.84

Table C. 4: (continued)

	Model 1			Model 2			Model 3		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Motherhood status									
Childless	0.71	0.00	2.03	See above.			See above.		
Mother	0		1						
Age of first child (for mothers)									
ages 0-1	-0.88	0.00	0.42	-0.96	0.00	0.38			
ages 2-3	-0.20	0.00	0.82	-0.23	0.00	0.79			
ages 4-5	0		1	0		1			
age 6	0.14	0.14	1.16	0.16	0.11	1.17			
ages 7+	-0.04	0.61	0.96	-0.03	0.69	0.97			
Municipality type									
Stockholm, Malmö, Gothenburg	-0.02	0.11	0.98	-0.02	0.11	0.98	-0.02	0.11	0.98
Other urban municipalities	0		1	0		1	0		1
Sparsely populated rural municipalities	-0.42	0.00	0.66	-0.42	0.00	0.66	-0.42	0.00	0.66
Period									
07/1990-06/1995	0.26	0.00	1.30	0.26	0.00	1.30	0.26	0.00	1.30
07/1995-06/1999	0		1	0		1	0		1
07/2000-06/2001	0.50	0.00	1.65	0.50	0.00	1.65	0.50	0.00	1.65
07/2001-06/2002	0.16	0.00	1.17	0.16	0.00	1.17	0.16	0.00	1.17
07/2002-06/2004	-0.13	0.00	0.88	-0.13	0.00	0.88	-0.13	0.00	0.88
Standard deviation of the unobserved heterogeneity term (ξ_i)	0.75	0.00		0.75	0.00		0.75	0.00	
Log-likelihood of model	-327,459.28			-327,305.31			-327,262.50		

Notes: (1) ls=linear spline.

(2) Due to the small number of women who contributed to the exposure time, we grouped widowed women together with those who were divorced. For the same reason, we also grouped women with missing information on municipality type together with those who live in Stockholm, Malmö or Gothenburg.

Table C. 5: Women's risk of undergoing a change in educational field, Model 2 - the effect of educational field in which the previous degree was attained by motherhood status

	Motherhood status					
	Childless			Mother		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field in which the previous degree was attained						
General	2.43	0.00	11.31	1.47	0.00	4.33
Teacher training	-0.37	0.00	0.69	-0.93	0.00	0.39
Art and media	1.34	0.00	3.82	0.92	0.00	2.50
Humanities	2.18	0.00	8.88	2.61	0.00	13.64
Social sciences, journalism and law	1.92	0.00	6.80	2.13	0.00	8.44
Business and administration	0.93	0.00	2.53	0		1
Natural sciences	1.90	0.00	6.71	1.59	0.00	4.88
Engineering and construction	0.98	0.00	2.66	0.17	0.29	1.19
Manufacturing and processing	0.20	0.06	1.22	0.09	0.62	1.10
Agriculture, forestry and animal health	0.15	0.15	1.16	-0.44	0.07	0.64
Health care and welfare	0.12	0.15	1.13	-0.77	0.00	0.46
Tech. oriented health care, pharmacy	0.13	0.37	1.13	0.41	0.31	1.50
Personal services	0.48	0.00	1.61	-0.23	0.05	0.80
Security services	0.36	0.33	1.43	-	-	0.00

Notes: (1) The full model is included in Table C. 4, Model 2. (2) We did not observe an event (change in educational field) for mothers with a degree in security services. Therefore, their relative risk is zero.

