Øystein Kravdal

Sociodemographic Studies of Fertility and Divorce in Norway with Emphasis on the Importance of Economic Factors

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Abstract

Øystein Kravdal

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This is a doctoral dissertation, defended at the University of Oslo 11 February 1994. The eight separate studies that are included in the dissertation, are primarily devoted to the timing of first birth, the proportion of two-child mothers who have an additional child, and the stability of marital unions. Special attention is paid to the influence of economic factors, such as women's educational level and work experience, and husbands' income. It seems that economic considerations are quite important in certain aspects of reproductive decision-making. However, the results also suggest that some contemporary differences in the costs of childbearing may be inadequately described by economic-demographic theory. There is some support for the idea that secularization may have been a key driving force behind the weakening of the traditional marriage and the drop to below-replacement fertility. The studies also address the relationships between age at first birth, age at marriage, the progression to parity three, the total number of children, and the divorce rate. These relationships are partly of a causal nature, partly due to selection.

Keywords: Demographic analysis, Divorce, Education, Fertility, Income, Labour force participation.

Sammendrag

Øystein Kravdal

Sosiodemografiske studier av fruktbarhet og skilsmisse i Norge med vekt på betydningen av økonomiske faktorer

Sosiale og økonomiske studier 90 • Statistisk sentralbyrå 1994

Dette er en avhandling som ble forsvart for den filosofiske doktorgrad ved Universitetet i Oslo 11. februar 1994. Avhandlingen inneholder åtte separate studier, som hovedsakelig dreier seg om tidspunkt for første fødsel, andel to-barnsmødre som får enda et barn, og stabiliteten av ekteskapene. Spesiell oppmerksom er rettet mot betydningen av økonomiske faktorer, slik som kvinnenes utdanningsnivå og yrkeserfaring og ektefellenes inntekt. Det ser ut til at økonomiske overveielser er viktige i en del av de beslutninger som tas angående fødsler. Resultatene antyder imidlertid også at noen av de forskjeller i konstnader som er forbundet med å få barn i våre dager, er utilstrekkelig beskrevet innenfor den økonomisk-demografiske teori. Det er en viss støtte til den oppfatning at sekularisering har vært en viktig årsak til at fruktbarheten har falt under reproduksjonsnivå og at det tradisjonelle ekteskapet er svekket. Studiene vier også oppmerksomhet til sammenhengene mellom alder ved første fødsel, alder ved giftermål, hyppigheten av tredjefødseler, totalt barnetall, og skilsmissetilbøyeligheten. Disse sammenhengene er til dels kausale, til dels forårsaket av seleksjon.

Emneord: Demografisk analyse, Fruktbarhet, Inntekt, Skilsmisse, Utdanning, Yrkesdeltaking.

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The research presented in this dissertation has been done in the Statistics Norway during 1988 to 1993. Several colleagues of mine deserve to be thanked: Olav Bjerkholt for having admitted me into the Research Department even though my educational background did not include the social sciences, Helge Brunborg and Per Sevaldson for having inspired and encouraged me, and Lars Østby for having provided a well-functioning administrative framework. I am also grateful for the valuable advice these seniors have given me during my research, and the inspiring discussions I have had with Svein Blom, Nico Keilman, Jose Gomez de Leon, Marit Rønsen and Inger Texmon. Liv Hansen has kindly helped with production of figures and tables, and has assisted me in my library search. The computer staff have also been most helpful. Besides, professor Jan Hoem at Stockholm University is acknowledged for having introduced me into the hazard regression methodology and for having commented several manuscripts in an extremely inspiring and helpful way.

Turid Noack and Rolf Aaberge at Statistics Norway have been involved in the divorce analysis. The former took the initiative to the project and co-authored one of the papers included in this thesis. She wrote a first draft of most of the paper, on the basis of my calculations. I am also very thankful for her welcoming behaviour when I was a junior in the demographic research unit. Rolf Aaberge helped me to specify models with control for unobserved heterogeneity and took part in the writing of the paper. Tom Wennemo did all the computer work in connection with the estimation of these particular models.

Thanks are also due to the Norwegian Research Council for Science and the Humanities, the Norwegian Council for Applied Social Research, and the Ministry for Children and Family Affairs for their financial support.

Finally, I am indebted to my wife Gunnhild for her continuous emotional support and to my two small children Liv Ingrid and Håkon for having improved my understanding of the true pleasures and burdens of parenthood.

In memory of my dear father, who always showed a very strong family orientation, and took a particular interest in our intellectual pursuits and achievements.

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II Kravdal, Ø. (1994) The importance of economic activity, economic potential and economic resources for the timing of first births in Norway. *Population Studies* **48**, 249-267.

III Kravdal, Ø. (1992). The emergence of a positive relation between education and third birth rates in Norway with supportive evidence from the United States. *Population Studies* **46**, 459-475.

IV Kravdal, Ø. (1992). The weak impact of female labour force participation on Norwegian third-birth rates. *European Journal of Population* **8**, 247-263.

V Kravdal, Ø. (1992). Forgone labor participation and earning due to childbearing among Norwegian women. *Demography* **29**, 545-564.

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VIII Kravdal, Ø. and T. Noack (1989). Like marries like - the safest choice? A brief study of homogamy and heterogamy in Norwegian marriages. *Scandinavian Population Studies* **9**, 243-258.

Introduction*

The goal of the analysis

The main objective of this research has been to assess the impact of economic factors on contemporary family behaviour in Norway, partly in comparison with other determinants. The focus is on childbearing and divorce. These events are influenced by many of the same social, cultural and economic forces, and also affect each other mutually.

Economic-demographic family and fertility theory, of which the 1992 Nobel Prize Laureate Gary Becker is reckoned as the founding father, has strongly inspired the scholarly community throughout the past three decades. In addition to being based on easily understandable concepts such as family income and the economic costs of childbearing, the attraction of this way of thinking probably also stems from the fact that population science is not enriched with many other behavioural theories. Besides, revealing economic mechanisms is particularly interesting from a policy perspective, since some of the economic factors may be more easily manipulated through political initiatives than, for instance, our family values. However, the idea that economic considerations play a dominant role in the decision-making concerning reproduction and changes in marital status has also met with much scepticism, both from a theoretical and empirical point of view. This controversy motivated the present study, in which the issue of economic variables and family behaviour is addressed once again using very rich Norwegian data.

Admittedly, it is primarily the fertility analysis that has been influenced by this drive to find out more about the impact of such factors as income, education and work experience. The papers on divorce that are included in this thesis were primarily written to throw light on a broader range of determinants and, above all, the purely demographic.

* The objective of the introductory essay is to summarize and synthesize the results from the eight separate papers that are included in the thesis. Papers II-VI have been published in international journals, and paper VIII has appeared in Scandinavian Population Studies, in which symposium papers are printed without being subject to any editorial interference. Below I also sketch the main demographic trends and review briefly the economic-demographic theories. The discussion of each of the papers, and in particular those on divorce, which were written in 1988 and 1989, has been influenced by my own after-thoughts and empirical and theoretical studies that have been published more recently.

However, they also contain results that add to our understanding of how the economic position of a couple may affect their risk of breaking up.

The scope of the eight papers included in the thesis, and the connections between them

Three of the papers (papers II, III, and IV) are devoted to a statistical analysis of how education, employment, wage potentials, and income affect the demographically important first- and third-birth rates. To some extent, these effects are compared with non-economic effects. **Paper I** is a detailed description of recent fertility trends both from a period and cohort perspective, and serves to justify the focus on first and third births in the other papers. It also contains a brief discussion of how economic changes, social reforms, and various cultural forces may have contributed to push the birth rates up since the mid-1970s. This discussion draws on results from papers III and IV. **Paper V** is complementary, in the sense that it deals with the consequences *for* lifetime income and employment *of* childbearing. Such an estimation of opportunity expenditures and time expenditures, which is also conditional on the woman's educational level, is fairly unique in the international literature. This knowledge about the costs that are actually involved in childbearing can, in turn, be used in the interpretation of the estimates from fertility models (e.g. paper III).

The strong impact of previous reproductive behaviour on the divorce risks, which can be explained within the very general economic-demographic theoretical framework, and which partly reflects the influence of economic barriers, is documented and discussed in **paper VI**. This subject is addressed once again in **paper VII**, but with a more advanced statistical methodology. A wide array of sociodemographic effect estimates are also presented in that paper. **The final paper (VIII)**, which was written with the intention of assessing the effect of heterogamy, contains important results about the influence of educational level in general as well as that of religious denomination. All in all, these three papers provide considerable information about how a variety of factors, economic as well as non-economic, influence marital stability in contemporary Norway.

A brief summary of results

A very important conclusion from this research is that some variables that are often used in economic-demographic fertility analysis, such as women's educational level, women's potential wage and husbands' income, have a fairly weak impact on reproductive behaviour, or even an effect that runs in a direction opposite to that suggested by micro-economic theory. Also women's work experience before and shortly after second birth turned out to be unrelated to the subsequent fertility. On the other hand, we have found that current educational and occupational activity, as well as the work experience, are strong determinants of the first-birth rates.

One interpretation of these results is that higher earning capacity and higher educational level not necessarily increase the costs of childbearing. In particular, it seems that the use of purchased child care as a substitute for mother's time, which means that there is a movement away from opportunity costs towards the less wage-dependent direct costs, needs to be better incorporated into the theories.

The modest role played by current educational level and wage potentials with respect to the first-birth rates may also reflect that these variables have no strong influence on the birth timing that would minimize the childbearing costs (maximize lifetime income). By contrast, activity state has a strong bearing on the optimal timing. Women who are currently enrolled, as opposed to their contemporaries who are employed, probably recognize that there are economic as well as non-economic penalties associated with having the child immediately rather than postponing the transition into motherhood. Moreover, wealth accumulation appears to be more important for first-birth timing than suggested in other studies.

The relatively low frequency of marital disruption that we have found for the better-educated women indicates that their higher earning capacity has a fairly small divorce-promoting impact, if any, compared to various counteracting factors that tend to increase their gains from remaining married. Also the very weak effect of income earned during one particular year suggests that women's economic independence is an unimportant determinant. Husbands' income is found to be inversely related to the divorce risk, as theoretically predicted, but the effect is relatively small.

On the other hand, we have estimated strong effects of some demographic factors, such as age at marriage, timing of first birth and number of children. The protective influence of the latter variable may reflect the higher economic barriers to divorce among couples with (many) children, but non-economic explanations are not likely to be less important. Above all, the emotional consequences of a disruption both for the parents and the children (who are "marital-specific capital" for the parents according to the economic-demographic terminology) must weigh heavily in the decision-making. With respect to the impact of early demographic behaviour, there is little support for an economic interpretation. According to our model estimates, the high divorce risk among women with a premarital birth is not due to a lower social status associated with or caused by this birth-marriage sequence. It is probably a matter of selection and a short "search time".

Moreover, we have found that occupation, place of residence and religious denomination are strong correlates of divorce. Finally, some forms of heterogamy seem to weaken the marital cohesion. These factors are likely to operate through the couple's economic position as well as, for instance, the general quality of the relationship, the availability of alternative mates, and normative constraints.

All in all, it seems that the rising female wages, the better job opportunities and the stronger work commitment may have been less important driving forces behind the recent demographic changes, and in particular the fertility decline, than claimed in many previous scholarly contributions. On the contrary, it may well be that certain changes in our policies concerning the labour market and the family have paved the way *both* for a higher participation rate of females *and* an increasing third-birth rate after the mid-1970s.

One should not on the basis of these studies advocate the view that the economic-demographic theories have little relevance, but the results suggest that some revisions

are called for. Unfortunately, competing theories about exogenous sources of trends in family behaviour are scarce. We have seen in our Norwegian data that various value indicators load heavily on fertility and divorce rates. This lends some support to the idea that demographic development to a large extent is rooted in ideational changes (which, of course, may be closely associated with major economic transformations that have taken place in our society). Attempts to identify these changes and their mode of diffusion should be high on the future research agenda.

A review of the rapidly changing pattern of fertility, marriage and divorce

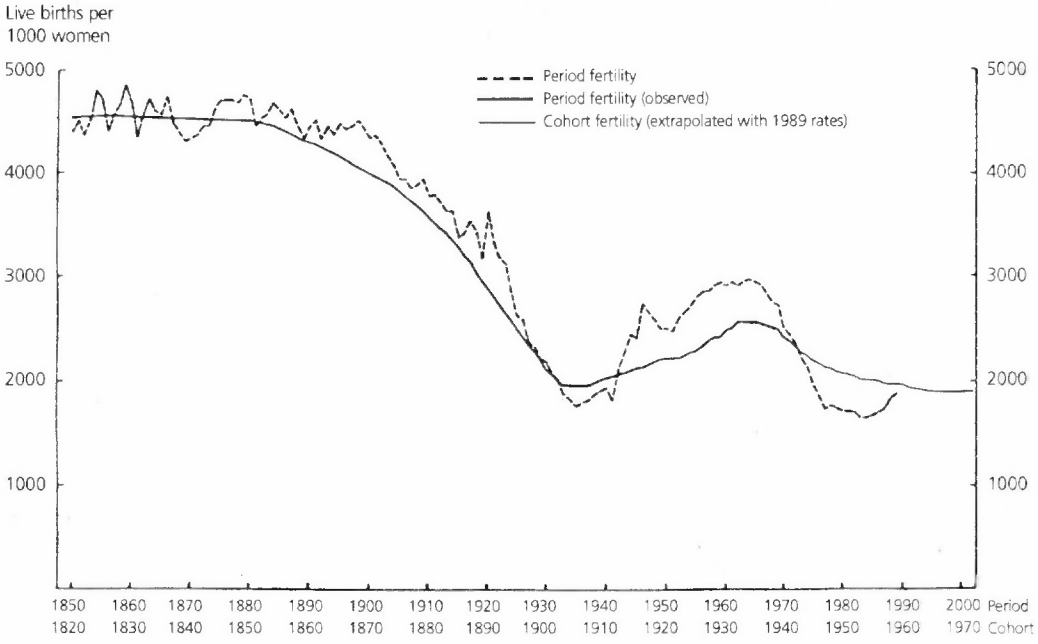
There have been rapid changes in fertility, marriage and divorce during the last few decades, with possibly important implications for individuals and the society at large. The main trends are now briefly reviewed, starting with the onset of what has been referred to as the "second demographic transition" (van de Kaa, 1987; Lesthaeghe, 1992). This was a development that brought much of the industrialized world to a below-replacement fertility, very high divorce rates, and high prevalence of consensual unions and extra-marital births.

In Norway, this development dates back to the mid-1960s, when the total fertility rate was close to 3 (see Figure 1) and the average age at which a woman married was lower than 23. Among women born in the 1930s, only 5 per cent remained unmarried, and cohort fertility exceeded 2.5.

This post-war "peak of familism" had been preceded by a sharp decline in fertility around the turn of the century - as part of the (first) demographic transition which also involved a reduction of mortality - and a following upturn (Brunborg, 1988). In fact, the total period fertility rate (TFR) was as low as 1.78 in 1935, and the average number of children born to the 1903-1907 cohorts did not even surpass 2. As regards family formation, the pattern of almost universal marriages in the first decades after World War II is markedly different from the Northern and Western European pattern that prevailed in the previous century and well into the 20th (Hajnal, 1965; Central Bureau of Statistics, 1978). The fact that the first steps of the family-building took place at a "mature" age, and the fact that a large fraction never married, are major reasons why cohort fertility in Norway and many neighbouring countries never reached the high levels observed nowadays in the least developed countries.

During the late 1960s and the 1970s a new wave of declining fertility materialized in Norway and brought the TFR down to an all-time-low of 1.66 in 1983 and 1984. Simultaneously, the age at first birth increased sharply. This has been followed by an upturn in TFR, to 1.89 in 1989, and a stable level in 1990 and 1991. Cohort fertility is likely to be about 2.0 for women born in the mid-1950s.

Figure 1. Total fertility rate for the years 1850-1989 and the cohorts 1820-1973



Source: Report 88/4 and unpublished tables

These changes in reproductive behaviour have gone hand in hand with a marked downward trend in the marriage rates, which has not yet been followed by a turn-around (Figure 2). In a synthetic cohort of women that experience the current age-specific marriage rates, more than one-fourth will never enter a marital union. The declining marriage rates have been set off against a booming number of consensual unions (Table 1). Figures from the Fertility and Occupation Survey of 1988 actually suggest that there has been a *decrease* in the age at entry into first union (being either marriage or cohabitation) when we compare the cohorts born between 1945 and 1960 (Blom et al., 1993).

Generally, consensual unions are not of a very permanent nature. Within a few years, a large proportion of them are either converted into formal marriages, or the partners have split up. Women born between 1945 and 1968 who had a child while living in a consensual union may serve as an illustration. Only about 20 per cent lived in the same consensual union 5 years after the birth, about 55 per cent had married their partner, and more than 20 per cent had broken the relationship (Blom et al., 1993). If no child is involved, the partners are even more likely to leave each other (Hoem and Hoem, 1992).

Another important change in our family life is the escalating divorce rates. At the turn of the century there were barely 100 divorces annually, in the 1950s there were about

Figure 2. Marriage rates for unmarried women in different age groups. 1961-1990

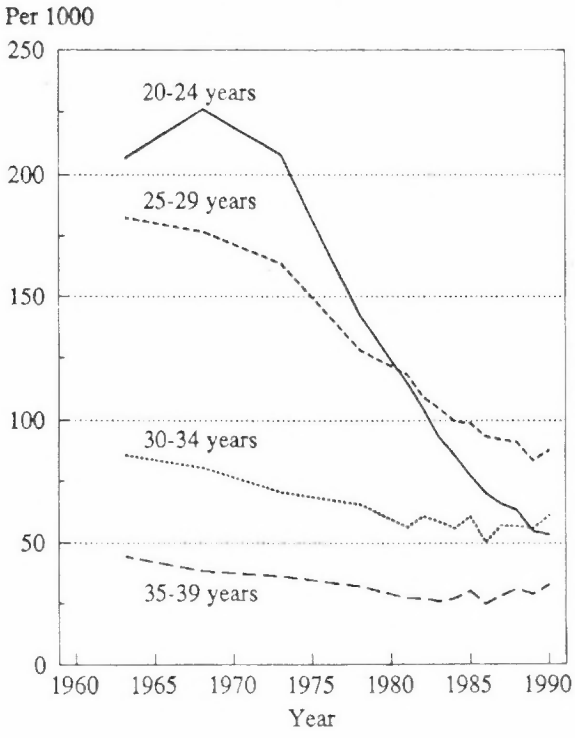
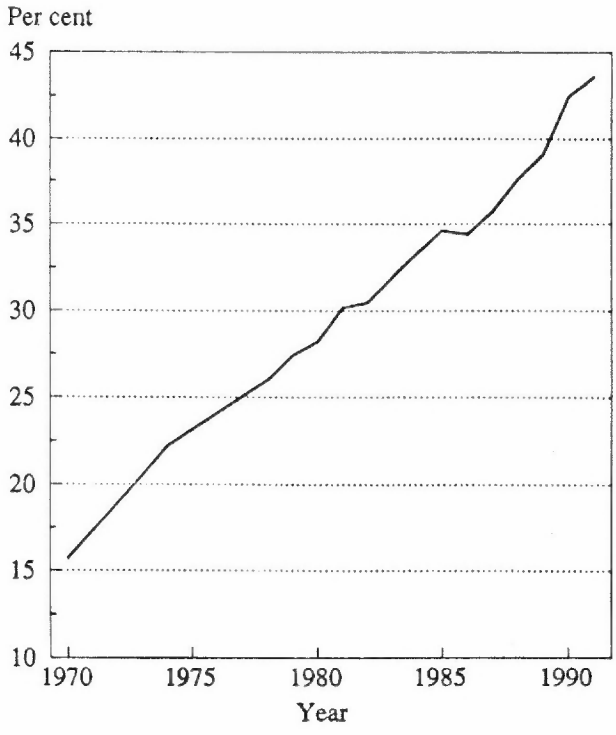


Table 1. Per cent in consensual union and marriage, according to the Fertility Survey of 1977 and the Family and Occupation Survey of 1988, by age.