Table C. 6: Women's risk of undergoing a change in educational field, Model 2 - distribution of the exposure time and number of women who contributed to the exposure time by educational field in which the previous degree was attained and motherhood status

	Motherhood status			
	Childless		Mother	
	PY	N_{PY}	PY	N_{PY}
Educational field in which the previous degree was attained				
General	161,355	55,280	12,376	4,031
Teacher training	25,930	9,014	8,117	3,172
Art and media	35,372	10,701	3,002	1,122
Humanities	27,960	9,551	1,320	660
Social sciences, journalism and law	35,597	12,402	2,162	1,187
Business and administration	105,869	20,776	19,459	5,104
Natural sciences	19,856	5,904	1,817	709
Engineering and construction	27,772	6,852	3,164	1,071
Manufacturing and processing	8,722	1,735	2,423	584
Agriculture, forestry and animal health	11,384	2,877	2,238	625
Health care and welfare	109,007	25,135	36,420	9,045
Tech. oriented health care and pharmacy	3,119	894	414	163
Personal services	40,223	9,149	10,769	2,532
Security services	298	147	44	25

Source: Swedish register data

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY. (2) Categories in which N_{PY} is smaller than 50 are printed in grey.

Table C. 7: Women's risk of undergoing a change in educational field, Model 3 - the effect of educational field in which the previous degree was attained by motherhood status and age of first child

	Motherhood status & age of first child											
	Childless			Mother: child aged 0-1			Mother: child aged 2-3			Mother: child aged 4+		
	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)	β	p-value	exp(β)
Educational field in which the previous degree was attained												
General	1.50	0.00	4.47	-0.48	0.00	0.62	0.54	0.00	1.72	0.416	0.00	1.516
Teacher training	-1.30	0.00	0.27	-2.74	0.00	0.06	-2.31	0.00	0.10	-1.77	0.00	0.17
Art and media	0.41	0.00	1.51	-1.29	0.00	0.27	-0.13	0.48	0.87	0.189	0.33	1.208
Humanities	1.26	0.00	3.52	0.87	0.00	2.39	1.57	0.00	4.80	1.333	0.00	3.79
Social sciences, journalism and law	0.99	0.00	2.69	0.56	0.00	1.76	0.88	0.00	2.41	0.848	0.00	2.33
Business and administration	0		1	-2.17	0.00	0.11	-1.45	0.00	0.23	-0.64	0.00	0.53
Natural sciences	0.98	0.00	2.66	-0.09	0.66	0.92	0.55	0.01	1.74	0.331	0.14	1.39
Engineering and construction	0.05	0.09	1.05	-1.29	0.00	0.27	-0.96	0.00	0.38	-1.06	0.00	0.35
Manufacturing and processing	-0.72	0.00	0.48	-2.08	0.00	0.12	-1.50	0.00	0.22	-0.51	0.03	0.60
Agriculture, forestry and animal health	-0.78	0.00	0.46	-2.49	0.00	0.08	-1.56	0.00	0.21	-1.28	0.00	0.28
Health care and welfare	-0.81	0.00	0.45	-2.78	0.00	0.06	-2.23	0.00	0.11	-1.47	0.00	0.23
Tech. oriented health care, pharmacy	-0.80	0.00	0.45	-2.36	0.02	0.09	-0.18	0.72	0.84	-0.66	0.40	0.52
Personal services	-0.45	0.00	0.64	-2.29	0.00	0.10	-1.63	0.00	0.20	-0.94	0.00	0.39
Security services	-0.57	0.11	0.56				-	-	0.00			

Notes: (1) The full model is included in Table C. 4, Model 3.

(2) For the interaction, we merged child age 4-5, child age 6 and child age 7+ together in one category due to the low number of women with children at higher ages in the sample.

(3) We did not estimate the risk of change by age of the first child for mothers with a degree in security services due to the low number of women who contribute to these categories. Instead, we estimated the relative risk of mothers with a degree in security services (irrespectively of the age of the first child), which equals to zero since, even for this category, we do not observe an event (change in educational field).