		1977	1988
20-24	Consensual union	12	34
	Marriage	46	20
25-29	Consensual union	5	24
	Marriage	78	50
30-34	Consensual union	2	12
	Marriage	84	70

2000, and in 1991 there were more than 10000. A couple who from age 25 onwards experience the age-specific divorce rates recorded in 1991 (with a correction for divorces at earlier ages) run a total divorce risk of about 44 per cent. The corresponding figure in 1970 was 16 per cent (Figure 3). Calculations based on duration-specific rates yield closely similar results (Kravdal and Noack, 1988).

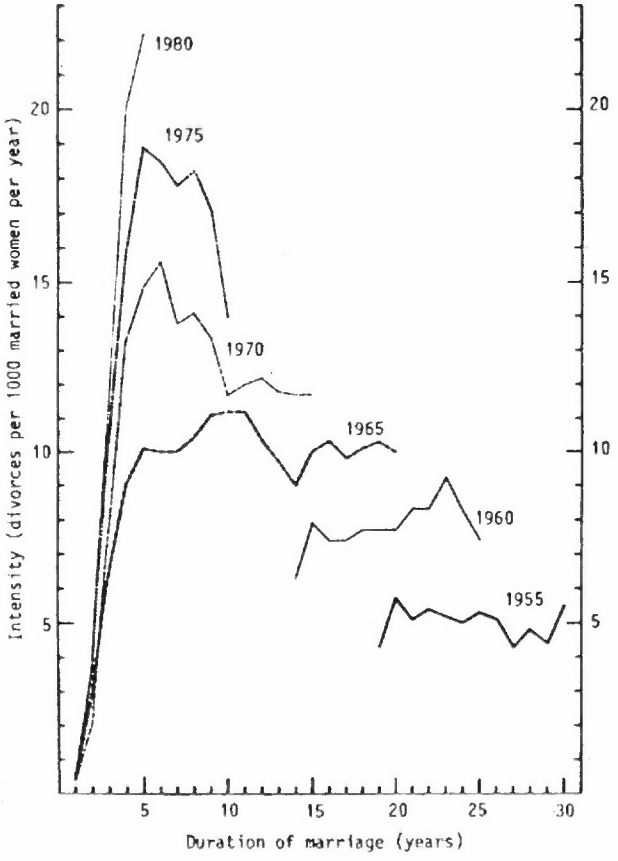
Figure 3. Percentage who divorce before age 65. Predicted on the basis of age-specific divorce rates 1970-1990



So high divorce probabilities are, of course, not seen yet within real marriage cohorts. Register-based research reported in detail elsewhere has shown that 17 per cent of the marriages contracted in 1965 had been dissolved because of divorce before 1984 (Kravdal and Noack, 1988; Kravdal, 1988). The divorce intensity in this marriage cohort increased during the first 5 years and then levelled off (Figure 4). If the intensities have remained constant after 1984, about 25 per cent will have divorced by the end of 1992. In younger marriage cohorts, the intensities are generally higher and decline after the first few years of the marriage. Among those marrying in 1975, 13 per cent had split up within 10 years.

To summarize, there are no indications that young men and women in Norway today prefer to remain single, but the unions they enter are less stable, and they are likely to live a larger part of their adult life without a partner than, for instance, their predecessors born during the Depression. Likewise, children's experience with lone-parent families has increased considerably. Jensen (1992) has estimated that 14 per cent of the children born in 1972 have experienced a parental divorce before age 18, and a percentage of 30 is predicted for those born 12 years later.

Figure 4. Divorce intensities, by marital duration and marriage cohort[1]



1) First and second marriage pooled together.

Throughout much of the industrialized world the demographic trends have been largely similar during the last few decades, with a later entry into marriage and parenthood, emergence of consensual unions as an alternative to marriage, a declining cohort fertility, and a higher rate a marital break-up and non-marital births. There are, of course, also remarkable differences in the timing of these changes as well as in the level of the various demographic indicators. For instance, the post-war "baby-boom" was more pronounced in Norway than in the two other Scandinavian countries, and the subsequent decline relatively steep (Bourgeois-Pichat, 1987). Moreover, while total period fertility rates in Norway were below 1.75 only for a fairly short period, the level has been below 1.45 since 1975 in the Federal Republic of Germany, and there is likely to be a cohort fertility of about 1.6 among women born in the late 1950s (Sardon, 1990). Southern Europe has lagged behind in the post-war fertility decline, but currently witness extremely low fertility rates (Perez and Livi-Bacci, 1992). In Eastern Europe

fertility has been fairly high during the last few decades (until the "iron curtain" collapsed) compared to other European countries (Monnier and Rychtarikova, 1991). With respect to divorce, consensual unions, and non-marital births, Sweden has been considered a forerunner, with Denmark not far behind, whereas the catholic countries in Europe to a larger extent have stuck to the stable formal marriage as the predominant family living arrangement (Popenoe, 1987; Haskey, 1992). The highest divorce and separation frequencies are observed in the United States (see e.g., Bumpass et al., 1991).

The shifts in family and childbearing behaviour that have swept over much of the industrialized world have evoked considerable public concern. It seems to be a widely accepted notion in the population that a child suffers emotionally and economically from a parental divorce. This has also been substantiated with much empirical evidence (see e.g., Kiernan and Chase-Lansdale, 1991). In addition, a break-up may have a profound impact on the life of the mother, who usually takes custody of the child, as well as that of the father. Strong scholarly efforts are being made to explore such issues.

Also the declining total fertility rates have by many observers been considered a threat to our welfare society. Part of this concern is not well rooted in reality, since period fertility rates may drop to levels far below that of the cohort fertility. We cannot run away from the fact, however, that the average number of children born to women in the cohorts from the 1950s is below replacement level in many countries. In the absence of a net in-migration the total size of a population is bound to decrease in the long run if the average fertility is lower than 2.08 (with current Norwegian mortality rates). If the current fertility rates persist, we will also be faced with a progressively older population (until a stabilization of the age-distribution is reached).

It has been speculated whether this aging is likely to influence the productivity and mobility of the labour force and the potential for technological progress. Also the possible impact on the composition of the production, on the needs for investments, and on the savings has been discussed. Moreover, the implications for the social security and the pension system have received much attention. All in all, there seems to be little scholarly support for the view that aging will have a detrimental effect, but it is generally agreed that some adaptations are called for so that economic and human resources can be steered in the direction where they are most needed (Espenshade, 1978; Holtsmark and Aamdal, 1992; Teitelbaum and Winter, 1985; Weaver, 1986). Less moderate views have also been voiced, however. For instance, some French politicians and scholars appear to have considered the future population decline and aging very disadvantageous for their country (Teitelbaum and Winter, 1985). Within the contemporary industrialized Western world, France is in fact the country where the most consistent and explicit efforts have been made to increase fertility.

The effects of a shrinking population size on the economies in developed countries are not well understood (see e.g., Thonstad, 1984). Possibly, a smaller population in these countries will be viewed with less concern now that we are becoming more conscious of environmental damages (see e.g., Ohlin, 1992). On the other hand, ideas about national prestige and power hinging on population size may (still) influence the public opinion in the affluent societies.

Economic theories

Many explanations have been presented to account for the trends and variations in family behaviour. For instance, some researchers have taken a special interest in the social and economic driving forces, whereas others have focused their attention on the ideational changes. These efforts to gain a deeper understanding of the demographic processes have been inspired by theories or sets of explanations from a variety of scientific disciplines, but few attempts have been made to establish a more complete theoretical framework specially intended for demographic analysis.

The basic elements of the "New Home Economics" theory for family behaviour (and associated theoretical contributions), in which a fundamental axiom is that behaviour is governed by rationality in terms of individual utility-maximization, are now reviewed. Firstly, the ideas about the impact of economic factors on the reproductive behaviour are considered. This is followed by a description of how divorce is handled within this theoretical tradition. Afterwards, a couple of competing ideas about demographic changes are mentioned very briefly. The low priority given to these explanations must not be taken to imply that one should consider them a priori as less important.

Economic-demographic theory of fertility

The crucial idea of economic-demographic fertility theory is that certain costs are associated with childbearing, and that the demand for children ("child quantity") increases with income. A complicating fact is that income also may contribute to increase the requirements for child "quality", and thus the costs of childbearing, so that a negative effect of income on fertility results. This idea that child quality is "endogenous", rather than dictated "exogenously" by social norms, has not been incorporated in all theoretical contributions, however.

A particularly important component of the costs of childbearing is the mother's forgone income (since it is usually the mother who takes the main responsibility for the childcaring). The price of her time, at least if she considers employment an alternative to homemaking, is her wage potential. In other words, women who have a high wage have more to lose ("opportunity costs") by staying out of the labour market. This is thought to dominate over a possibly positive impact of her larger contribution to the family income,

so that a negative wage effect results. Moreover, it is stated that with fixed costs of childbearing and a fixed income, fertility may be subject to variations because preferences or "tastes" differ. These "tastes" may even be related to the income.

Early versions of the theory can be found in Becker (1960) and Mincer (1963). A decade later, Willis (1973) synthesized much of the previous theoretical work in a formal model where both fertility and female employment were determined endogenously. In the economic-demographic models the emphasis has been placed primarily on completed fertility, but during the last 10 years efforts have also been made to extend the theoretical focus to the timing of births (Happel et al., 1984; Cigno and Ermisch, 1989). For more details about these tempo theories, see paper II.

When confronted with empirical data, the economic theory has not always fared well, and much scepticism has also been voiced from a theoretical point of view (for an early example see Blake, 1968). However, some studies have apparently lent considerable support to the economic-demographic theory. In particular, the analysis of aggregate American time-series data reported by Butz and Ward (1979) has been very influential. These authors based their analysis on a distinction between one- and two-earner couples, since somewhat different wage effects are likely to show up in these two groups. They claimed that rising men's wages were an important ingredient behind the American post-war "baby-boom", whereas the increased labour force participation and the higher wages of females contributed to driving fertility rates down in the 1960s and 1970s. This distinction between one- and two-earner couples is probably less relevant today, when most women (re-)enter the labour market some time after childbearing, and it has also been contended that the study by Butz and Ward has some statistical shortcomings (Murphy, 1992).

All in all, there appears to be little support for a positive income effect from individual-level analysis, although it has occasionally been observed (see e.g. Freedman and Thornton, 1982). Whether this reflects a near balance of the "quality" and "quantity" elasticities remains unanswered. In fact, child "quality" has rarely been operationalized. A complicating fact is also that the income effect may depend on parity (see e.g., Bernhardt, 1972).

The relation between women's employment and fertility is particularly complex. According to the Butz and Ward line of reasoning, we may think of better job opportunities and a stronger preference for gainful work as exogenous structural changes, partly related to the growth of the service occupations, that drive women into a situation where they take their forgone income due to childbearing into account and thus reduce their fertility (as opposed to the situation where they drop out of the labour market after marriage or first birth, and remain homemakers regardless of subsequent childbearing). Actually, it seems to be a well established notion in public opinion as well as among many scholars that there is an inverse reciprocal relationship between women's employment and fertility. However, much of the evidence collected during the last dozen years suggests that the fertility-inhibiting effect of work activity may be modest (e.g. Cramer, 1980; Klijzing et al., 1988; Hoem and Hoem, 1989). Undoubtedly, there is ample room for conceptual and methodological advances within this

demographic subject. The joint nature of the fertility and employment decision-making stands out as a particular challenge (for examples of such models, see e.g. Willis, 1973; Hotz and Miller, 1988; Turchi, 1991). Besides, theoretical discussions tend to be hampered by inadequate distinctions between *actual* work activity before or after birth, employment *opportunities*, and individual *preferences* or *need* for employment.

An effort has been made to incorporate purchased child care into the models, since it has become progressively more common for a mother to have the child in a day care centre instead of taking care of it herself (Ermisch, 1989). The fundamental idea is that if the price of child care is sufficiently low compared to the woman's own wage, she will substitute part of her opportunity costs with direct costs. In that situation, the costs of chilbearing tend to be determined by the almost wage-independent cost of child care facilities rather than her own forgone income. If one assumes that her contribution to the family income has a stimulating effect on fertility, the effect of her wage on fertility may thus turn out to be positive. This, of course, contradicts previous notions within economic fertility theory. As yet, there are few empirical studies that have been devoted to the importance of purchased child care for reproductive behaviour, but this seems to be a growing research area (Blau and Robins, 1989; Mason and Kuhlthau, 1992).

Economic-demographic theory of divorce

Theories have been developed along similar lines to account for trends and variations in the divorce propensity. These theories make use of a fairly broad cost concept that includes also the non-economic disadvantages associated with a marital break-up, and allow predictions about non-economic factors, such as the number of children born to the couple and the age at union formation.

The basic idea is that a marriage is dissolved if the expected gains from remaining married are poor and the costs of divorce are low (see e.g. Becker et al., 1977; Becker, 1981). The process leading up to the marriage is thought to play a very important role. If the search for a partner is terminated too quickly, it may lead to a far from optimal match - for instance because the partners turn out to be too different. Heterogamy (except with respect to earning capacity, which affects the division of labour between the spouses) is thought to reduce the gains from marriage and thus increase the risk of dissolution. On the other hand, husband's income is an example of a factor that is assumed to increase the gains from marriage, because wealthy men attract desirable mates and because they can provide the family with a high standard of living.

A high earning potential and good job opportunities for a woman are believed to have a destabilizing impact. Becker et al. (1977) argued that this fact is important for our understanding of the post-war divorce boom. As regards women's educational level, the effect on divorce cannot easily be predicted (see also Ermisch, 1986). Better-educated women have a high wage potential, they may be more confident that they can cope with the difficulties encountered when they establish a separate household, and they may be less influenced by traditional norms about marital stability (which is also a cost component). On the other hand, they may have searched more thoroughly for a partner and they may be better able to work their way through a conflict. This tends to increase

their gains from marriage. The bulk of the empirical evidence suggests that the latter mechanisms dominate.

It has also been emphasized that the expected gains from marriage may be appreciably revised because of unanticipated events, or because important new information about the spouse becomes available. This may, for instance, be particularly likely in case of a hasty initiation of the union. In fact, Becker et al (1977) claimed that both favourable and unfavourable unexpected events - examples being a surprising economic success, unemployment, and fecundity impairments - will contribute to destabilize marriage.

Also the effects of non-economic factors have been discussed and predicted within a cost-benefit framework. For instance, it has been expected that an early marriage tends to increase the divorce risk. One explanation is that young women are more strongly aware of the fact that there are alternative mates available (see e.g. Bahr et al., 1983; Booth and Edwards, 1985; Lee, 1977). It has also been claimed that children have a protective effect because they are "marital-specific capital", in the sense that a parent who moves out, which is usually the father, receives much less satisfaction from them. Moreover, considerable attention has been devoted to the variation in the divorce risks by marital duration. One hypothesis is that accumulation of "investments" (not only children) in the marriage, makes it gradually more valuable, and that the divorce risk therefore declines. An alternative view is that the gains from living in the union decrease because of accumulated irritation and new (negative) information about the spouse.

Whereas empirical studies have repeatedly shown that such factors as age at marriage and the number of children are inversely related to the divorce risk, at least up to a certain level, there is much less consensus about many of the other variables mentioned above. For further literature reviews, see the sections where the three papers on divorce patterns in Norway are summarized and discussed.

Non-economic explanations of trends in reproductive behaviour

The importance of individual preferences, or "tastes", has been duly recognized in many theoretical economic-demographic contributions, but few attempts have been made by economists to develop this concept further. However, individual "tastes", as well as norms and values that prevail among a larger group, have been in focus of more sociologically oriented demographic research. Lesthaeghe is one of those who most convincingly have advocated the view that both family and fertility changes to a large extent should be attributed to an increased individual freedom from religious and political doctrines and a more intense search for self-fulfilment (see e.g. Lesthaeghe and Surkyn, 1988; Lesthaeghe, 1992).

It is believed to be important that this "newfound freedom" also extends to women, and allows them to pursue their own educational and occupational goals as well as to seek a fulfilling leisure time. A famous American demographer once wrote that "our past success at population replacement, throughout all of human history, has been conditional on the discriminatory treatment of women" (Ryder, 1979).

Finally, the introduction of modern contraceptives (the pill and IUD), combined with the use of abortion to cancel failures, is thought to have played an important role in reducing fertility to below-replacement level and increasing the age at first birth. It seems that the effect of this technological innovation is especially difficult to grasp in quantitative analyses. This is not least because the choice of contraceptive methods signals fertility desires, and because the current users of the new methods might also have managed well with more traditional methods, although with certain "inconvenience costs".

Data and methods

Register-based biographies

Much of the research has been based on individual biographies extracted from the Central Population Register of Norway. Complete maternity histories have been established for all Norwegian women born after 1935. We also know the changes in marital status after 1964 for these women, as well as the year of marriage for those who were married at the time of the 1970 Population Census (Brunborg and Kravdal, 1986; Kravdal and Noack, 1988).

Such a data set with information for complete cohorts can only be established in countries where there is a population registration system in which each person is assigned an identification number. Sweden was the first country to build up register-based demographic histories (Johanson and Finnäs, 1983), and efforts are now being made in Denmark to produce a similar file (Knudsen, personal communications).

On the basis of this large data set, the trends in some important fertility and divorce indicators can be studied in detail. However, in order to gain improved insight into the behavioural mechanisms, more information on the explanatory variables is needed. For that reason the register-based life-histories have been linked with data from the Population Censuses of 1960, 1970 and 1980. This extended life-history file has been used in some of the papers (III, VII, VIII) to assess the influence of education, income, work experience and religious affiliation on family and fertility behaviour. In papers I and VI, the census data have not been used, only the purely demographic biographies.

Family and Occupation Survey of 1988

The Family and Occupation Survey of 1988 contains a very wide range of variables for a few thousand respondents. Individual biographies of pregnancies, child births, marital and non-marital unions, educational activity and employment were collected for 4019 women born in 1945, 1950, 1955, 1960, 1965 and 1968 and for 1543 men born in 1945 and 1960 (Central Bureau of Statistics, 1991). The survey data have been linked with annual income and tax records from the Directorate for Taxation, covering the years 1967-1988. Such individual income histories have rarely been available for demographic research.

Papers II, IV and V have been based on this data source.

Parity-specific analysis

In the fertility studies reported in this thesis, a parity-specific analysis, with a focus on first and third births, has been preferred. The trends in the timing of first birth and in the proportion who advance to parity three seem to have been particularly important components of the fertility change both in Norway and other countries (see e.g., Ryder, 1986; Prioux, 1990). This "piecemeal approach" has been criticized by some authors, but little agreement has been reached about its limitations, and the gains from encompassing more of the reproductive career in a single model have not been clearly demonstrated (for a discussion, see e.g. Heckman and Walker, 1992).

Focus on judicial divorce

A marital break-up is a long process that often involves the following three important events: moving apart, formal registration of a separation, and obtaining a judicial divorce. However, some couples divorce directly, some may spend many years in a status as "separated", and a considerable proportion also start living together again after having been separated for some time. In the analyses included in this thesis, it has been preferred to focus on the divorce, partly because this is essentially an irreversible step which signals that the close relationship has reached a definite end, and partly because of certain data limitations.

Hazard regression

The multivariate intensity regression method is a statistical tool that is very well suited to analyse transitions from one state to another, such as e.g. from marriage to divorce. The methodology handles censored data in an efficient way and allows the investigator to assess the net effects of a number of variables that influence the attrition process.

The LOGLIN program, developed at Harvard University (Olivier and Neff, 1976), has been used when estimating hazard models in papers I, II, VI and VIII. This program requires categorical covariates and assumes that the intensities (rates) are constant over certain duration intervals. These intervals are chosen to be 1, 2 or 3 years in most of the analysis reported here. Hierarchical models are compared by likelihood-ratio tests.

Hazard regression models with control for unobserved heterogeneity

Controlling for unobserved heterogeneity is a more advanced methodology that requires very time-consuming calculations. For an excellent review, see Trussell and Rodriguez (1990). The technique is not yet part of the standard statistical equipment for the empirically oriented social scientist (and may possibly never be), and there seems to be no consensus about its importance when estimating demographic transition models. Our motive for plunging into this rather unexplored field was that we wanted to see whether our estimates of the baseline hazard and the various sociodemographic covariate effects were sensitive to the inclusion of unobserved heterogeneity and, in particular, whether the impact of first-birth timing could be accounted for within this methodological framework (paper VII).

We have used the so-called Heckman-Singer approach (see e.g. Heckman and Singer, 1982, 1984), where the distribution of the unobservable is modelled as a discrete probability function with the mass concentrated at relatively few points (which in its simplest version degenerates to the "mover-stayer" situation). The likelihood function and its first and second derivatives (with respect to the parameters) were fed into a NAG-routine that is based on a Newton-Raphson maximization algorithm. A variety of starting values for the iteration had to be tried before we could claim that we had probably found the maximum value of the likelihood function.

None of the covariates are time-varying, and for simplicity they are all assumed to have the same effect on the divorce rates throughout the observation interval.

Some other methodological considerations are dealt with in the sections where the results from the Heckman-Singer model are discussed.

Logistic regression

Part of the analysis (papers III and IV) has been based on logistic regression models estimated in SAS (LOGIST or CATMOD procedure). The focus has been on a 5- or 10-year interval after second birth, and the probability of having a third child within that interval is modelled. The sociodemographic regressors that are included refer to the time before or immediately after second birth.

This approach does not allow inclusion of covariates that change their value during the interval under observation, which is no great disadvantage in these particular investigations. (Note that logistic regression may also be used when there are time-varying covariates if each individual observation is split into a sequence of observations for different spells of the life course, e.g. one observation for each year. This strategy has been discussed by Arjas and Kangas, 1992. For another empirical example, see e.g. Teachman and Schollaert, 1989). Another restriction imposed by the method is, of course, that one is compelled to condition on having survived and remained a Norwegian resident throughout the 5- or 10- year observation interval. This seems to be no serious limitation either.

All in all, the approach does not provide the same flexibility as the hazard model regression, and the use of the data is less efficient. It has the advantage, however, that it is technically much less cumbersome. The logit-procedures in SAS also permit continuous covariates (which have only been used in some preliminary model runs). Finally, it should be emphasized that the logit-procedures are based on a likelihood-optimalization that adds up the contributions from each individual observation. This would make it difficult to handle a sample with a very large number of observations, such as that used in the analysis reported in paper VI. By contrast, LOGLIN operates on aggregate exposure and occurrence matrices.

Estimation of time and opportunity expenditures

The estimation of time and opportunity expenditures of childbearing (paper V) is based on OLS regression models (REG procedure in SAS), with cumulated labour force

experience or cumulated income as the dependent variable and number of children, age at first birth, birth interval, education and some other factors as regressors.

The approach rests on the assumption that there are no differences in work activity, net of educational level, *before* childbirth. For instance, it has been assumed that a mother who had her first child at age 25 had worked just as much up to that age as a woman who has remained childless or who entered motherhood at a higher age. A discussion of the validity of this assumption, as well as of some selectivity issues, can be found in the paper. More recent research (paper II) shows that work experience increases the first-birth rates. This means that women who give birth to a first child have more labour market experience at that time than women of the same age who are still childless, but who are otherwise equal. The implication of this is that the estimates of forgone employment due to childbearing are biased slightly towards zero.

Summary and discussion of the results

The most important findings in the eight papers are now summarized, without repeating more than a few references. When reviewing the divorce analyses (papers VI, VII and VIII), reference is made to some results that were not discussed in the papers, because they were less interesting from the perspective originally taken. A few findings from research projects that are not yet finished are also considered. Finally, the discussions of each of the eight papers, but in particular those on divorce, are influenced by our own after-thoughts and empirical and theoretical studies published more recently.

Some of the main findings will be referred once again and further synthesized in the final chapter, where the intention is to draw some overall conclusions about the lessons that can be learned from these scientific efforts.

Paper I: A detailed description of fertility trends, with a brief discussion of potential determinants

In this study, we have estimated parity- and age-specific birth rates for each (calendar) year, and have also calculated parity distributions for a sequence of birth cohorts. This provides us with a detailed empirical picture of the "baby-bust" and "baby-boom" during the last couple of decades, which in turn may facilitate the generation of explanatory hypotheses.

The analysis confirms that the declining cohort fertility among women born during the late 1930s and the 1940s is due to a reduction of the third-birth rates, whereas no changes are seen in the proportion who remain childless. This trend, along with an increasing age at first birth, resulted in a very sharp reduction of the total period fertility rate from the mid-1960s to the mid-1970s. Among women born in the 1950s, there seems to have been a different pattern of change, characterized by a slightly widening parity distribution (see below).

Another important result is that the "baby-boom" during the last half of the 1980s, when the annual number of births increased by about 10000 (or 20 per cent), should be attributed primarily to tempo changes: A larger fraction of the women entered their thirties and late twenties as childless, and – presumably as a catching-up phenomenon –

they also experienced higher age-specific first-birth rates. Besides, the decline of the first-birth rates among younger women was called to a halt, and the total increase in the number of first births was, of course, followed by an increase in the number of second births. Only a small part of the fertility increase stems from the moderately rising second- and higher-order birth rates.

Our charting of fertility rates in a period perspective has revealed the following turning-points:

About 1965: The decline of the second- and higher-order birth rates starts
About 1972: The decline of the first-birth rates starts
About 1977: The decline of the third- and fourth-birth rates is substituted by a moderate increase. Second-birth rates stabilize.
About 1984: First-birth rates among women in their 20s stabilize. Second-birth rates start to increase slightly, and the rise of the higher-order birth rates gains extra speed.

Similar changes of the birth rates in 1977 and 1984, or thereabout, have occurred in Sweden as well. The most important difference is that there was an increase, and not merely a stabilization, of the first-birth rates in Sweden, and that there also was a much steeper rise of the second- and higher-order birth rates among women who had given birth less than four years previously (Hoem, 1990a). The latter phenomenon has been attributed to a gradual extension of the maternity leave that makes birth intervals shorter than 30 months economically advantageous. Also some other European countries have apparently experienced a stabilization of the higher-order birth rates (Prioux, 1990). Whether this has been followed by an upsurge is less certain. This cross-national parallelity suggests that influential economic, social or cultural factors have swept over much of the industrialized world, perhaps with extra strength in the Scandinavian countries. Also changes in "proximate factors" may be responsible for the turn-around. A British study indicates that a growing scare of the contraceptive pill after the mid-1970s may have had some impact on the birth rates (Murphy, 1993).

In Norway, consistent political efforts have been made to mitigate the conflict between employment and childbearing - through extension of the maternity leave, increased supply of public and (subsidized) private child care facilities, and various other initiatives. These changes or reforms have taken place over a fairly long period, with no clear mile-stones in 1977, or thereabout, but may nevertheless have had a bearing on the rising higher-order birth rates (see also discussion of paper IV). According to a multi-level analysis that is currently being carried out on the basis of the Family and Occupation Survey of 1988, registered migration histories, and community time series data, the growing supply of day care centres during the 1980s and second half of the 1980s seems to explain a considerable fraction of the upsurge of the third-birth rates. First- and second-birth rates, however, seem to be insensitive to the day care supply.

Moreover, it is thought-provoking that the 1977 turn-around coincides with a stabilization of women's real wages. Although other research throws some doubt on the notion that real wages are strong determinants of fertility (see also discussion of papers

II and III), this result deserves some more attention in future studies. Apparently, there has also been a more marked increase in the economic transfers to families with children after the mid-1970s. This has been channelled partly through the taxation system. One may well doubt, however, whether the economic impact of tax reforms are immediately well known to the public.

Another crucial question is why such changes in the compatibility between family and gainful work, and in the wages and economic transfers, would influence only women who have had at least one birth previously. We have argued in paper II that childbearing costs may enter into the decision-making in a somewhat different manner for first births than for higher-order births, but could not conclude that they are generally less important.

It would also be interesting to learn whether a similar development in the economic sphere has been experienced in non-Scandinavian countries where a stabilization of the third-birth rates seems to have occurred. Moreover, it is a challenging fact that, if we disregard the short durations since previous birth, the increase in the second- and higher-order birth rates are of roughly the same size in Norway and Sweden, in spite of the more generous support to working mothers in the latter country.

The stabilization and increase of the third-birth rates has, of course, materialized also in a cohort perspective. Among women who have had their second child, the proportion who have proceeded to a higher parity has not been subject to a continuing decrease among those born after about 1950 (when comparing women at age 35). Because of the slightly increasing period third-birth rates, a higher progression ratio between parity two and three is likely to show up in future cohort tabulations. This may be outbalanced by a somewhat higher proportion of childless women, so that a fairly constant average cohort fertility results. At age 35 the proportion of childless women has increased from 11 to 14 per cent, and we cannot possibly know yet how much of this gap will be closed at a higher age. First-birth rates among women older than 35 have been low (in fact, less than 2 per cent have had their first birth after age 35 among women currently in their 40s and 50s), but they are increasing.

With respect to the stabilization of the first-birth rates among women in their 20s that occurred around 1984, we have not gained much insight (see also paper II). It is not theoretically unreasonable to expect women's unemployment to speed up the childbearing, but all in all we hesitate to consider the unemployment peak in 1983 and 1984 important for the stabilization of the first-birth rates. After 1984, unemployment rates for females soon dropped to a low level, to be followed by a new upturn, whereas the first-birth rates remained stable. Moreover, there has been a similar trend for men, and a high level of male unemployment is not likely to induce a higher tempo of childbearing.

PAPER II: Trends and variations in first-birth rates: The impact of economic activity, potentials and resources

Paper II deals with the demographically important timing of entry into parenthood. In a hazard model analysis we assess the effect that the educational and occupational activity

("activity state") exerts on the first-birth rates among adolescents and young adults, and the effects of economic potentials and resources. In an attempt to throw light on the decline and stabilization of the aggregate age-specific first-birth rates, we have included period as a regressor and searched for temporal changes in the effects of the socioeconomic variables.

The complexity is overwhelming when studying first births: Entry into parenthood is deeply intertwined with entry into marriage or consensual union, and some of the sociodemographic effects are strongly age-dependent, probably as a result of certain catching-up phenomena.

Not surprisingly, educational activity turns out to be a very strong determinant of first-birth rates, and the high rates among better-educated women at the higher ages may be interpreted as an attempt to "make up for" the low fertility during preceding enrollment. The longer time spent at school also seems to explain much of the downward trend in the aggregate first-birth rates.

Unfortunately, we cannot reach any firm conclusion with respect to the effect of being unemployed, which after all has been fairly uncommon in Norway, and which is also under-reported in the survey. It would be economically rational for a couple to have the first child during a period when the mother is (temporarily) unemployed and receives an income compensation without having to be away from the child. We also found in our data that women who reported to be neither employed nor enrolled had a very high first-birth rate. However, there may also be some unemployed women among those who have reported to attend school or to have gainful employment. Besides, unemployment would generally lead to a lower cumulated work experience, which seems to reduce first-birth rates strongly (see below). In the scholarly literature, the bulk of the evidence suggests that a high overall unemployment rate has an inhibiting effect on fertility, but there are also indications that unemployment of females may have a less negative effect (if any) than that of males. Hopefully, the issue of unemployment and fertility can be addressed in future research with more well-suited data from Norway or from countries that have experienced generally higher unemployment rates.

The most interesting result of this analysis is that work experience affects the first-birth rates very strongly, partly through a higher rate at entry into a marriage or cohabitation. Among women at a given age and educational level, those who have had a few years of work experience display significantly higher first-birth rates than do other women who are otherwise equal. The most important explanation is probably that a certain accumulation of wealth is considered important before taking the initial steps in the family-building process. However, we cannot rule out the possibility that many young Norwegian women may *believe* (although this does not appear to have been documented scientifically) that their cumulated income would be higher in the long run if they drop out temporarily from the labour market after having gained some experience rather than shortly after employment entry.

Such a clear effect of work experience has not shown up in the few, and very diverse, previous investigations that have addressed this issue. Further research would be needed

before we can conclude whether this is largely a result of methodological differences, or whether it reflects substantial cross-national differentials.

Another finding that deserves attention is that very little individual variation in the timing of first birth seems to be explained by the variables that are thought to tap the economic potential. Among single women, a low potential wage increases the first-birth rates. This may be partly attributed to the fact that the social security system makes it particularly inexpensive to have a child for a single woman with poor income opportunities. (The remaining negative effect of education among single women could stem from, for instance, differentials in contraceptive efficiency.) Among those living in a union, however, women's actual current wage, women's predicted current wage, and women's expected wage rise have little influence.

To sum up, we have separated the effects of educational level and work experience and found that the former is weak and the latter is strong. Our interpretation of these results is that economic potentials are relatively unimportant in the decision-making regarding the first-birth timing, whereas the accumulated economic and material resources are of considerable importance. This can be accommodated within the theoretical framework proposed by Happel et al. (1984), but some revisions are called for. Above all, we believe that the desire for consumption smoothing creates an incentive to accumulate wealth and financial assets, and not only an incentive to postpone the first birth until the husband earns a sufficiently high income. The latter was introduced into the model as a consequence of a simplifying assumption about complete absence of capital markets. During much of the period we have investigated, the penalty from borrowing money has actually been very small in Norway, but access to such capital has usually been conditioned on prior savings. Another motive for saving or investing in durable consumer goods is, of course, that it may open up for a reasonably high consumption in the initial stages of family-building also in the absence of borrowing.

According to Happel et al., high expected costs of childbearing would tend to strengthen such an economically based motive for further postponement of the first birth (whether it is derived from a need for accumulated material and economic resources or a need for a higher male income). In light of this, our results may be taken to suggest that the overall costs associated with having a first child (leaving aside the timing-dependence) are actually only weakly influenced by the earning capacity, especially among women who are married or cohabiting. Also previous Norwegian studies have indicated that a higher wage potential not necessarily increases the costs of having a *third* child (papers III and V), because of the use of purchased child care as a substitute for mother's time. However, it is also possible that there actually *are* higher childbearing costs among the better- educated, but that this is counterbalanced by the fact that they need less time to reach a given level of wealth, so that, in total, the desire for consumption smoothing does not lead to a later first birth for these women.

An additional explanation of the weak effects we have estimated for the educational level and wages, is that the earning capacity may be virtually unrelated to the first-birth timing that would maximize lifetime income. Alternatively, any such impact on the optimal timing may be unknown to the decision-makers. By contrast, part of the

explanation for the low birth rate among the enrolled and the high rate among the "non-active" is probably that these women recognize that certain penalties or benefits are associated with having a child *now* compared to *later*. In our opinion, the current activity state should be taken more explicitly into account in future efforts to refine the theoretical models centred around the idea of lifetime income maximization. Besides, there are likely to be important non-economic explanations for the strong impact of activity state.

We did not reach any clear understanding of the aggregate temporal changes in first births, except that the longer time spent at school has been important. It seems that the decline and stabilization of the first-birth rates is a general trend in Norway. There were some indications that employed women experienced rising first-birth rates after 1986, but this was a non-significant increase, and the reforms and changes that may have facilitated childcaring among employed women, have been implemented over a much longer period.

PAPER III: The theoretically unexpected effects of woman's education and husband's income on the third-birth probabilities

Paper III is primarily devoted to the impact of educational level on the probability of having a third child. It is widely agreed that a woman's educational level is inversely related to her lifetime fertility. This has been thought to reflect the higher real wages and the better access to emotionally rewarding jobs among the better-educated, which means that they have more to lose by staying home in order to take care of a child. It has also been suggested that they may have "quality" requirements that contribute to increase the "price" of the child, and it is possible that they have had a more efficient birth control during much of the last few decades.

As regards the initial steps of the reproductive career, there is little doubt that education has an inhibiting impact (see also paper II). Among the better-educated there is a relatively high proportion who remain childless, and education also tends to increase the age at which the woman has her first child. Rindfuss et al. (1980) have argued that these differences in the transition into motherhood actually explain the entire educational gradient in lifetime fertility in the United States. Much less is known about the importance of education for the later stages of the family-building. The few studies that have addressed the issue of third births and educational level are not easily comparable because of different analytical set-ups, but apparently the results point in different directions. This may, of course, be a manifestation of substantial cross-national differentials in such factors as child care supply, rights for employed mothers, and social gradients in the wages. Indications of positive education effects have been found only in Sweden.

Our own analysis clearly reveals that two-child mothers with some post-secondary education have a higher probability of advancing to parity three than other women who had their second child in the same year and at the same age, and who are also otherwise equal. This effect is actually so strong that it outweighs the counteracting influence of a higher age at first and second birth among the better-educated, and produces a positive zero-order effect of educational level in recent *second-parity cohorts*: Among women who

had their second child after the mid-1970s, those with a higher education have most often proceeded to parity three within a 5- or 10-year interval, in spite of their higher age. However, among the *birth cohorts* who have largely completed their childbearing we have not yet observed a positive zero-order educational gradient in the third-birth progressions. The calculations have been replicated for the United States, where there also seems to have been a high third-birth probability among college- or university-educated women in recent second-parity cohorts.

We now enter into a discussion that we believe to be somewhat more insightful than that presented in the paper (which was submitted to the journal as early as November 1990).

The surprisingly high fertility among two-child mothers with some post-secondary education cannot be explained by the higher income among their partners. We have seen in models restricted to the large majority of the women who lived in their first marriage at the time of second birth as well as by the end of the observation interval, that control for husband's income did not reduce the estimated effect of education. In fact, third-birth probabilities turned out to be somewhat *higher* than average if the husband had a *low* income.

This result is quite interesting in itself, given the theoretically expected positive relationship between income and demand for child "quantity". Although the educational level of the husband has been controlled for, it seems that differential "quality" requirements or differential "tastes" for childbearing more than outweigh the postulated positive impact of income on the demand for child "quantity". Similar findings have also been reported previously, however. There are some indications in the scholarly literature that a negative income effect would be particularly likely to show up at the higher parity transitions.

A possible interpretation of the positive effect of female education is that the costs of childbearing are unrelated to the educational level, or that they are even highest among women with *low* education. This is because the mother's time can be (partly) substituted by purchased child care, which means that the opportunity costs are reduced at the expense of less wage-dependent direct costs. A positive effect of female wages could show up in a situation where the following three conditions hold: Firstly, the prices of purchased child care are independent of the earning capacity. Secondly, the prices are relatively low, so that mothers generally prefer employment to homemaking. Thirdly, there is a positive effect of the woman's contribution to the family income. However, if we also assume that women with a low wage potential compared to the child care costs tend to "sacrifice" their income rather than make use of the child care facilities, a U-shaped relationship between female wages and fertility could materialize, as also pointed out by Ermisch (1989). This explanation is not altogether attractive, however, since we have found the husband's income to be inversely related to the third-birth probabilities. That makes it unlikely that the woman's contribution to the family income would tend to increase fertility.