Table C. 8: Women's risk of undergoing a change in educational field, Model 2 - distribution of the exposure time and number of women who contributed to the exposure time by educational field in which the previous degree was attained, motherhood status and age of first child

	Motherhood status & age of first child							
	Childless		Mother: child aged 0-1		Mother: child aged 2-3		Mother: child aged 4+	
	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}	PY	N_{PY}
Educational field in which the previous degree was attained								
General	161,355	55,280	5,129	3,456	3,259	2,416	3,987	1,753
Teacher training	25,930	9,014	3,688	2,702	2,315	1,737	2,115	1,173
Art and media	35,372	10,701	1,509	1,087	822	608	672	314
Humanities	27,960	9,551	702	561	332	303	286	167
Social sciences, journalism and law	35,597	12,402	1,186	1,001	489	436	486	270
Business and administration	105,869	20,776	7,652	4,998	5,168	3,499	6,638	2,347
Natural sciences	19,856	5,904	888	655	482	356	447	216
Engineering and construction	27,772	6,852	1,394	992	793	589	977	378
Manufacturing and processing	8,722	1,735	883	570	648	428	891	305
Agriculture, forestry and animal health	11,384	2,877	904	612	591	417	743	259
Health care and welfare	109,007	25,135	13,467	8,659	9,592	6,503	13,360	4,577
Tech. oriented health care and pharmacy	3,119	894	212	147	110	94	92	46
Personal services	40,223	9,149	3,872	2,475	2,797	1,859	4,100	1,333
Security services	298	147	21	18	11	9	12	10

Source: Swedish register data

Notes: (1) PY=person years at risk, N_{PY}=number of individuals who contributed to PY.

(2) Categories in which N_{PY} is smaller than 50 are printed in grey.

Appendix D

To CHAPTER 7 - The simultaneous impact of unobserved characteristics on educational trajectories and childbearing behaviour

Table D. 1: Composition of the sample for the event history analysis of women's risk of attaining a first degree in teacher training, health care and welfare or agriculture, forestry and animal health

Time-varying covariates:	Exposures			Occurrences
	PY	in %	N_{PY}	N
Civil status				
Single/cohabiting	910,234	97.5	134,572	35,687
Married	21,499	2.3	7,661	581
Divorced	2,265	0.2	893	46
Widowed	48	0.0	15	1
Motherhood status				
Childless	875,763	93.8	134,559	35,333
One child	40,638	4.4	15,635	732
Two or more children	17,644	1.9	7,102	250
Municipality type				
Missing	13	0.0	1	0
Stockholm, Malmö, Gothenburg	163,065	17.5	35,905	4,608
Other urban municipalities	718,390	76.9	116,810	29,299
Sparsely populated rural municipalities	52,579	5.6	12,077	2,408
Period				
Years 1990-1999 and 2001-2004	839,861	89.9	134,618	32,362
Year 2000	94,185	10.1	101,743	3,953
Sample size				
Total exposures (person years at risk)	934,046			
Total number of individuals in the data set	134,618			
Total occurrences	36,315			

Source: Swedish register data
Notes: PY=person years at risk, N_{PY}=number of individuals who contributed to PY.

Table D. 2: Comparison between separate event history models and a simultaneous event history model for women's educational trajectories and women's childbearing behaviour

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
FIRST BIRTH						
Woman's age in years (ls)						
Constant	-4.19	0.00		-4.19	0.00	
16-20	0.46	0.00		0.46	0.00	
20-26	0.12	0.00		0.12	0.00	
26-30	0.06	0.00		0.06	0.00	
30-37	-0.13	0.00		-0.13	0.00	
37-41	-0.33	0.00		-0.33	0.00	
41-45	-0.68	0.00		-0.68	0.00	
Period (ls)						
1990.5-1991	1.58	0.00		1.59	0.00	
1991-1992	0.03	0.17		0.03	0.17	
1992-1998	-0.05	0.00		-0.05	0.00	
1998-2005.25	0.04	0.00		0.04	0.00	
Educational level		Ages 16-24			Ages 16-24	
Missing	-0.66	0.00	0.52	-0.63	0.00	0.53
Primary/lower secondary	0.58	0.00	1.79	0.60	0.00	1.82
Upper secondary	0		1	0		1
Short/long post-secondary	-0.30	0.00	0.74	-0.30	0.00	0.74
		Ages 25-30			Ages 25-30	
Missing	-2.87	0.00	0.06	-2.85	0.00	0.06
Primary/lower secondary	-0.14	0.00	0.87	-0.14	0.00	0.87
Upper secondary	0		1	0		1
Short post-secondary	-0.01	0.25	0.99	-0.01	0.65	0.99
Long post-secondary	-0.11	0.00	0.89	-0.09	0.00	0.91
		Ages 31-45			Ages 31-45	
Missing	-2.62	0.00	0.07	-2.60	0.00	0.07
Primary/lower secondary	-0.42	0.00	0.66	-0.45	0.00	0.64
Upper secondary	0		1	0		1
Short post-secondary	0.27	0.00	1.30	0.28	0.00	1.33
Long post-secondary	0.44	0.00	1.56	0.46	0.00	1.58