Alternatively, a positive education effect could show up, regardless of the income effect, if the better-educated somehow incur the *lowest* total child care costs. This would happen if they manage to move into acceptable child care arrangements relatively easily (e.g. because of certain advantages connected with their jobs) and thus experience fairly low opportunity costs that are not completely outbalanced by their higher direct costs. In addition, one may speculate whether women with a lower education tend to remain homemakers (i.e. sacrifice their income rather than having the child in a day care institution) even in a situation where that is not economically optimal, because they face higher strains in connection with a combined worker/mother role. This deserves to be empirically tested in the future. The results in paper V support the idea that forgone income is lower among the better-educated than among their contemporaries with a low education, but we do not know to what extent that is set off against higher direct costs.

At the fear of simplifying too much, one might say that the better-educated have more resources to handle the inherent conflict between work activity and family obligations. These resources must be due to their own education as well as the higher level among their husbands, which seems to have a net positive effect on the third-birth probabilities. Certainly, we cannot see any educational differences in the effect that employment activity shortly after second birth exerts on the third-birth probabilities, but that is no compelling evidence against our explanation (see also discussion of paper IV).

In principle, it is also possible that the costs of childbearing actually are invariant with educational level, or even highest among the better-educated, but that this has little impact on fertility compared to certain counteracting educational differentials in the preference structure. To our knowledge, however, there is no documentation of such structures that could explain the surprising social pattern in the birth rates.

A slightly more pronounced positive net effect of woman's educational level has been estimated for the early 1980s than for the early 1970s. In the latter period a U-shape turned up. The zero-order effect has increased more sharply. That must be due to compositional changes within the various educational groups that we have not yet explored properly.

When discussing possible temporal changes in the education effects, at least three aspects are particularly relevant. Firstly, it has become generally more common for women to take some secondary education. This may have resulted in a lower relative value of a higher education, which in turn would be likely to give this group of women a fertility pattern that deviates progressively less form the average. Secondly, the various political efforts aimed at reducing the job-family conflict may have benefitted some social groups more than other. The ongoing research about child care supply as a potentially stimulating factor, which was referred to above, indicates that the rising number of places in day care centres has had a particularly strong effect on the third-birth rates among better-educated women. Thirdly, the educational differentials in contraceptive use and knowledge may have diminished. This would tend to reduce a fertility-inhibiting effect of education.

Before terminating the review of paper III, we point out that our analysis of third births confirms the strong impact of age at second birth and interbirth interval, which has been repeatedly demonstrated in previous research (referred to as "engine of fertility" in e.g. Rodriguez et al, 1984). This signals that we are "set on a track" at an early stage of the life-course - by chance or as a result of different life-strategies or individual resources. A further discussion, which also takes into account a few similar findings from other papers, can be found in the final chapter.

PAPER IV: Readdressing the impact of labour force participation

In the analysis reported in paper IV, we have made use of the survey data to gain more insight (than that provided in paper III) into the relation between labour force participation and the progression to parity three. This issue of employment and fertility is theoretically complex and previous empirical evidence is rather blurred. While there is no doubt that childbearing has a profound impact on subsequent work activity, there seems to be little empirical support from individual-level data for a strong subduing effect of various employment indicators on fertility.

Information about individual employment plans, work commitment, and expected consequences for the work activity of having a child is very important in this field of research. Both in Sweden and Britain attempts have been made to distinguish between a group of women who seem to have strong employment preferences and a group who are more home-attached. The theoretical point of departure is, of course, that women with long work experience have more to lose by having a child because the employment means more to them, and because their higher wage potential would make the costs of non-employment higher, whereas some of the home-attached may not even consider employment an alternative. Somewhat surprisingly, the third-birth rates did not differ markedly between these two groups of women.

Our own analysis has been based on a slightly different approach: We place more emphasis on the *changes* in employment around the time of second birth, which are likely to signal the employment forgone because of childbearing ("time costs"). This approach has been taken because we believe that a measure of total work experience captures a combination of general work commitment, availability of jobs and problems with finding acceptable child care arrangements.

When we compare women who hold a job shortly *after* second birth with those who are homemakers at that stage, no fertility differentials show up. This confirms the register-based results (paper III). As expected, a particularly low third-birth rate is estimated for those among the non-employed who had worked much *before* second birth, and thus may have a strong commitment to occupational tasks but difficulties in combining employment and childcaring. If these problems are likely to show up also after the arrival of the next child, they face particularly high opportunity costs of childbearing, which may reduce their probability of advancing to a higher parity. However, according to our estimates, their probability of having a third child is not *significantly* lower than that among other women. In fact, we were not able to identify any employment profile that was associated with a fertility markedly lower or higher than average. This holds for the entire period under study. Unfortunately, our data do

not cover the mid-1960s properly, since only women born after 1945 have been interviewed.

Our results agree well with those from Sweden and Britain. Apparently, they do not fit with the notion that increased employment opportunities and generally stronger preference for work activity have been important driving forces behind the decline in the cohort fertility. It certainly seems plausible that enhanced work *motivation* - in the sense that women think progressively more in terms of lost income - may have a *subduing* effect on fertility. Possibly, the initial stage of the "second demographic transition", which is not adequately covered by our data, may be characterized as a transition away from a situation where employment often would not be considered a realistic alternative among mothers, regardless of their further reproductive behaviour.

On the other hand, as soon as women take their lost work experience into account, better job *opportunities* - or any other factor that leads to an expectation of a shorter time diverted from market work in case of a birth - may be thought to produce *elevated* birth rates. As discussed in paper I, various social and economic changes and reforms have facilitated the combination of employment and childcaring during the 1970s and 1980s. This may have paved the way both for higher participation rates and higher birth rates.

Opportunities and *motivation* are, of course, deeply intertwined, and it is hardly possible to define two groups of women who differ in one of these factors and not the other. Therefore, one cannot conclude on the basis of the Norwegian results whether job opportunities and job motivation have a generally weak influence on fertility, or whether they both have more marked effects that tend to outweigh each other. Presumably, this distinction is not very important anyway, because the expansion of the female labour market over the last few decades to a large extent signals that improved job opportunities and stronger work motivation have gone hand in hand.

Another important result reported in paper IV is that place of residence and church attendance are very strong determinants of third-birth probabilities (as are the factors that capture previous demographic behaviour, such as age at second birth and interbirth interval). We are inclined to interpret this as an indication that value orientation plays a relatively dominant role in reproductive decision-making and behaviour. This is discussed in more detail in the final chapter.

Paper V: The price of a child

The complete employment and maternity histories in the sample survey have allowed us to estimate the total time diverted from the labour market because of childbearing. We believe that this fills an important gap in the scholarly literature. Much attention has been focused previously on how the employment status at a given stage of a woman's life is influenced by her family size at that time, but little is known about the time expenditures incurred during the total life course. Work activity profiles (by age) for women with different reproductive careers have been predicted in the United States and Britain on the basis of employment transition rates that were estimated for a very

limited number of years. To our knowledge, the Norwegian analysis is the only attempt to assess time and opportunity expenditures for *real cohorts*.

In view of the published employment statistics for the three countries, the results are surprisingly different, with a much longer time diverted from the labour force in Norway and Britain than in the United States. This is discussed at length in the paper. It would be very interesting to compare these countries with more similar methods and data in the future.

According to our Norwegian study, a two-child mother born in 1950, whose births occurred in her early 20s, has lost 6.6 woman-years up to age 37 compared to a childless woman. Her lost income amounts to 151000 dollars at 1990 prices (98000 after tax). There is good agreement between these estimates of forgone labour participation and earnings, which are derived from interview data and registered taxation data, respectively. The paper contains a fairly detailed account of the data quality and a discussion of some methodological problems, which we see no reason to repeat now.

In an earlier version of paper V, some rough estimates of other costs of childbearing were presented, and it was concluded that one million NOK (at 1990 prices) would be an appropriate "price tag" for two children raised during the 1970s and 1980s. Child allowances at a level of 0.3 million were deducted.

As expected on the basis of previous investigations into the social differences in the work activity of females, we found that better-educated women have diverted less time from the labour market because of childbearing than other women. In spite of their higher wages, it also seems that their opportunity expenditures are lower. This pertains to second and third births exclusively. These educational differentials in the opportunity costs are not significant at a 0.05 level, but the results are nevertheless thought-provoking, since a positive effect of educational level on the third-birth probabilities has been found in recent second-parity cohorts (see paper III). In the light of these findings, we are inclined to question the idea that a child has a particularly high price for a better-educated woman. One must keep in mind, however, that if women in the higher social strata actually incur lower opportunity expenditures, this is set off against higher direct expenditures due to non-familial child care.

It remains to be seen whether the opportunity costs and direct costs of childbearing have changed much during the last few decades, and whether such changes would be consistent with the observed fertility trends. We have been compelled to focus on the 1945 and 1950 cohorts, and because of the sharp rise in the labour force participation among women with small children, there is little doubt that younger cohorts divert less time from the labour market because of childbearing (see also the discussion of paper IV). Another issue that deserves to be further explored is the long-term employment and income consequences ("pay-penalty") of a temporary withdrawal from the labour market. This would require data on older women.

Paper VI: How reproductive behaviour affects marital stability

Paper VI reports a purely demographic analysis, where no social, economic or cultural variables are included. Our focus has been on the timing of first birth relative to marriage, but also the effects of the current number of children and the age of the youngest child have been addressed in the paper. A more detailed discussion of the latter issues is found elsewhere (Kravdal, 1988; Kravdal and Noack, 1988).

The analysis confirms that the timing of first birth is a strong determinant of divorce. The most important result is that the high divorce rate that has often been found among women who have a child when they marry, is not confined to those who marry another man than the father of their child. Also women who marry the father run a very high risk of marital break-up, even when we control for the fact that they at a given stage of the marital life course have older children, which is found to have an independent divorce-promoting effect. Moreover, we have found that premarital childbearing has had a gradually weaker effect on the divorce risks during the last couple of decades. This probably reflects that this birth/marriage sequence has become more common, and thus to a smaller extent signals "deviant" characteristics.

To our knowledge, the distinction between women who marry the father of their child and those who marry another man had not been made in previous investigations from other countries. Nor have these previous studies controlled properly for the current number of children and their age. However, a number of recent studies have shown that there is a higher risk of marital disruption among couples who cohabit before marriage than among those who marry directly (Hoem and Hoem, 1992; Klijzing, 1992; de Rose, 1992; Thomson and Colella, 1992; Trussell et al., 1992). (An even higher dissolution risk is, not surprisingly, found among couples who are still living in a consensual union. See also Schoen, 1992). While not exactly the same phenomenon, premarital birth and premarital union experience are undoubtedly closely related.

The Norwegian register-based analysis also demonstrates that a premarital conception that has led to a "legitimate" birth tends to increase the divorce risk compared to having the first child more than 7 months after marriage. Apparently, this had not been generally accepted previously. Moreover, we have found that postponing the birth until at least two years after marriage increases the stability slightly during the first 10 years of the union. This may partly be an artifact due to the broad groups we have used when controlling for the current age of the children, but it may also reflect that such a late entry into parenthood helps to cement the marriage.

One reason for the excess marital instability among couples with a premarital birth or conception, which in fact seems to persist throughout the marriage, is that the couple may have contracted their marriage too quickly in order to "legitimize" the child. Such haste is thought to produce less compatible matches and lower expected gains from remaining married (in the economic-demographic terminology). Another explanation is probably that the "unorthodox" sequencing of marriage and birth signals that these women have relatively liberal family values, which also makes them more inclined to dissolve an unsatisfactory marriage. (In other words, they have lower costs of dissolving the marriage because of weaker normative constraints). One might also expect that a

quickly arranged marriage leads to or is associated with low socioeconomic status, which in turn has an adverse effect on marital stability. This is not confirmed by our later research, however (paper VII).

Also the age at marriage is a strong correlate of divorce, net of the birth-marriage sequence. This has shown up clearly in our own study (for details see Kravdal and Noack, 1988), and has also been repeatedly demonstrated in previous research. Again, we seem to witness the effects of quickly contracted marriages and a shorter "search time". Besides, a lower age has been thought to influence the ability to cope with interpersonal conflicts (thus affecting the expected gains from marriage). As referred in the theoretical chapter, it has also been suggested that young men and women are more strongly aware of the fact that there are alternative partners available, which reduces the costs of divorce.

Finally, the analysis reported in paper VI shows that a larger number of children and a lower age of the youngest child reduce the divorce risk markedly. This comes as no surprise, since children, and in particular small children, increase the costs and inconvenience of setting up a new household. It is probably also important that children generally may be considered "marital specific capital", in the sense that the satisfaction received from them cannot be enjoyed fully by both parents after a break-up. Moreover, a couple with children may, of course, tend to remain married in order to protect them from the emotional consequences of a family disruption. The causality may also run in the opposite direction, however. Fear of a marital break-up may have prevented the couple from having (more) children.

Also other studies have shown, with few exceptions, that children tend to reduce the divorce risks, but there is no scholarly consensus that the parity effect is *monotonic*. For instance, Hoem and Hoem (1992) have estimated from a much smaller Swedish data set that having a third child *increases* the union disruption risks compared to what it is among couples with only two children. They contended that this could be due to an additional emotional and economic strain on families who go beyond the two-child norm. A similar U-shape has been reported by Murphy (1984) from Britain.

Paper VII: Unobserved heterogeneity, attitudinal dimensions and socioeconomic factors

When paper VII was written there were no published studies where unobservables had been included in empirical divorce models, and there were also few examples of such methods being used in investigations of other demographic events. Shortly afterwards, however, Hoem (1990c) published an analysis where he considered a number of family transitions simultaneously in an attempt to capture the influence of a persistent unobservable.

Our intention was to see whether a control for unobserved heterogeneity would influence the estimates of the baseline hazard and the various covariate effects, and whether the high divorce risk among women with a premarital birth could be accounted for by the unobservables. However, paper VII also contains results about the influence of a large number of sociodemographic factors, which are hardly discussed in the text. As

part of the review of the paper, we present a few predictions based on the model estimates in paper VII.

The baseline hazard

The analysis has been focused on women who married in 1968 -1970, and who remained married for at least two years and until the Population Census of 1970. (Some other restrictions were also imposed). It is known from other sources (Kravdal and Noack, 1988) that the divorce rates for these marriage cohorts have increased during the first 5 years of marriage and then levelled off. However, there is no theory that would tell us which functional form we should expect, and the empirical results from other studies are contradictory (see e.g., Becker et al., 1977; Hoem and Hoem, 1992; Menken et al., 1981; Trussell et al., 1992). A low divorce rate during the first few years seems very likely, but at longer durations of marriage no firm predictions exist (see theoretical chapter). We decided to use a log-logistic baseline hazard in most of the models. This functional form can fit both a monotonically increasing hazard and one that declines after a few years of marriage. In addition, the large sample and the powerful computer allowed us to experiment with a more flexible semi-parametric hazard. Using two different specifications also seemed sound on the basis of previous findings indicating that the results might be sensitive to the functional form of the hazard (Trussell and Richards, 1985).

When no unobservables were included, we estimated a log-logistic baseline that reached a maximum at about 8 years of marriage. In the Heckman-Singer model with two support points, which gave significantly better model fit, the population was split into two groups with an hazard that increased monotonically throughout the entire interval under investigation (this result was modified when we allowed the baseline to differ between the two groups). Similarly, the semi-parametric specification gave a stable hazard after about 6 years of marriage when no unobservables were included, and a continuously rising hazard for two sub-groups according to the Heckman-Singer model. The interpretation of this pattern is that the spouses gradually "wear each other out" and that the levelling out or decline observed at the aggregate level is due to the fact that the "divorce-prone" become a gradually smaller group during the marital life course. However, it must be admitted that the continuously rising hazard in the Heckman-Singer model comes as no surprise. A constant or declining intensity in the two sub-groups could not possibly have produced the plateau that was estimated for the aggregate rate in the standard models.

Mixing distribution, impact of unobservables and sensitivity issues

Control for unobservables improved the model fit significantly both when we estimated a purely demographic model and also (just as much, as judged by the change of the log-likelihood) when a number of socioeconomic covariates were included. The high-risk group comprised typically 10 per cent of the women, and the divorce rate in this group was more than 20 times higher than in the low-risk group. This is a very high excess risk compared to those estimated for the observed covariates. The covariate effects turned out to be virtually insensitive to the inclusion of unobservables. These conclusions hold for log-logistic as well as semi-parametric baseline hazards.

Separate models for women with a premarital birth and those with a marital birth

The paper also reports an attempt to relax the assumption of independence between observables and unobservables. Family values and adherence to "traditional" norms are among the factors that are unobserved (except that they are partly captured by the religiosity indicator and the regional variable), and they are likely to be very important for the divorce risks. As discussed in paper VI, we believe that the timing of first birth compared to marriage is strongly correlated with such attitudinal dimensions, and we therefore estimated separate models for women with a premarital birth and women who conceived their first child after marriage. It turned out, however, that in both these strata there were about 10 per cent in a high-risk sub-population. Among these high-risk women, first-birth timing had virtually the same effect as we found in standard models where unobserved heterogeneity was not taken into account. Afterwards we have seen that Hoem (1990c) also failed to "explain" a similar phenomenon, namely the impact of previous cohabitational experience, when he introduced a (persistent) unobservable.

Methodological after-thoughts

The mathematical theory has been further developed after paper VII was written. It now seems well established that one can always find models incorporating unobserved heterogeneity, with different combinations of baseline hazards and heterogeneity distributions, and one model not including unobservables that fit the data equally well (Trussell and Rodriguez, 1990; Hoem, 1990b). Theoretical arguments must be used to choose the best model. This certainly throws some doubt on the gains from using such techniques.

It has also been documented recently by Manton et al. (1992) that a serious bias may be introduced if unobservables and observables are incorrectly assumed to be independent. Our divorce study is, unfortunately, a very good example of such a situation. We assumed the mixing distributions and the effects of the unobservables to differ by birth-marriage sequence, but should probably have gone further steps in this direction. In particular, variables related to previous demographic events, such as age at marriage, are likely to be correlated with the unobservables.

Moreover, the interpretation of the estimated mixing distribution seems uncertain. Some studies based on Monte Carlo simulations indicate that it is difficult to estimate the "true" distribution of the unobservable (e.g. Heckman and Singer, 1984; Gonul, 1989). This means that a comparison of mixing distributions between, for instance, women with a premarital birth and those who had their first child in-wedlock may be of limited relevance.

More about the estimated covariate effects

Our socioeconomic covariates refer to the situation at the time of the 1970 Census, which is less than three years after marriage. Income is the amount earned during 1970.

An important result is that the effect of first-birth timing remains when we include a number of socioeconomic controls. This means that the high divorce risk among women

who have had a premarital birth is not due to a lower social status associated with or caused by this birth-marriage sequence.

We also find a considerable effect of place of residence when we combine region and a rural/urban dimension. Part of this can undoubtedly be attributed to the higher divorce risks in urban than in rural areas, which has often been explained in terms of social integration and women's work opportunities. In addition, there is a regional gradient, which appears more clearly in research that we have not yet finished: The highest divorce risks are found in Eastern Norway and the lowest in Western Norway. This bears some resemblance to the pattern usually found with respect to the frequency of extramarital births and consensual unions, except that these frequencies are just as low in Southern Norway as in Western Norway, and that they are highest in Northern Norway. Presumably, these regional differences in family behaviour partly reflect the influence of attitudinal factors. For instance, religious doctrines are likely to have a relatively strong hold on the population in Southern and Western Norway.

Besides, we have found that certain occupations are associated with a low divorce rate (e.g. agricultural work), whereas others are associated with less stable marriages (e.g., hotel and restaurant work, sea transportation for men). This is probably the consequence of a number of factors such as selection into that occupation, economic barriers to divorce, availability of potential mates at work, being away from home etc., which affect the expected gains from marriage as well as the costs of divorce.

We have included second-degree polynomials to capture the effects of some (approximately) continuous variables such as education and income, without testing whether a first-degree polynomial would have performed just as well. To facilitate interpretation of the results, we show the predicted relative divorce rates for a few selected groups in Table 2.

Woman's educational level is not significantly related to the divorce risk. The predicted risk increases extremely slowly with educational level. By contrast, a higher education for the husband has a clear protective effect. We return to an interpretation of these results when we review paper VIII, which adds to our understanding of the importance of educational level.

No clear effect of a woman's income can be seen. The divorce risk increases only slightly up to about 10000 NOK, and then decreases slowly. (We have not predicted relative risks for income levels beyond 60000 NOK, which were fairly uncommon at that time.) However, because the income variable refers to the total amount earned during 1970 and the data did not allow us to control properly for employment, the result is difficult to interpret. A high income can be due to high wages as well as high work activity during that particular year. The latter, in turn, signals that the first child has not yet been born (which also has an impact on the age and number of children at a later stage of the marital life course), that the woman is not enrolled, that she has a strong work commitment, or that she is faced with good job opportunities. Since we have controlled quite well for the first-birth timing and for the educational activity at the time of the census, the result may indicate that neither wage potential, work commitment nor job

Table 2. Prediction of some relative divorce risks, according to the estimates in Model 3

	Relative risk, by	
	woman's educational level	husband's educational level
9 years	1.00	1.00
12 "	1.05	0.81
15 "	1.07	0.70
18 "	1.07	0.63

	Relative risk, by	
	woman's income	husband's income
0 NOK	1.00	1.00
5 000 "	1.11	1.13
10 000 "	1.12	1.04
20 000 "	1.11	0.88
40 000 "	1.09	0.69
60 000 "	1.07	0.58

	Relative risk, by woman's age at marriage
18 years	1.00
20 "	0.65
25 "	0.39
30 "	0.30
35 "	0.33

Risk if both spouses are affiliated with a religious society other than the Norwegian Church, compared to that among couples who are members of the Norwegian Church	0.51
Risk among women who have their first child within 7-24 months of marriage, compared to that among women who have had a premarital birth	0.49

opportunities exert a strong positive effect on the divorce risk. This interpretation is, of course, based on the assumption that these wage and employment variables are reasonably stable over time, and thus may be captured by one single measurement shortly before or after entry into marriage.

Except for a weak increase up to about 5000 NOK, husband's income during 1970 is found to be inversely related to the divorce risks, just as predicted by the economic-demographic theory. In other words, there is an independent protective effect of both income and educational level for men. However, the income effect seems to be fairly small. Even a 50 per cent increase in the income around the average level has little impact on the divorce risks compared to, for instance, the effect of the birth-marriage sequence, of the place of residence, and of the religiosity indicator (for further discussion of the latter effect, see review of paper VIII).

Women who are enrolled in school shortly after entry into marriage appear to have a significant excess divorce risk. In contrast to this, a non-significant protective effect of husband's schooling is found. Explanations are discussed in the review of paper VIII.

Finally, we have found that the educational level of the woman's parents tends to raise the divorce risk. Such a result has also been reported by Hoem and Hoem (1992) from Sweden. It could possibly be attributed to transmission of liberal family norms and the possibility of receiving economic support in case of a marital dissolution.

Paper VIII: The importance of heterogamy, educational level and religious denomination for the marital stability

The main objective of paper VIII is to describe briefly the prevalence of heterogamy in contemporary Norwegian marriages and to discuss whether heterogamous couples run a higher divorce risk than their homogamous counterparts. The issue of heterogamy has received much attention in the literature, and it seems to be a well-established notion that "marrying-out" reduces the gains from marriage - because of lack of common values and interests or because of sanctions from others. It may also signal deviation from group norms, and thus be associated with lower costs of divorce. One exception that has been mentioned is a union between a man with a high earning capacity and a women with a low earning capacity, because this is supposed to foster a sexual division of labour that increases the gains from marriage (Ermisch, 1986).

Our analysis is a follow-up of two complete Norwegian marriage cohorts (1968 and 1978), with information about socioeconomic characteristics two years after marriage (from the Population Censuses of 1970 and 1980). We have focused on age, education and religious denomination, and find only moderate support for the view that heterogamy has an adverse effect on the union stability. There is a relatively high divorce risk among the few women who marry a man who is more than 4 years younger. Moreover, if only one of the spouses is affiliated to a religious society other than the Norwegian Church (in which the large majority of the Norwegian population are members), the couple run a high divorce risk compared to couples where both husband and wife are members of the Norwegian Church, and compared to couples where both

partners have another religious denomination. This suggests that religious heterogamy may be detrimental to the quality of the union.

There are no clear heterogamy effects - neither protective nor adverse - with respect to the educational level. It turns out that a multiplicative main effects model where educational level of husband and wife are included fits the data well. The interaction effects between the two educational variables are small. In other words, the impact of husband's education is approximately independent of the wife's education and vice versa. For instance, the woman's educational level reduces the divorce risks even if her husband has a low education. This general structure is more easily understood from Figure 1 in paper VIII if we disregard the very small groups with maximum educational heterogamy.

According to such a main effects multiplicative model, husband's education has a weak protective effect in the 1968 cohort, whereas woman's education has no significant effect. A stronger protective effect of both partners' education is found for the 1978 cohort, but a female educational level beyond the medium does not further increase the probability of remaining married. These results are consistent with those reported in paper VII, where the focus was on the 1968-1970 marriage cohorts and there was a positive, but clearly non-significant, effect of woman's education on the divorce risks (and more controls included). Moreover, research that we have not yet finished suggests that the effect of educational level is of a fairly general nature. The educational variable appears not to be involved in interpretable and significant interactions with other covariates.

This weak negative effect of woman's educational level (which appears when we pool over the two marriage cohorts) does not run counter to previous empirical results. As stated in the theoretical section, the effect of woman's educational level is not easily predicted because a number of counteracting mechanisms may be involved. Empirical results have been widely different. It is usually concluded that woman's educational level has a protective effect, but many studies have failed to control for the husband's educational level (see e.g., Trussell et al., 1992; Bumpass et al., 1991; Menken et al., 1981). Some investigators have also claimed that education is unrelated to the divorce risks (Balakrishnan et al., 1987; Lehrer, 1988). Moreover, there are indications that the effect of education depends on marital duration (Morgan and Rindfuss, 1985; Ermisch, 1986) and that it even may change from being negative to being positive across the life course (South and Spitze, 1986). Finally, it has been reported in a recent Swedish study that education protects against union break-up as long as there are no children involved, whereas a weak adverse effect may be discerned after birth (Hoem and Hoem, 1992). An adverse effect has also been found in Italy, possibly because of the lengthy legal procedures that the divorcing couples have to go through (de Rose, 1992). Taken together, our own results and those reported from other countries suggest that any divorce-promoting effect of a high wage potential among better-educated women is more than outweighed by factors working in the opposite direction.

It also turns out that women who are enrolled in school two years after marriage run a particularly high risk of divorce, whereas husband's enrollment has no impact (as also

found in paper VII). Our more recent, and still unpublished, research has shown that this effect of enrollment erodes markedly with increasing duration of marriage. A possible interpretation of the results, which is based on the idea that men and women may have different expectations about a marital relationship, is that the wife and student roles may not be quite compatible, for instance because of husband's irritation about heavy burdens of reading or about the wife's participation in campus social life. By contrast, it may be more easily tolerated that a newly-wed man engages in educational activities. It seems less likely that the effect stems from a stronger exposure to alternative mates and to a set of liberal family values, since that would probably also affect the enrolled husbands. Nor do we believe that the higher educational level in the *future* among those who are enrolled shortly after they marry (recall that the educational level at *that time* is controlled for) is an important explanation, since this human capital variable actually proved to be inversely related to the divorce risks.

Husband's education has received less attention as a determinant of divorce, and theoretical and well as empirical evidence seems to point more clearly towards a protective effect (see e.g. Lehrer, 1988). We have found that the high stability of unions where the husband has a higher education cannot be fully explained by his high income. It was shown in paper VII that there was a net protective effect of both these variables in the 1968-1970 marriage cohorts.

Finally, the analysis demonstrates (see also results in paper VII) that persons who are not members of any religious society display very high divorce risks. On the other hand, being affiliated to other denominations than the Norwegian Church, which is likely to signal a more active religious life and stronger adherence to the doctrines, is associated with a low divorce risk (except in the heterogamous marriages where only one of the partners is a "non-conformist").

Conclusions

Challenging the economic fertility theories

Some of the results from this analysis tend to challenge the economic-demographic theories or to question their importance. For instance, we have found that husband's income has a very weak negative effect on the third-birth probabilities (paper III). An interpretation of this is that differential requirements for child "quality" more than outweigh the allegedly positive effect of income on the demand for "quantity", even though we have controlled for his educational level. While not actually running counter to the economic-demographic theories, this result and similar findings reported elsewhere, usually with smaller data sets, suggest that the overall income level in the society has little direct impact on the reproduction of the population.

The analysis has also revealed that education affects the childbearing pattern in a very complex manner that partly contradicts theoretical expectations. As repeatedly shown in previous research from a wide range of countries, the age at first birth and the proportion who remain childless rise with increasing education. The findings reported in paper II support the conclusion from a German study that this is primarily due to the *time* required to take the education, and not the higher price of the woman's time that follows from a higher educational *level*. Current educational activity strongly reduces a woman's probability of becoming a mother at that time, and the longer time spent at school has obviously been an important ingredient behind the rising age at first birth during the last two decades. When the activity state is controlled for, the educational level has no subduing effect on the first-birth rates. The only exception is the group of women who reported to be neither married nor cohabiting. Among these women, there is a negative net effect of educational level on the first-birth rates, which seems to operate partly through a negative wage effect. The remaining fertility-inhibiting effect of educational level among single women could perhaps be attributed to differentials in contraceptive efficiency.

As well known, the age at first birth strongly affects the probability of having a third birth. In addition, there is an unexpected positive net effect of educational level (paper III). The better-educated women in recent second-parity cohorts proceed more often to

parity three than their contemporaries with less education, in spite of their later start of childbearing.

These results from studies of first and third births suggest that higher wages do not necessarily increase the total costs of childbearing in a situation where mother's time may be substituted by purchased child care. Possibly, there may even be relatively *low* costs among the better-educated (for a more detailed argumentation, see the review of paper III). At the fear of simplifying too much, one might say that the better-educated have more resources to handle the inherent conflict between work activity and family obligations. For instance, they may have been able to benefit more than other women from family and labour market policies designed to reduce costs and inconvenience of childbearing for employed mothers. In fact, ongoing research about child care supply as a potentially stimulating factor, indicates that the increasing number of places in day care institutions has had a particularly strong effect on the third-birth rates among the better-educated.

With respect to the decisions about first births, the childbearing costs may be particularly important if they are known to depend strongly on the timing of first birth. Entry into parenthood is an event that almost everyone wants to experience, and the decision-making probably centres primarily around the issue of *when* the transition should be made. One interpretation of our results is that the earning capacity is virtually unrelated to the first-birth timing that would maximize lifetime income, or that any such influence on the optimal timing may be unknown to the decision-makers. By contrast, part of the explanation for the low first-birth rates among the currently enrolled, and for the high fertility among the "non-active", is probably that these women easily recognize that certain penalties or benefits are associated with having a child *immediately* compared to *later*.

The strong effect of work experience on the first-birth rates suggests that wealth accumulation is important. This could be incorporated into the tempo theories launched by Happel et al. by allowing for a slightly extended "consumption smoothing incentive": In order to enjoy a reasonably high consumption during the initial stage of family-building, the couple may have to wait for a certain level of accumulated financial and material resources, and not only for a high income of the husband.

The relationship between employment and reproduction is particularly complex. It has often been assumed that better job opportunities and stronger work orientation for women, as exogenous structural forces, increase the price of their time, and thereby reduce fertility - for instance the probability of having a third or fourth child. The analysis reported in paper IV, which shows that employment before and shortly after second birth is almost unrelated to the third-birth probabilities, suggests that these ideas are too simplistic.

It certainly seems plausible that enhanced work *motivation* - in the sense that women think progressively more in terms of lost income - may have a *subduing* effect on fertility. Possibly, the initial stage of the "second demographic transition", which is not adequately covered by our interview data, may be characterized as a transition away

from a situation where employment often would not be considered a realistic alternative among mothers, regardless of their subsequent reproductive behaviour.

On the other hand, as soon as women take their lost work experience into account, better job *opportunities* - or any other factor that leads to an expectation of a shorter time diverted from market work in case of a birth - may be thought to produce *elevated* birth rates. As discussed in paper I, various social and economic changes and reforms have facilitated the combination of employment and childcaring during the 1970s and 1980s. This may have paved the way both for higher participation rates and higher birth rates.

Opportunities and *motivation* are, of course, deeply intertwined, and it is hardly possible to define two groups of women who differ in one of these factors and not the other. Therefore, one cannot conclude on the basis of our results whether job opportunities and job motivation have a generally weak influence on fertility, or whether they both have more marked effects that tend to outweigh each other. Presumably, this distinction is not very important anyway, because the expansion of the female labour market over the last few decades to a large extent signals that improved job opportunities and stronger work motivation have gone "hand in hand."

On the whole, it seems that the shift towards higher educational goals both among men and women has been a very important driving force behind recent changes in reproductive behaviour. According to our studies, this is primarily because the longer time spent at school tends to increase the age at first birth. The higher wages for women, the better job opportunities and the stronger work orientation, which are deeply intertwined with the "educational revolution", but which also have originated from other sources, seem to have played a less crucial role in the fertility decline than claimed by many proponents of the economic-demographic theory. When drawing these conclusions, little attention is paid to the aggregate study (paper I), which merely describes a striking similarity between the trajectories of the third-birth rates and the average real wages for females, with no evidence for a causal relationship.

In spite of these critical remarks, it cannot be concluded that economic-demographic theory should be dismissed as largely irrelevant. On the contrary, theories centred around the costs of childbearing, which are indeed large (paper V), are intuitively appealing and deserve to be further developed. Our results suggest that the total costs of childbearing may be important in the decision-making, but that these costs are not necessarily positively related to women's wages and educational level. One should welcome the efforts to take purchased child care into account when refining the theoretical models (see Ermisch, 1989). Also other factors affecting the compatibility of employment and family obligations deserve to be included. With respect to the timing of first birth, more attention could well be paid to the importance of wealth accumulation.

A variety of divorce determinants

Current demographic research on divorce has much of an explorative character, with continuous efforts to assess the impact of a broad array of factors. In the Norwegian investigations reported in this thesis, we have had access to an unusually large data set,

and have used relatively advanced methods. Therefore, the results are potentially interesting to a wide audience.

We have estimated significant *net* effects of a number of covariates, not only the purely demographic, but also such as occupation, place of residence, religious denomination, educational activity, educational level of the marriage partners and of the wife's parents, age heterogamy and religious heterogamy. Such effects can be interpreted within a broad economic-demographic framework built on the concepts of benefits from marriage and costs of divorce. For instance, some of the divorce correlates may affect the expected gains from remaining married through the ability to solve conflicts, the general emotional harmony, or the sexual division of labour. They may also influence the costs of divorce through availability of potential mates, economic costs of setting up a new household, normative constraints, and various expected emotional consequences of splitting up the family.

Admittedly, our estimates of covariate effects cannot yield much insight into the relative importance of the underlying behavioural mechanisms sketched above, but some of the evidence suggests that the purely economic considerations may have fairly modest importance. To substantiate this, a few factors that are related to the economic barriers to divorce, or to the material wealth of the family, are now addressed.

In accordance with most previous studies, we have found a weak protective effect of a high education for women (paper VII and VIII). Better-educated women tend to have a relatively high age, and to be childless when they enter marriage. They also often have better-educated husbands. When these factors are controlled for, the remaining effect of educational level on the divorce risk is negative or non-significant, depending on the marriage cohort. This result indicates that the higher wage potential for the better-educated women has a fairly small divorce-promoting effect, if any, compared to various factors that contribute to increase their gains from remaining married. For instance, women with some education have been thought to search more thoroughly for a partner, and it is possible that they are better able to handle the interpersonal problems.

Moreover, women's income measured during one particular year has no clear impact on the divorce risk (paper VII). With due respect to the methodological limitations, these results throw some doubt on the notion that women's growing economic independence has been a key driving force behind the rapidly escalating divorce rates since the 1960s - an increase which even continued during the years when fertility rates levelled off.

We have found that the educational gradient in the divorce risk is steeper in the 1978 than in the 1968 marriage cohort (paper VIII). If these two years are representative, the result suggests that women with low education have experienced the most pronounced increase of the divorce rates during the 1970s and early 1980s. This would be consistent with an idea that there is a diminishing marginal effect of women's economic strength, so that a general wage rise and an expansion of the female labour market have the strongest impact among the economically disadvantaged. However, since we have failed to observe any marked effects of these economic variables, the temporal change in the

educational differentials may equally well be interpreted as a diffusion of liberal family values across social strata.

The number of children is another factor that is related to the economic barriers to divorce. It certainly exerts a strong protective effect on the divorce risk (paper VI), but the purely economic explanations are not necessarily the most important. Above all, the emotional consequences both for the parents and the children (who are "marital-specific capital" for the parents according to the economic-demographic framework) must weigh heavily in the decision-making. A similar argumentation is relevant with respect to the low frequency of marriage disruption among farmers (paper VII). High economic costs associated with a marital disruption, as well as a variety of other factors, are likely to be important for these couples.

With respect to husband's income, we have estimated an effect that runs in the expected protective direction, even when it is controlled for his educational level. However, the effect is relatively weak (paper VII).

As a final example of the modest role that seems to be played by economic factors, we point out that the high divorce risk we have found among women with a premarital birth seems to operate largely through non-economic mechanisms, such as selection with respect to norms and the length of the "search time" (papers VI and VII). According to our estimates, there is little support for the view that the effect is due to an inferior social position associated with or caused by this particular birth-marriage sequence.

This review of divorce determinants is terminated with a brief comment on the estimated hazard profile. On this subject, theories provide no firm predictions and the empirical evidence has been conflicting. Our results suggest that accumulation of information and irritation dominates during the early stages of the marital life course, whereas the following stabilization or decline of the divorce risk signal that investments serve as a barrier to divorce. Alternatively, a strongly divorce-prone group, with a continuously increasing divorce risk, is gradually thinned out. It was found that a Heckman-Singer model with control for unobserved heterogeneity fits the data better than a standard model (paper VII), but given the recent critical comments on the statistical method, one should hesitate to take this as special support for the thinning-out hypothesis.

Correlations across the life course

There are very strong correlations between demographic behaviour in different stages of the life course. For instance, an early entry into parenthood and a short second-birth interval tend to increase completed fertility and the intensity of the third-birth progressions (papers III and IV). Besides, a premarital pregnancy and a low age at marriage are associated with a high divorce risk (papers VI and VII). In fact, the estimated effects of such purely demographic factors are among the strongest we have observed in our fertility and divorce models. This is somewhat discouraging, since one interpretation simply is that people are different in terms of family values, adherence to group norms, basic life preferences, fecundity etc., and that these differences have a persistent influence throughout the life course (which could not be traced in the models

incorporating unobservables). Such intracohort selection effects do not provide any information about the exogenous forces behind the drop to below-replacement fertility and the escalating divorce rates.

However, there are probably also some causal effects behind the correlations across the life course. For instance, women who have had an early first birth have a longer time of exposure for further pregnancies. In particular, this is likely to explain their higher lifetime fertility. Less is understood about the influence of first- and second-birth timing on the probability of having a third birth within, say, a fixed 5-year interval. One relevant explanation may be that the young mothers to a smaller extent are faced with fecundity impairments later on. Moreover, a low age at marriage may have a causal impact on the divorce rates through the ability to cope with interpersonal conflicts and the probability of attracting alternative partners. Undoubtedly, there must also be a causal effect of the current number of children on the risk of marital break-up, and, conversely, expecting or having experienced a divorce leads to a reduced fertility.