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	0.03	0.22	1.03	0.00	0.98	1.00
General	-0.26	0.00	0.77	-0.25	0.00	0.78
Teacher training	0.30	0.00	1.35	0.25	0.00	1.28
Art and media	-0.27	0.00	0.77	-0.23	0.00	0.79
Humanities	-0.39	0.00	0.68	-0.39	0.00	0.68
Social sciences, journalism and law	-0.10	0.00	0.90	-0.11	0.00	0.90
Business and administration	0		1	0		1
Natural sciences	-0.04	0.08	0.96	-0.05	0.06	0.95
Engineering and construction	-0.04	0.03	0.96	-0.04	0.02	0.96
Manufacturing and processing	0.03	0.29	1.03	0.04	0.15	1.04
Agriculture, forestry and animal health	-0.01	0.84	0.99	-0.10	0.00	0.90
Health care and welfare	0.24	0.00	1.28	0.18	0.00	1.20
Tech. oriented health care, pharmacy	0.08	0.05	1.08	0.05	0.18	1.05
Personal services	0.03	0.09	1.03	0.04	0.01	1.04
Security services	0.24	0.00	1.27	0.22	0.00	1.25
Educational status						
Missing	0.32	0.00	1.37	0.31	0.00	1.36
Not enrolled						
Enrolled: Ages 16-24	-0.93	0.00	0.40	-0.93	0.00	0.39
Enrolled: Ages 25-30	-0.56	0.00	0.57	-0.57	0.00	0.56
Enrolled: Ages 31-45	-0.08	0.00	0.93	-0.09	0.00	0.91
Civil status						
Single/cohabiting	-1.47	0.00	0.23	-1.47	0.00	0.23
Married	0		1	0		1
Divorced	-0.99	0.00	0.37	-0.99	0.00	0.37
Widowed	-1.48	0.00	0.23	-1.48	0.00	0.23
Municipality type						
Stockholm, Malmö, Gothenburg	-0.27	0.00	0.77	-0.27	0.00	0.76
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.11	0.00	1.12	0.11	0.00	1.12

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
SECOND BIRTH						
Time since previous birth (ls)						
Constant	-6.00	0.00		-6.00	0.00	
<=0.5 years	6.42	0.00		6.42	0.00	
0.5-1.0 years	2.62	0.00		2.62	0.00	
1.0-1.5 years	0.70	0.00		0.70	0.00	
1.5-2.0 years	-0.32	0.00		-0.32	0.00	
2.0-2.5 years	0.10	0.00		0.10	0.00	
2.5-4.0 years	-0.32	0.00		-0.32	0.00	
4.0-6.0 years	-0.29	0.00		-0.29	0.00	
6.0-10.0 years	-0.18	0.00		-0.18	0.00	
10.0-15.0 years	-0.17	0.00		-0.17	0.00	
Age at previous birth (ls)						
<=24	0.02	0.00		0.03	0.00	
24-29	-0.03	0.00		-0.03	0.00	
29-34	-0.04	0.00		-0.04	0.00	
34-39	-0.16	0.00		-0.16	0.00	
39+	-0.27	0.00		-0.27	0.00	
Period (ls)						
1990.5-1991	1.35	0.00		1.36	0.00	
1991-1992	0.12	0.00		0.12	0.00	
1992-1997	-0.07	0.00		-0.07	0.00	
1997-2005.25	0.02	0.00		0.02	0.00	
Educational level						
Missing	-0.64	0.00	0.53	-0.61	0.00	0.54
Primary/lower secondary	-0.29	0.00	0.75	-0.29	0.00	0.75
Upper secondary	0		1	0		1
Short post-secondary	0.25	0.00	1.29	0.26	0.00	1.30
Long post-secondary	0.39	0.00	1.48	0.41	0.00	1.50