In other words, economic, social and cultural changes may affect one component of the family behaviour both directly and through other components. With respect to fertility and divorce trends, the direct effects have probably been most important. The reduction of cohort fertility among Norwegian women seems to explain only a minor part of the divorce boom (Kravdal and Noack, 1988). We have also seen in Norway that completed fertility among women born in the 1930s and 1940s is only about 0.2 lower for the relatively few (less than 20 per cent) who have experienced a marital break-up than among their contemporaries in stable unions (Kravdal, 1991). Part of this difference may even be explained by their lower fertility *prior* to divorce. However, it is possible that an increased awareness among *all* married women that they run a high risk of dissolution, and that they may be left alone with a heavy burden of responsibility, may have fuelled the fertility decline (Bumpass, 1990).

Further search for the exogenous forces behind the "second demographic transition"

The research reported in this thesis throws some doubt on the role played by the rising wages and improved job opportunities for women in the "second demographic transition", although we are far from rejecting the idea that cost considerations enter into the decision-making.

Two alternative explanations for the changing family behaviour were mentioned in the theoretical chapter. Firstly, the introduction of modern contraceptive methods may have been important in shaping a new reproductive pattern. That issue has hardly been touched in the analysis. Secondly, it has been claimed that the recent trends in fertility and family behaviour are deeply rooted in ideational changes (which may, in turn, be associated with economic and social transformations of our society.) A wave of "secular individualism" may have swept over many countries and driven cohort fertility down to below-replacement level, induced us to demand more from a marriage, reduced the normative barriers to divorce, and legitimized extramarital sexuality (see e.g. Lesthaeghe and Surkyn, 1988; Lesthaeghe, 1992).

Some variables that are indicators of (or strongly correlated with) the value orientation have proved to have a very pronounced impact on childbearing and divorce in Norway. For instance, we have found that religious activity is a strong determinant of third births (paper IV), and that religious denomination affects the divorce risks considerably (papers VII and VIII). This probably reflects that attitudes towards, for instance, materialism, consumerism, gender equality and abortion play a very important role. Also place of residence has been found to have a marked impact on fertility and divorce, above and beyond the urban/rural differentials, which may also have an economic interpretation (papers IV and VII). The regional pattern, which is consistent with that found in other Norwegian studies, as well as with tabulations in published vital statistics, may be attributed partly to differential religious attitudes and family values.

These results are not directly applicable to the *intercohort* comparison, however. One simply cannot know how important a generally growing secularism, with emphasis on self-fulfilment and individual freedom, may have been compared to the fairly large behavioural differences we find between, for instance, the religiously active and the religiously passive within a given birth cohort.

To summarize, the studies included in this thesis suggest that we need both refined economic theories and a further development of alternative explanations originating from non-economic sciences. Above all, identification of potentially influential ideational changes and their mode of diffusion should be high on the research agenda.

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Paper I

COMPONENTS OF THE RECENT FERTILITY INCREASE IN NORWAY: PERIOD AND COHORT PERSPECTIVES[1]

by

Øystein Kravdal[2]

This analysis demonstrates, on the basis of maternity histories for complete birth cohorts, that there was an important turn-around in reproductive behaviour in Norway around 1977. After a steady decline of the higher-order birth-rates since the mid-1960s, Norwegian women who had already given birth to two or more children experienced a moderate fertility increase. This development may possibly reflect lower costs and inconvenience of childbearing, not least because of a gradually reduced incompatibility between employment and family obligations. The fairly sharp increase in the total fertility rate during the last half of the 1980s is primarily a matter of tempo changes, however. During this period a larger fraction of the women entered their late twenties and thirties as childless, and - presumably as a catching-up phenomenon - they also experienced higher age-specific first-birth rates. Besides, the decline of the first-birth rates among the younger women was called to a halt in 1984 or thereabout, and the increase of the higher-order birth rates gained extra speed.

[1] This is a revised and updated version of a paper presented at the European Science Foundation Working Party on Recent Family Trends, Stockholm, 13-14 December 1990. The stimulating advice from Jan M. Hoem at Stockholm University is gratefully acknowledged.

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INTRODUCTION

During the last few decades period total fertility rates have been brought down to below-replacement level in most of the industrialized world. This development is thought to be closely linked with a stronger orientation among women towards the labour market without adequate support to handle the conflict between family and work, a steady movement towards gender equality in general, rising real wages for women, a growing secular individualization, and improved birth control. There are prominent American and European demographers who have argued that the potentials of these factors are still not exhausted, and that we may witness even lower fertility rates in the years to come (see e.g., Bumpass, 1990; Demeny, 1986; Lesthaeghe and Surkyn, 1988; Ryder, 1979).

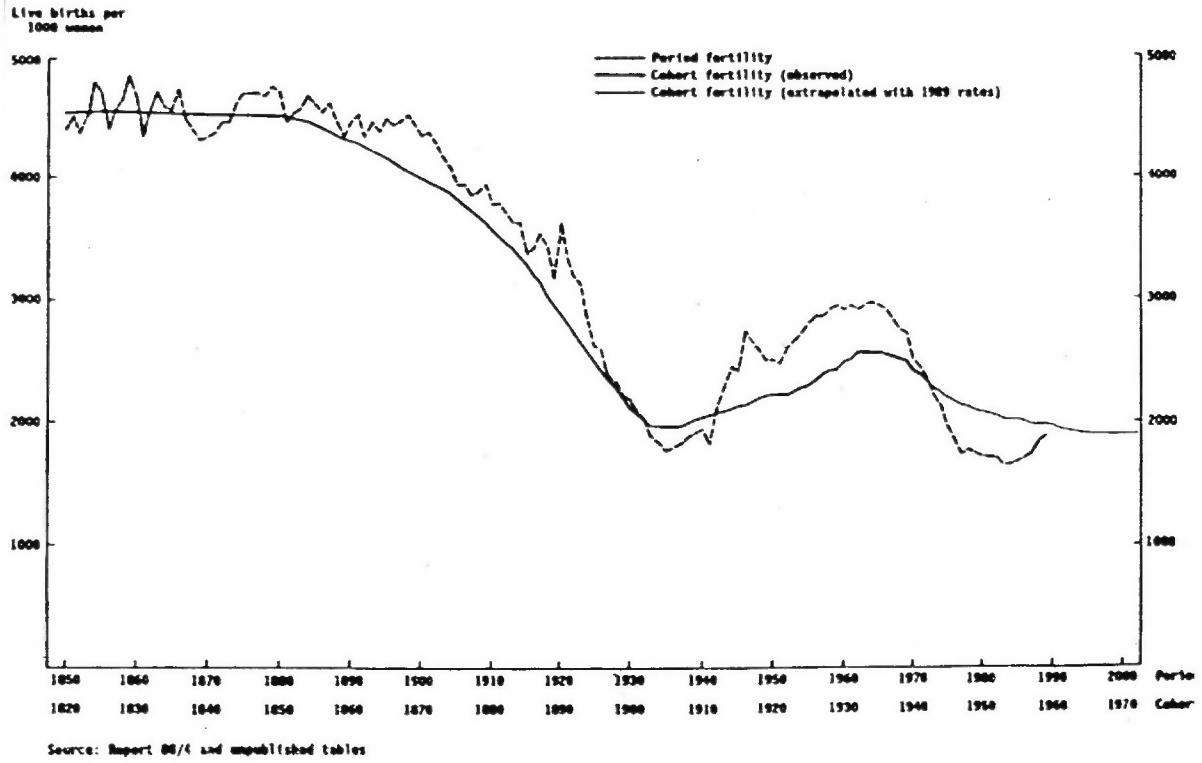
Since the mid-1980s, however, the annual birth rates have increased rather sharply in the Scandinavian countries. This fertility boost has been most pronounced in Sweden, where the total fertility rate was slightly above reproduction level both in 1990 and 1991 in spite of very high female labour force participation (OECD, 1991), and a "modern" family life with high divorce rates and wide acceptance of consensual unions (Haskey, 1992; Popenoe, 1987). In Norway, the total fertility rate dropped steeply after the mid-1960, but never to such low levels as in the Federal Republic of Germany and some other Western and Northern European countries, and which are currently also observed in Mediterranian countries (Pérez and Livi-Bacci, 1992). An all-time-low of 1.66 was reached in 1983 and 1984, after which there was an increase to 1.89 in 1989 and 1.92 in 1991 (Figure 1). According to preliminary figures, there was a very weak downturn in 1992. Because of the concomitant rise in the number of women in reproductive ages in the last half of the 1980s, there was quite a boom in the total number of births, from 50000 in 1984 to 610000 in 1991. A more modest rise of the total fertility rate has been observed in some other countries in Western and Northern Europe (Monnier and de Guibert-Lantoine, 1991).

In this paper we describe, on the basis of maternity histories for complete female birth cohorts, some major changes in reproductive behaviour that have taken place in Norway during the last three decades. We show that the recent recuperation of the total fertility rate can be attributed largely to a catching-up of delayed first, and thus also second, births among women in their thirties and late twenties. After about 1984 the larger number of first and second births in these age groups has been accompanied by no further postponement of the entry into motherhood among the younger cohorts. In addition, the higher-order birth rates have stabilized or increased after about 1977. In contrast to Sweden, there has been no extension of the maternity leave system that provides an incentive to space the births more narrowly. The moderately increasing parity progression rates have been experienced by all women in Norway with two or more children, regardless of the age of their youngest child. Our calculations suggest a small increase in the proportion of a female birth cohort who ever proceed from parity two to parity three, possibly at the expense of a somewhat higher permanent childlessness.

DATA AND METHODS

Our analysis has been based on maternity histories extracted from the Central Population Register of Norway. These biographies cover complete female birth cohorts after 1935. For a discussion of the data quality, see Brunborg and Kravdal (1986).

Figure 1. Total fertility rate for the years 1850-1989 and the cohorts 1820-1973.



Source: Report 88/4 and unpublished tables

Period total fertility rate is too crude a measure to enable us to catch important features of the developments in childbearing. To better understand what is going on, we need to consider separately the behaviour of women who have not had any children (yet), that of women who have one child, women with two children, and so on. Our discussion of period effects is therefore based on parity-specific birth rates for the years 1960 through 1991, estimated separately for various age groups or in hazard regression models.

In these hazard models we include the current age of the mother (for first births) or the age of the mother at previous birth and the duration since previous birth (for higher-order births), along with year of exposure[1]. Our focus is primarily on the net period effects we obtain from these models, also referred to as "indirectly standardized period effects" (Breslow and Day, 1975; Hoem, 1991). The LOGLIN program has been used in the estimation (Olivier and Neff, 1976). 1977 has been chosen as a basis year.

We also devote much attention to cohort fertility, which responds more slowly to cultural, social and economic changes, but which is more crucial for the long-term population growth. Parity distribution and average number of children are tabulated from a cohort perspective.

PARITY-SPECIFIC PERIOD BIRTH RATES

In Figure 2, which is referred to repeatedly throughout this section, we have plotted one index curve for each birth order. For first-births we have included only women younger than 30. As discussed below, the development is markedly different for older women.

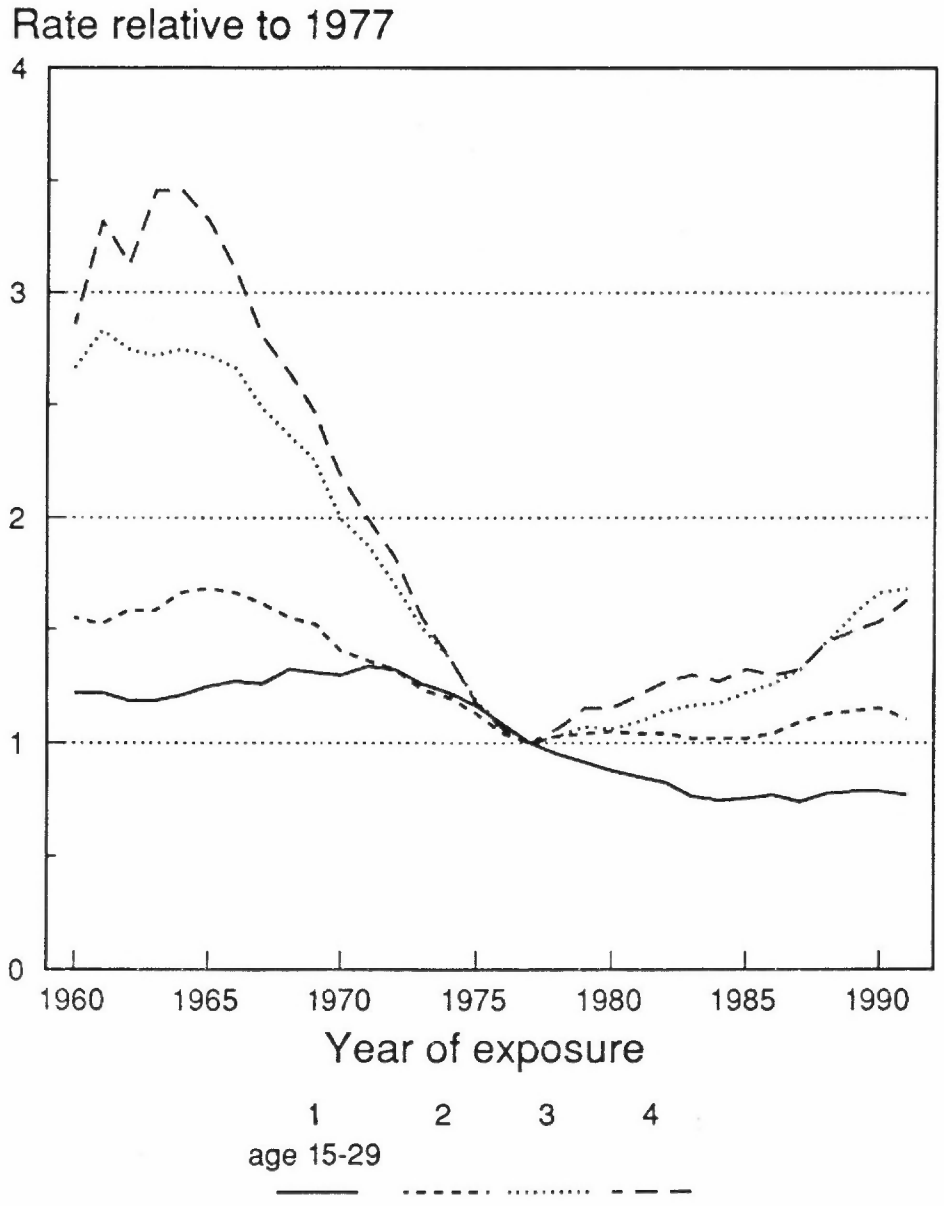
First Births

First-birth rates for various age groups are shown in Figure 3. We find that a downward trend among women younger than 30 started around 1972. After about 1984 an almost constant level appears, except for a further weak decline among teenagers and a weak increase among those close to 30. Among women in their thirties, a stable level during the 1970s and early 1980s has been followed by an upturn during the last half of the 1980s. A small bump is seen in 1987 for women in their twenties.

Except for a peak in teenage fertility in the early 1970s, there have been no more than minor changes in the first-birth rates between 1960 and 1972. In a Swedish analysis based on similar data and methods has clearly revealed a temporary minimum in 1970 (Hoem, 1992). Such a low can hardly be discerned in the Norwegian data.

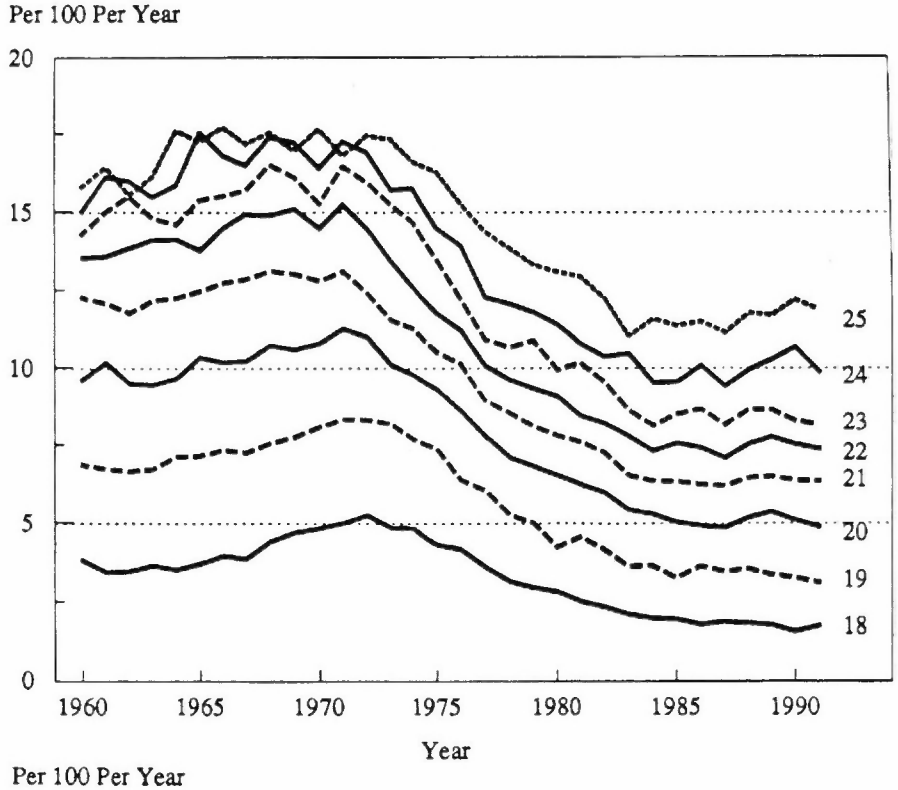
The downward trend in the first-birth rates among young women has been followed by an increased number of births to women in their thirties and late twenities. In fact, Table 1 shows that the "first-birth quotients"[2] for women older than 30 (number of first births divided by the total number of women in that age group, regardless of their parity) have increased throughout the 1980s and a large part of the 1970s. This should be interpreted as a catching-up phenomenon: A larger fraction of the women entering their thirties and late twenties have been childless, and there has also been an increase in the first-birth rates in these age groups. This, in turn, leads to a catching-up of second births, which typically occur 2-4 years after the first. As discussed below, the changes in the second-birth interval and the total proportion who ever advance to parity two are small and cannot account for much of the increase of the second-birth quotient. During the early 1980s, the increase in the first-birth quotients among women in their thirties and late twenties was more than compensated for by

Figure 2. Standardized period effects in Norwegian birth rates 1960-1991, by birth order. (Calendar year index).



Model for order 1: Year+Age
Model for orders 2-4: Year+Age*Duration

Figure 3. Annual first-birth rates 1960-1991, by age.



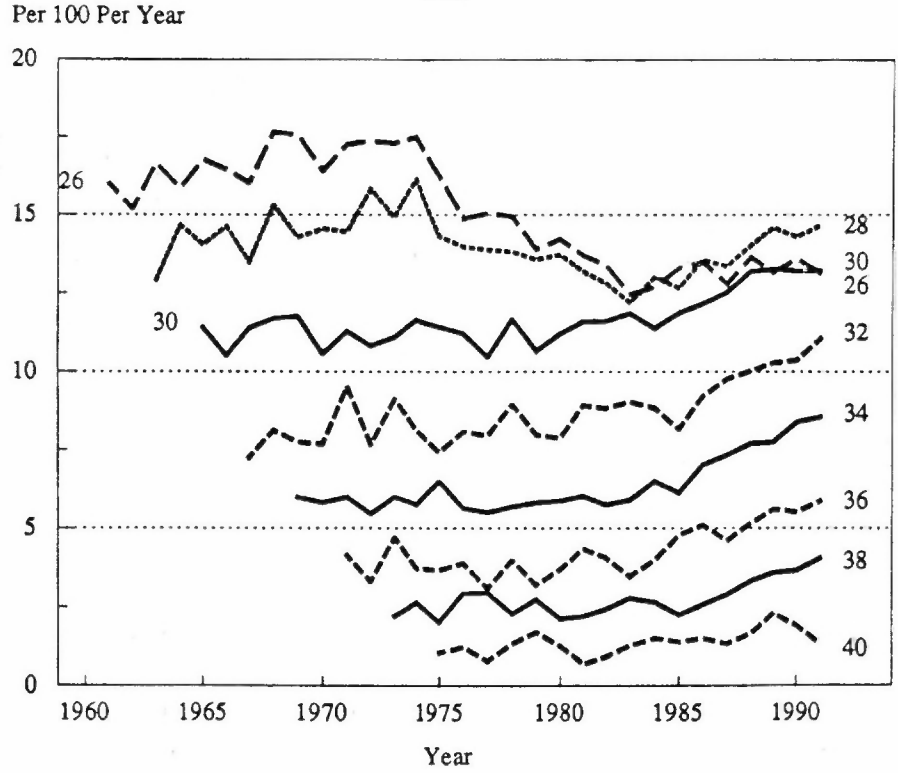


Table 1. Parity- and age-specific birth quotients[1]. Per 1000

	Total	20-24	25-29	30-34	35-39
Total					
1970	2538	160	160	98	46
1975	2002	128	135	73	29
1980	1741	102	127	71	26
1984	1671	86	126	77	26
1989	1879	86	140	99	34
First birth					
1970	941	93	49	13	4
1975	835	79	44	13	4
1980	728	65	47	13	4
1984	709	57	51	16	4
1989	808	62	62	23	6
Second birth					
1970	785	53	65	28	8
1975	712	44	63	27	7
1980	645	33	59	28	7
1984	600	26	55	31	7
1989	662	22	57	41	11
Third birth					
1970	477	12	34	33	13
1975	298	6	23	22	8
1980	263	3	18	22	9
1984	263	3	18	23	8
1989	309	3	18	27	12

[1] Number of births of a given order divided by the number of women in that age group regardless of their parity. Only women living in Norway by the end of 1989 are included in the calculations.

Source: Kravdal, 1991

the continued decrease among younger women. After about 1984, however, the latter decline was called to a halt and the catching-up phenomenon among those older than 25 became even more pronounced. The resulting increase in the overall first-birth quotient, along with a similar development of the second-birth quotient, explain about 80 per cent (0.16) of the total increase of the total fertility rate between 1984 and 1989.

Second Births

According to Figure 2, second-birth rates in Norway declined slightly from the mid-1960s and during the next dozen years. It has been shown elsewhere that 92 per cent of the women who had their first child in the early 1960s, and who were 20-24 years old at that time, proceeded to a higher parity within 10 years. In comparison, the corresponding figure for the late 1970s was 85 per cent (Kravdal, 1991).

When we estimate separate models for each duration since first birth, and standardize for the mother's own age, we find that the decline during the late 1960s and early 1970s has been confined almost exclusively to the short durations (Figure 4). In other words, there have been more pronounced changes in the *spacing* than in the total proportion who ever advance to parity two.

After about 1977 no further decline of the second-birth rates has been experienced in Norway, and a minor upturn materialized between 1985 and 1988. As judged by the standardized rates in Figure 2, there is an excess second-birth rate of about 20 per cent in 1990 compared to 1977. An increase is seen for all women except those who had their first child 4-5 years previously. Calculations reported elsewhere show that the proportion who have had a second child within 2.5 years of the first, has increased from about 24 to 28 per cent during the last half of the 1980s (Kravdal, 1991).

This development of the second-birth rates differs markedly from that observed in Sweden, where a relatively constant and low level during the 1960s and most of the 1970s (Hoem, 1992; Statistics Sweden, 1992) was followed by a sharp increase after 1977 among women with a first child younger than three. Among one-child mothers with an older child, however, the upward fertility trend resembles fairly closely that in Norway.

Third and Fourth Births

The changes in the third- and fourth-birth rates are much more pronounced. A sharp decline has been observed from about 1965. In the mid-1960s, more than 70 per cent of the Norwegian women who had their second child when they were 20-24 years old had a third child within 10 years, whereas the corresponding proportion 10 years later was lower than 50 per cent (Kravdal, 1991). A turn-around in 1977 appears for all women, regardless of the age of their second child (and their own age). The increase of the third-birth rates appears to have gained extra speed after about 1984. The upturn since 1977 has been slightly stronger among women who gave birth less than four years previously than among their counterparts with an older second child (Figure 5).

A similar pattern has been observed in Sweden, where the third-birth rates have escalated among women with a young second child. For other two-child mothers the increase seems to be of roughly the same size as that showing up in the Norwegian data (Hoem, 1992).

A recent socio-demographic analysis of third-birth probabilities in Norway shows that the better-educated women have led the way (Kravdal, 1992a). After the mid-1970s two-child

Figure 4. Standardized period effects in Norwegian second-birth rates 1960-1991, by duration since first birth. (Calendar year index).

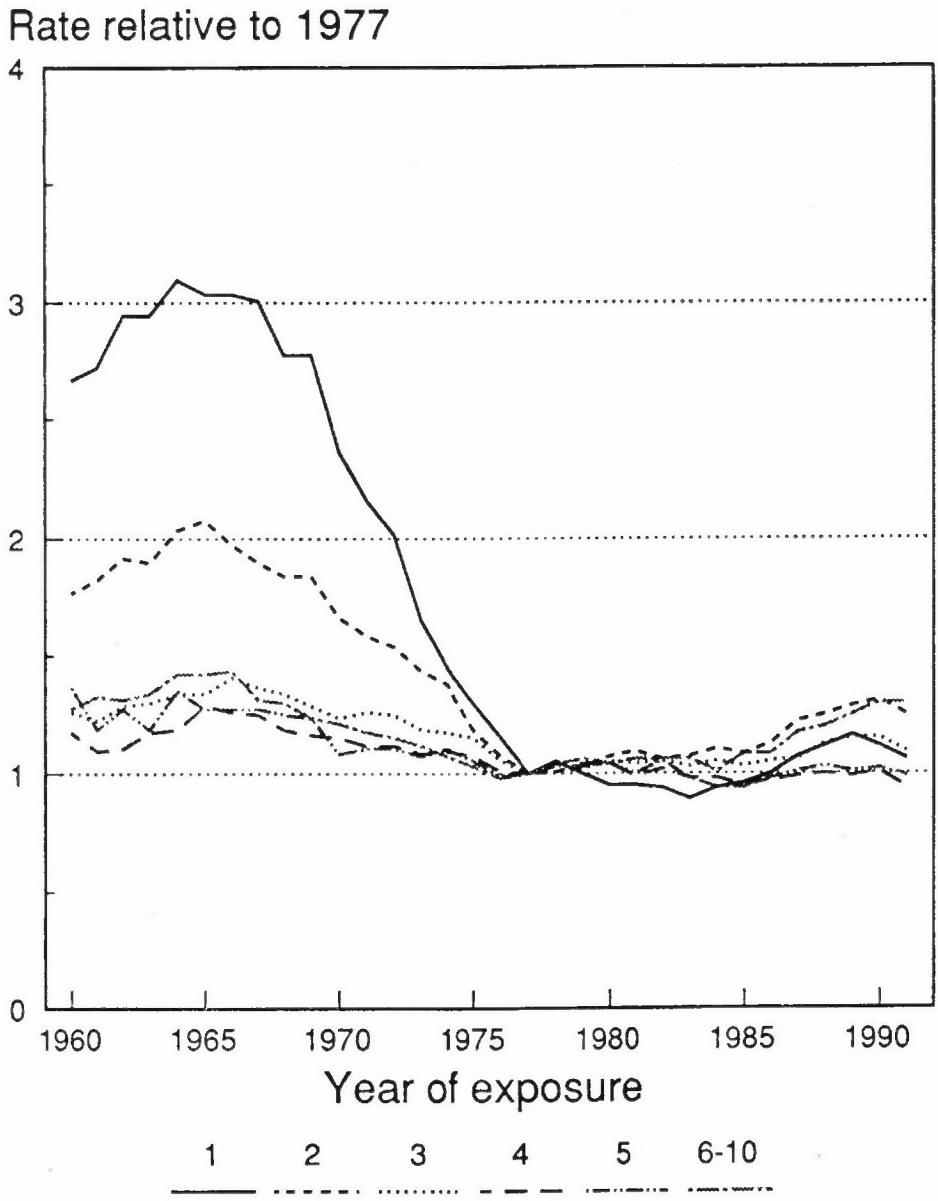
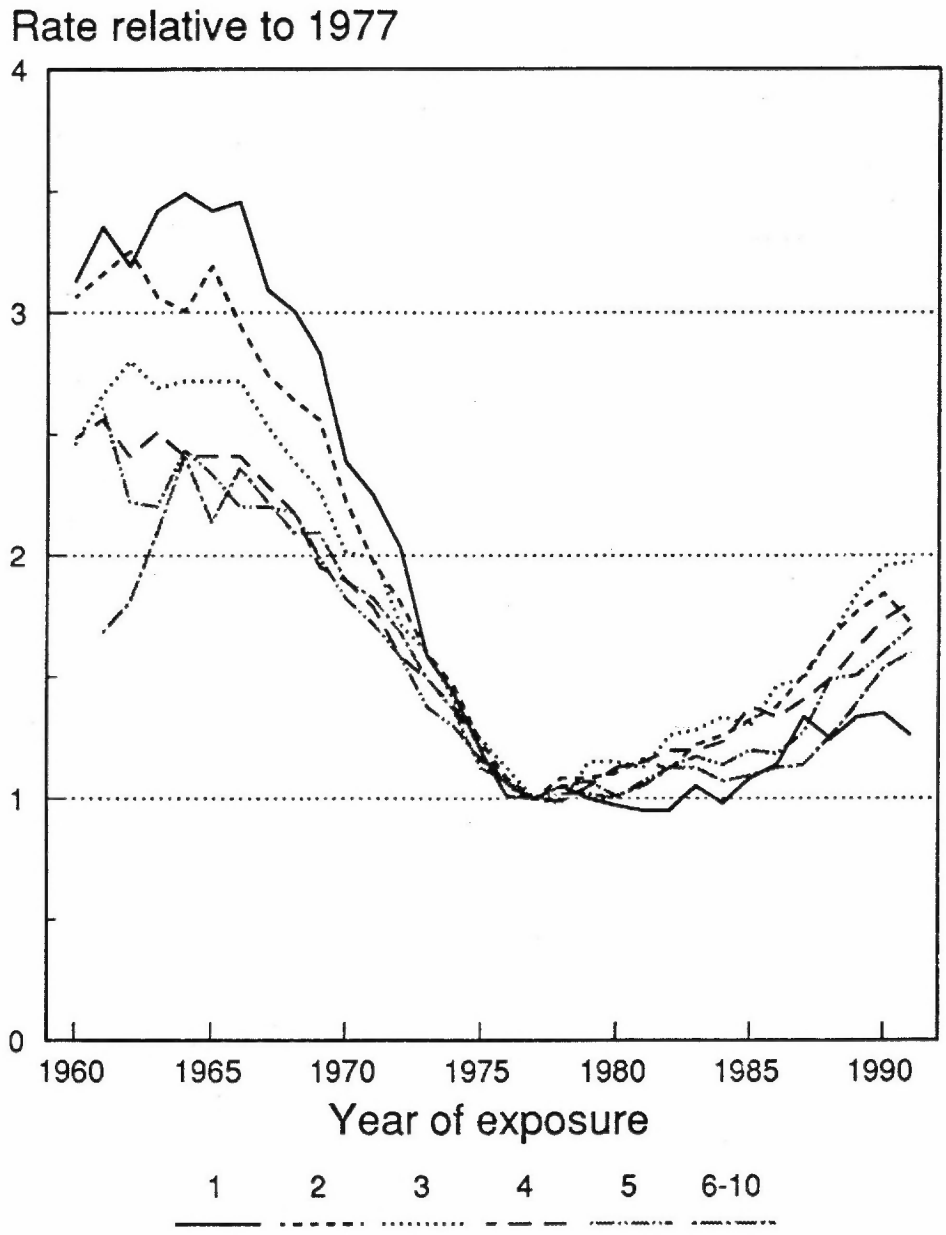


Figure 5. Standardized period effects in Norwegian third-birth rates 1960-1991, by duration since second birth. (Calendar year index).



mothers with some post-secondary education have had the highest third-birth probabilitites, even though they are relatively old when they begin childbearing and when they enter parity two.

TRENDS IN COHORT FERTILITY

We now turn to a brief description of the development among cohorts who have largely completed their fertility, and also address the implications of the recent period figures for the younger cohorts. Some important age-specific fertility measures for cohorts are shown in Table 2, Table 3 and Figure 6.

The post-war baby boom was much more pronounced in Norway than in many other European countries, and the completed fertility exceeded 2.5 among women born in the 1930s. By contrast, fertility is close to the reproduction level among those born in 1951 (Table 2). The proportion who have had at least three children has been reduced from 49 to 31 per cent, whereas the proportion who are permanently childless has remained virtually constant. Nevertheless, cohort fertility in Norway is still fairly high by Western European standards. For instance, completed fertility for the 1950 cohort is 1.98 in Sweden, 1.89 in Denmark, and 1.69 in the Federal Republic of Germany (Sardon, 1991).

The increase in the standardized third-birth rates, which appeared in our period-perspective analysis, has not yet resulted in a higher proportion who complete their fertile span with three or more children. In principle, such a development may never materialize either, since the increase in the standardized rates is set off against a higher age at second birth and a higher proportion who never have their second child. It is interesting to note, however, that when we focus on age 35, which allows us to observe the cohorts 1935 through 1956, a turn-around in the progression ratios actually shows up: Whereas 36.4 per cent of the women born in 1952 advanced from parity two to parity three before age 35, the corresponding figure for the 1956 cohort was 38.5 per cent (Table 3). Moreover, the proportion of the total cohort who have had their third child by that age (not conditioning on having had the second) is almost 1 percentage point higher in the 1955-1956 cohorts than in the 1953-1954 cohorts.

On the other hand, the proportion of childless women at age 35 has increased, and the porportion who proceed to have a second child has decreased slightly. As judged by the observations at age 35, the development of the parity progression ratios measured on a cohort level has changed fundamentally during the last few decades: Whereas the average number of children dropped because of fewer *third births* among those born in the late 1930s and the early 1940s, the continued decline in the completed fertility among the cohorts from the 1950s can be attributed to a higher proportion of *childless* and a lower proportion who proceed to parity *two*. This has led to a minor increase in the standard deviation of the number of children.

The recent trends in the period birth rates signal that there will be no further decline in completed fertility among younger cohorts. The trajectories of the first-birth rates indicate that the age at first birth and the proportion of permanently childless stabilize at levels somewhat higher than those observed for women born in the early 1950s. The median age at first birth still increases, but with a lower speed (Figure 7). Given the increase in the second- and higher-order birth rates, a rising cohort fertility may materialize. In the light of these observations, it is also interesting to know that the desired fertility among teenagers interviewed in 1988 did not differ appreciably from that among their predecessors interviewed 11 years previously (Central Bureau of Statistics, 1981, 1991).

Table 2. Parity distribution and average number of children, by age and birth cohort[a].

Age	Birth Cohort	Parity Distribution (per cent)					Average No. of Children
		0	1	2	3	4+	
20	1935	82.5	15.1	2.4	0.1	0.0	0.20
	1940	79.3	17.1	3.3	0.3	0.0	0.25
	1945	78.3	17.4	4.1	0.3	0.0	0.26
	1950	76.6	19.1	4.0	0.3	0.0	0.28
	1955	7.2	19.9	2.8	0.1	0.0	0.26
	1960	83.8	14.5	1.6	0.1	0.0	0.18
	1965	88.3	10.6	1.1	0.1	0.0	0.13
	1970	89.2	9.9	0.9	0.1	0.0	0.12
	1971	89.7	9.5	0.8	0.0	0.0	0.11
25	1935	36.8	31.1	24.3	6.5	1.3	1.04
	1940	34.5	28.5	26.6	8.3	2.2	1.16
	1945	33.1	29.5	27.5	8.2	1.8	1.16
	1950	34.1	32.2	27.6	5.5	0.7	1.07
	1955	42.9	30.7	22.9	3.1	0.3	0.87
	1960	52.2	27.7	17.3	2.5	0.3	0.71
	1965	55.9	27.2	14.4	2.3	0.2	0.64
	1966	56.2	27.5	13.8	2.2	0.3	0.63
30	1935	16.9	18.5	35.5	20.3	8.8	1.89
	1940	15.7	16.8	36.1	22.0	9.5	1.96
	1945	15.1	18.4	41.4	19.2	5.9	1.84
	1950	16.8	21.0	45.0	14.4	2.9	1.66
	1955	22.3	23.9	39.6	12.1	2.2	1.48
	1960	25.9	25.1	35.2	11.8	2.1	1.39
	1961	26.5	25.6	34.3	11.3	2.3	1.38
35	1935	11.3	11.8	32.1	26.8	18.0	2.36
	1940	10.9	11.4	34.2	28.2	15.5	2.32
	1945	10.5	12.8	42.3	25.2	9.1	2.13
	1950	11.5	15.0	46.0	21.5	6.0	1.97
	1955	14.4	16.6	42.8	21.0	5.2	1.87
	1956	14.7	16.8	42.1	21.2	5.2	1.87
40	1935	9.9	10.5	30.5	27.4	21.7	2.52
	1940	9,7	10.1	33.8	29.1	17.4	2.42
	1945	9.2	11.8	41.7	26.3	11.0	2.22
	1950	9.7	13.5	45.7	23.3	7.9	2.09
	1951	10.0	14.1	44.7	23.5	7.8	2.08

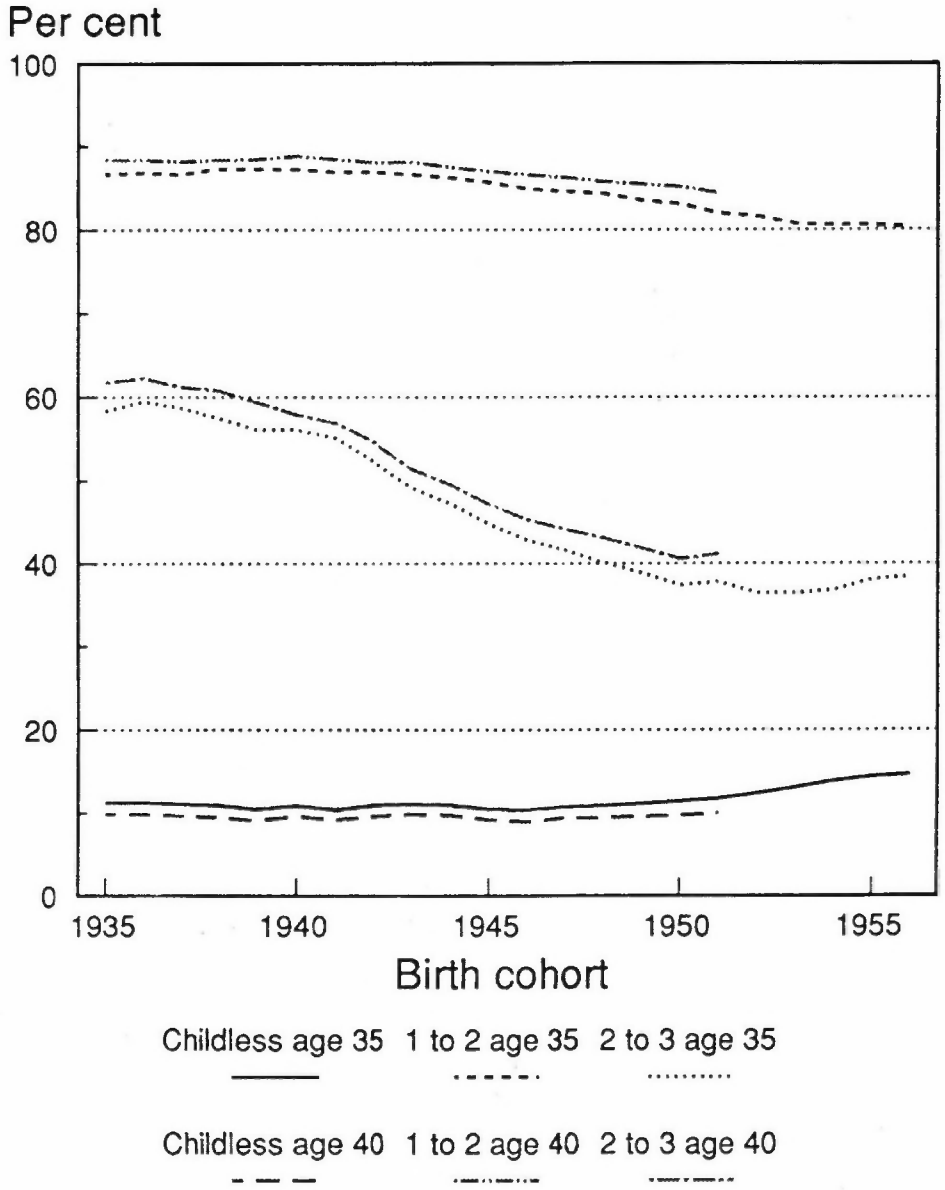
[a] Women living in Norway by the end of 1991