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	-0.06	0.04	0.94	-0.09	0.00	0.91
General	-0.01	0.70	0.99	0.00	0.85	1.00
Teacher training	0.00	0.89	1.00	-0.03	0.09	0.97
Art and media	-0.20	0.00	0.82	-0.17	0.00	0.84
Humanities	-0.18	0.00	0.84	-0.18	0.00	0.83
Social sciences, journalism and law	-0.11	0.00	0.89	-0.12	0.00	0.89
Business and administration	0		1	0		1
Natural sciences	-0.02	0.39	0.98	-0.03	0.32	0.97
Engineering and construction	-0.06	0.01	0.95	-0.06	0.00	0.94
Manufacturing and processing	-0.06	0.04	0.94	-0.05	0.09	0.95
Agriculture, forestry and animal health	0.08	0.01	1.09	0.03	0.43	1.03
Health care and welfare	0.06	0.00	1.06	0.02	0.10	1.02
Tech. oriented health care, pharmacy	0.03	0.48	1.03	0.01	0.75	1.01
Personal services	-0.10	0.00	0.91	-0.09	0.00	0.91
Security services	-0.08	0.23	0.93	-0.09	0.16	0.91
Educational status						
Missing	0.46	0.00	1.59	0.45	0.00	1.58
Not enrolled						
Enrolled	-0.25	0.00	0.78	-0.26	0.00	0.77
Civil status						
Single/cohabiting	-0.49	0.00	0.61	-0.49	0.00	0.61
Married	0		1	0		1
Divorced	-0.70	0.00	0.50	-0.70	0.00	0.50
Widowed	-1.11	0.00	0.33	-1.11	0.00	0.33
Municipality type						
Stockholm, Malmö, Gothenburg	-0.15	0.00	0.86	-0.15	0.00	0.86
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.08	0.00	1.09	0.08	0.00	1.09

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
THIRD BIRTH						
Time since previous birth (ls)						
Constant	-5.71	0.00		-5.70	0.00	
<=0.5 years	5.85	0.00		5.85	0.00	
0.5-1.0 years	1.44	0.00		1.44	0.00	
1.0-1.5 years	0.10	0.12		0.11	0.12	
1.5-2.0 years	-0.56	0.00		-0.56	0.00	
2.0-2.5 years	-0.12	0.13		-0.12	0.13	
2.5-4.0 years	0.26	0.00		0.26	0.00	
4.0-6.0 years	-0.18	0.00		-0.18	0.00	
6.0-10.0 years	-0.25	0.00		-0.25	0.00	
10.0-15.0 years	-0.22	0.00		-0.21	0.00	
Age at previous birth (ls)						
<=24	-0.05	0.16		-0.06	0.15	
24-29	-0.15	0.00		-0.15	0.00	
29-34	-0.12	0.00		-0.11	0.00	
34-39	-0.06	0.00		-0.06	0.00	
39+	-0.09	0.00		-0.09	0.00	
Period (ls)						
1990.5-1991	1.73	0.00		1.73	0.00	
1991-1992	0.12	0.01		0.12	0.01	
1992-1997	-0.18	0.00		-0.18	0.00	
1997-2005.25	0.01	0.00		0.01	0.00	
Educational level						
Missing	0.24	0.15	1.28	0.26	0.12	1.30
Primary/lower secondary	0.05	0.04	1.05	0.06	0.03	1.06
Upper secondary	0		1	0		1
Short post-secondary	0.30	0.00	1.36	0.31	0.00	1.36
Long post-secondary	0.70	0.00	2.01	0.71	0.00	2.03

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
Educational field						
Missing	0.14	0.01	1.15	0.12	0.04	1.13
General	0.15	0.00	1.16	0.16	0.00	1.17
Teacher training	0.14	0.00	1.15	0.13	0.00	1.14
Art and media	0.13	0.04	1.14	0.14	0.02	1.15
Humanities	0.23	0.00	1.26	0.22	0.00	1.25
Social sciences, journalism and law	0.01	0.79	1.01	0.01	0.88	1.01
Business and administration	0		1	0		1
Natural sciences	-0.03	0.62	0.97	-0.03	0.57	0.97
Engineering and construction	0.06	0.07	1.07	0.06	0.08	1.06
Manufacturing and processing	0.19	0.00	1.21	0.19	0.00	1.21
Agriculture, forestry and animal health	0.49	0.00	1.63	0.46	0.00	1.59
Health care and welfare	0.19	0.00	1.21	0.17	0.00	1.19
Tech. oriented health care, pharmacy	0.03	0.61	1.04	0.03	0.71	1.03
Personal services	0.12	0.00	1.13	0.12	0.00	1.13
Security services	-0.05	0.65	0.95	-0.06	0.60	0.94
Educational status						
Missing	0.70	0.00	2.01	0.69	0.00	2.00
Not enrolled						
Enrolled	0.13	0.00	1.14	0.13	0.00	1.14
Civil status						
Single/cohabiting	-0.22	0.00	0.80	-0.22	0.00	0.80
Married	0		1	0		1
Divorced	0.41	0.00	1.50	0.41	0.00	1.50
Widowed	-0.05	0.76	0.95	-0.05	0.76	0.95
Municipality type						
Stockholm, Malmö, Gothenburg	-0.09	0.00	0.91	-0.09	0.00	0.91
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.17	0.00	1.19	0.18	0.00	1.19

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
EDUCATIONAL CHOICE (FIRST DEGREE IN TEACHER TRAINING, HEALTH CARE AND WELFARE OR AGRICULTURE, FORESTRY AND ANIMAL HEALTH)						
Woman's age in years (ls)						
16-18	-9.97	0.00		-10.08	0.00	
18-19	2.96	0.00		2.94	0.00	
19-20	2.26	0.00		2.31	0.00	
20-22	-1.66	0.00		-1.62	0.00	
22-23	0.12	0.00		0.13	0.00	
23-24	0.17	0.00		0.19	0.00	
24-26	0.07	0.07		0.09	0.02	
26-30.5	-0.05	0.04		-0.03	0.23	
Civil status						
Single/cohabiting	0.01	0.85	1.01	0.00	0.97	1.00
Married	0		1	0		1
Divorced/widowed	-0.17	0.28	0.85	-0.12	0.44	0.89
Motherhood status						
Childless	0		1	0		1
One child	-0.94	0.00	0.39	-1.13	0.00	0.32
Two or more children	-1.11	0.00	0.33	-1.51	0.00	0.22
Municipality type						
Stockholm, Malmö, Gothenburg	-0.44	0.00	0.65	-0.45	0.00	0.64
Other urban municipalities	0		1	0		1
Sparsely populated rural municipalities	0.16	0.00	1.17	0.16	0.00	1.17
Period						
Years 1990-1999 and 2001-2004	0		1	0		1
Year 2000	0.03	0.11	1.03	0.02	0.17	1.02

Table D. 2: (continued)

	Separate models for childbearing and education			Simultaneous model for childbearing and education		
	β	p-value	exp(β)	β	p-value	exp(β)
Standard deviation of the unobserved heterogeneity terms						
ε_i^C - childbearing	0.44	0.00		0.44	0.00	
ε_i^E - educational choice	0.64	0.00		0.83	0.00	
Correlation of the unobserved heterogeneity terms				0.69	0.00	
Log-likelihood of models						
Childbearing	-1,402,085.10					
Educational choice	-228,167.51					
Childbearing and educational choice				-1,629,965.39		

Notes: (1) ls=linear spline. (2) Separate model for first, second and third birth risk corresponds to the one shown in Table B. 24, Table B. 25 and Table B. 26 (model with unobserved heterogeneity).

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