Table 3. Parity distribution, average number of children, standard deviation of the number of children, per cent of one-child mothers who have another child, and per cent of two-child mothers who have another child, by birth cohort. 35-year old women[a]

Birth Cohort	Parity Distribution (Per Cent)				Per Cent Who Proceed from 1 to 2	Per Cent Who Proceed from 2 to 3	Average No. of Children	Standard Deviation of No. of Children
	0	1	2	3+				
1935	11.3	11.8	32.1	44.8	86.7	58.3	2.36	1.29
1936	11.3	11.7	31.3	45.8	86.8	59.4	2.39	1.38
1937	11.1	11.9	31.8	45.2	86.6	58.7	2.38	1.40
1938	11.0	11.3	32.1	45.6	87.3	58.7	2.37	1.39
1939	10.5	11.4	33.2	44.9	87.3	57.5	2.37	1.35
1940	10.9	11.4	34.2	43.7	87.2	56.1	2.32	1.31
1941	10.4	11.7	35.0	42.9	86.9	55.1	2.31	1.28
1942	11.0	11.7	36.9	40.5	86.9	52.3	2.24	1.25
1943	11.1	11.9	39.2	38.0	86.6	49.2	2.19	1.22
1944	11.0	12.3	40.5	36.2	86.2	47.2	2.16	1.19
1945	10.5	12.8	42.3	34.3	85.7	44.8	2.13	1.15
1946	10.4	13.5	43.6	32.6	84.9	42.8	2.08	1.10
1947	10.8	13.7	44.0	31.4	84.6	41.6	2.06	1.11
1948	10.9	14.0	45.0	30.2	84.3	40.1	2.03	1.09
1949	11.2	14.7	45.3	28.9	83.5	38.9	2.00	1.09
1950	11.5	15.0	46.0	27.5	83.1	37.4	1.97	1.08
1951	11.8	15.9	45.0	27.3	82.0	37.8	1.95	1.08
1952	12.4	16.1	45.4	26.0	81.6	36.4	1.92	1.08
1953	13.1	16.8	44.6	25.5	80.7	36.4	1.89	1.08
1954	13.9	16.7	43.9	25.6	80.6	36.8	1.88	1.10
1955	14.4	16.6	42.8	26.3	80.6	38.1	1.87	1.11
1956	14.7	16.8	42.1	26.4	80.3	38.5	1.87	1.11

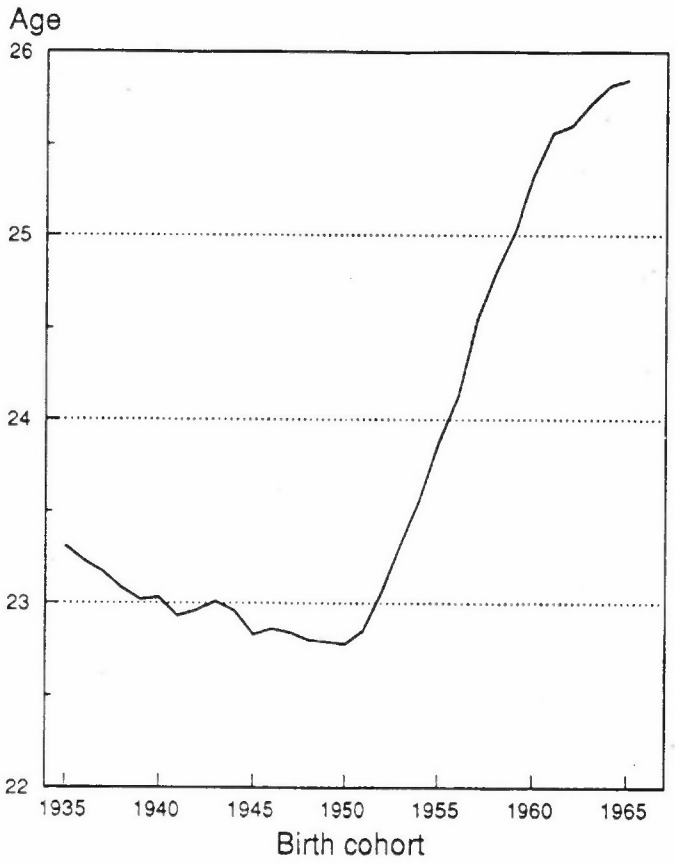
[a] Living in Norway by the end of 1991.

Figure 6. Proportion childless, proportion who have proceeded from parity one to parity two, and proportion who have proceeded from parity two to parity three, as measured at age 35 and 40, by birth cohort.[a]



[a] Women living in Norway by the end of 1991

Figure 7. Age when 50 per cent of a birth cohort have had their first birth (median age at first birth).



DISCUSSION

The turning-points in 1977 and 1984, or thereabout, are manifestations of fundamental behavioural changes that need to be understood. In the following discussion we address a few possible explanations and generate some hypotheses that may be able to stimulate more advanced analytical work in the future. Truly, the "baby boom" in the last half of the 1980s has proved to be largely a catching-up phenomenon (in terms of a larger number of childless women and rising first-birth rates among women older than 30), but we prefer not to dwell on such changes that are more of a compositional nature.

The 1977 Turn-Around as a General Phenomenon

Our results demonstrate that 1977 is an important mile-stone in the development of reproductive behaviour in Norway: Third- and fourth-birth rates start to climb, whereas the second-birth rates stabilize (and subsequently increase slightly). This fertility boost beyond parity one is small compared to that in Sweden, largely because the Norwegian women have not benefitted from a maternity leave system with a "speed premium on further childbearing" (Hoem 1990; Hoem, 1992)[3]. The trajectories of the birth rates do not differ much when we compare among women who had their last birth more than three years previously.

It is an interesting fact that other countries, such as France, the Netherlands and the United Kingdom, apparently have experienced a similar development. According to more rough calculations, the decline of the third-birth rates has been brought to an end around 1977 in those countries as well (Prioux, 1990). Whether this has been followed by an upsurge is less certain. Besides, there seems to have been a turning-point in the United States in the mid- or early-1970s (Kravdal, 1992a). This cross-national parallelity indicates that influential economic, social or cultural changes have swept over much of the industrialized world, perhaps with extra strength in the Scandinavian countries.

Reduced Incompatibility of Employment and Childcaring

Consistent efforts have been made in Norway to facilitate women's entry into the labour market and their continued attachment to it after childbearing. This should be considered primarily an attempt to promote gender equality and to improve the economic situation for families with small children. It is no part of an explicit pro-natalist policy.

In 1989, 79 per cent of all Norwegian women aged 25-54 were employed[4]. Among married women with a youngest child aged 0-2, the employment rate was 68 per cent, whereas 75 per cent of those with a child aged 3-6 were employed (Central Bureau of Statistics, 1990). The corresponding figures for 1975 were 35 per cent and 46 per cent, respectively. There is a considerable market for part-time jobs, and in many sectors parents with responsibility for small children have been allowed to reduce their working hours. In fact, this reduction even has become a statutory right, albeit with substantial limitations. During the last two decades, more than half of the employed married women with children have worked part-time (Ellingsæter, 1989).

This expansion of the female labour market has gone hand in hand with changes in the rights for employed mothers. Before 1978, women who had been in gainful employment for some months prior to delivery were entitled to a 12-month maternity leave with about 60

per cent wage compensation (Finans- og Tolldepartementet, 1993). From 1978 to 1987 the maternity leave was 18 weeks with full wage compensation, and from 1987 to 1990 it increased gradually to 28 weeks. The mother may also have a leave without wage compensation, up to a total of 3 years (1 year before 1981). Non-working mothers receive a relatively small amount at the time of delivery. In addition, there have been reforms concerning such as the right to stay at home with a child who is ill and the right to breastfeed during working hours.

Finally, the provision of public and (subsidized) private day care institutions has improved considerably, although there is still a large unmet demand (Figure 8). The coverage increased particularly sharply in the last half of the 1970s.

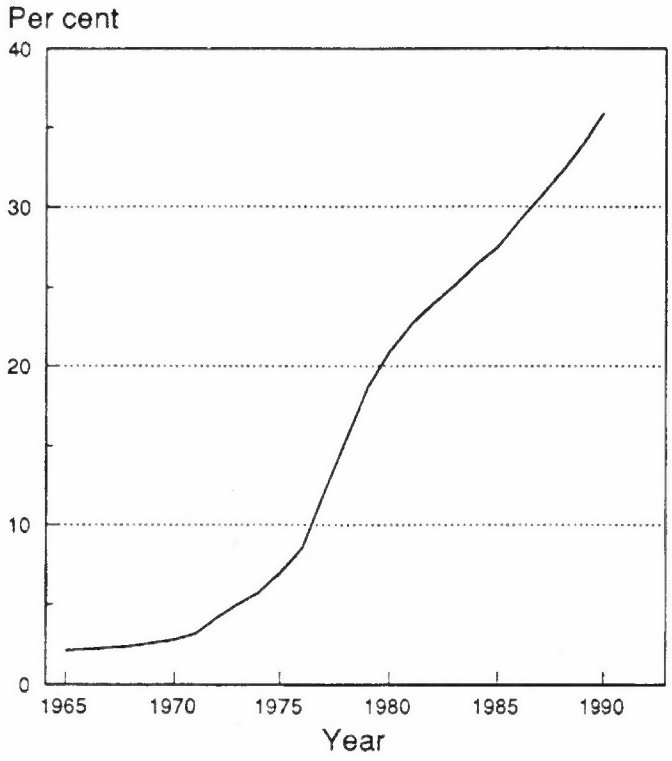
The interrelationship between employment and fertility is theoretically and empirically very complex (for a brief review see e.g. Kravdal, 1992b). In much of the demographic literature from the 1970s, as well as in more recent contributions, improved job opportunities for women was thought to reduce their fertility through increased opportunity costs of childcaring (e.g., Butz and Ward, 1977), and political attempts to encourage women's participation in market work might thus have anti-natalist implications. Some modifications seem to be called for, however. It is true that the arrival of a second or third child would be more expensive in forgone income in a phase of development where gainful employment is an alternative to homemaking than in a situation where the prevailing attitude is to drop out of the labour market at first birth. On the other hand, the sharp rise in the female employment rates during the last few decades also reflects the fact that it has become progressively more common to work even when the children are small. This practice tends to *reduce* the forgone income. Possibly, what we have witnessed in Norway and other Scandinavian countries is that certain societal changes have facilitated the combination of childcaring and gainful work activity and thus helped to push *both* fertility *and* participation rates up. The impact on fertility and employment of, for instance, better access to child care facilities is actually a research issue that is still in its infancy. The existing body of literature seems to suggest that an increasing supply of and lower cost of child care could increase female labour supply substantantially and have a more moderate fertility-promoting effect (Blau and Robins, 1989; Mason and Kuhlthau, 1992). One may also expect an extension of the maternity leave to lower the opportunity costs and thus lead to elevated birth rates. This also is a fairly unexplored research issue.

All in all, it does not seem unlikely that some of the recent fertility increase in Norway is a response to the expansion in maternity leave benefits and provision of day care institutions. Although less generous than in Sweden (Bernhardt, 1991; Secretariat, 1991; Sundström and Stafford, 1992), the welfare system has led to gradually reduced costs of and inconvenience of childcaring[5]. It must be emphasized, however, that the changes in the support to working mothers have taken place over a fairly long period. The shifts in 1977, or thereabout, are not very marked.

Other Fertility-Promoting Forces Related to the Costs of Childbearing

There is some evidence that the 1977 turn-around coincides with changes in the economic transfers to families with children. It has been claimed that the annual sum of child allowances and various benefits channeled through the Norwegian taxation system increased only slightly during the 1960s and early 1970s, but that these transfers increased considerably from 1975, when some new tax-regulations were introduced (Skrede, 1983). A modestly stimulating effect of transfers, in the form of child allowances, has been documented

Figure 8. Proportion of children aged 0-6 who are enrolled in a day-care institution.



empirically by Ermisch (1988), whereas Barnby and Cigno (1990) surprisingly seem to have reached the opposite conclusion with respect to second- and higher-order births.

It is indeed noteworthy that in France, where there apparently also was a levelling out of the third-birth rates after the mid-1970s, concern about the "baby bust" led to a strong growth of the family benefits at that time, especially to the advantage of the three-child families (Blanchet et al., 1991).

Another interesting fact is that the real wages in Norway no longer increased markedly after about 1977 (Figure 9). The average real wages (pooled over all sectors and both sexes) have been subject to a smooth upward trend from 1960 to 1977, except in 1970 when inflation was very high because of the introduction of a higher Value Added Tax. This was followed by a decline, which was due to the price and income freeze in 1978 (Central Bureau of Statistics, 1979). A new upturn was experienced in the early 1980s, but disposable income (after taxation) did not increase much (NOU, 1988).

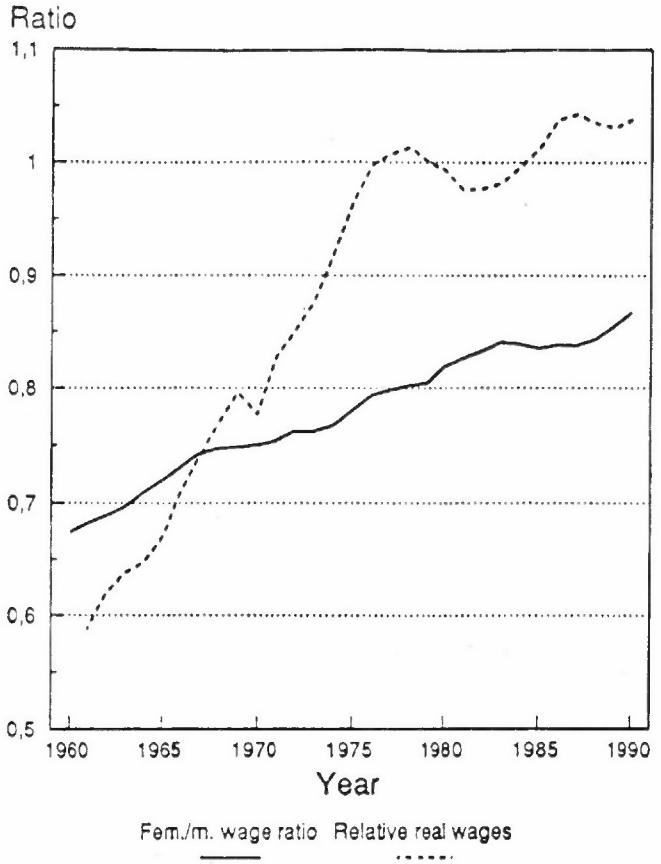
Given the steady increase in the female/male wage ratio (based on figures from the manufacturing industries), also the female real wages must have declined, or increased with a fairly modest speed, after 1977. It is possible that this has has played a role in bringing the decline of the second- and higher-order birth rates to a halt, but such an hypothesis is not very well rooted in previous research.

It is a crucial idea within economic-demographic theory that a higher income for a husband, net of "quality" requirements and other possibly important confounders (such as contraceptive use), leads to a greater demand for children, whereas a higher wage potential for a woman (if she considers gainful employment an alternative to homemaking) works in the opposite direction because of the higher price of her time (see e.g. the influential works by Becker, 1960; Mincer, 1963; Willis, 1973). In line with these expectations, Butz and Ward (1977) found that the American "baby-boom " during the 1950s can be explained as a response to rising male income, and that the higher female wages, along with the higher female employment rates, were important ingredients behind the following downward trend in the birth rates. Moreover, Ermisch (1988) concluded that the female/male wage ratio in Britain (with a peak in 1976) has been a very important determinant of the birth rates. These economic-demographic theories and empirical studies have also met with severe criticism, however (e.g. Blake, 1968; Murphy, 1992). In particular, a number of empirical studies have failed to demonstrate a positive effect of individual family income (e.g., Freedman and Thornton, 1982) or of macroeconomic indicators of the economic well-being (e.g., Sweezy, 1971). Other investigations suggest that the income effect may depend on the birth order, and that positive effects primarily tend to show up for the low parity transitions (e.g., Bernhardt, 1972; Simon, 1975). A recent Norwegian investigation reveals a slightly negative effect of husband's income on the third-birth rates, and the high fertility that is found among better-educated two-child mothers suggests that women's wage have a fairly modest impact (Kravdal, 1992a).

Economic Factors and the Upturn in the Mid-1980s

Although the changes in 1984 or 1985 are much less pronounced than those in 1977, they certainly deserve our attention. The stabilization of the first-birth rates among fairly young women contributed to the "baby boom" during the last part of the 1980s. It is thought-provoking that a similar trend-break, actually followed by an upswing, has been observed in in Sweden as well. Changes may also be discerned in the higher order birth rates: In Norway, both second- and third-birth rates gained extra speed after about 1985. To our knowledge,

Figure 9. Female/male wage ratio and relative average real wages (1979=1.00).



similar trends have not been documented for countries other than the Scandinavian.

The stabilization of the first-birth rate is concomitant with a relatively high unemployment rate (accompanied by a high growth of the Gross National Product and a low inflation). This development is shown in Figure 10. In fact, the unemployment rate among Norwegian women in their early twenties reached 8 per cent in 1983 and 1984. Even though the opportunity costs of childbearing are low when a woman can stay at home with an unemployment compensation, we hesitate to consider this unemployment peak important for the stabilization of fertility. To our knowledge, no fertility-stimulating effect of female unemployment has been reported in the literature, and any such effect may be outweighed by the presumably adverse effect of male unemployment. By and large, studies based on aggregate data conclude that unemployment (at least among men) contributes to reduce the birth rates (de Cooman et al., 1987). This is also supported by individual-level data (Rindfuss et al., 1988). Finally, it is an important fact that unemployment in Norway soon dropped to a low level, to be followed by a new upturn during the late 1980s, whereas the first-birth rates among women in their 20s remained constant or increased.

We cannot see any clear traces of the booming house prices in Norway after 1984. It has been suggested that high house prices have an inhibiting effect, primarily on first births (Ermisch, 1988). These effects tend to be explained as very similar to that of a lower family income. In addition, house prices may increase the costs of having another child, since a child places certain demands on the housing standard. The prices in Norway did not change much during the early 1980s, but increased dramatically from 1984 to 1987, typically from about 6000 NoK per m^2 to 9000 (OPAK, 1991). Afterwards there was a steep decline. We do not completely rule out the possibility, however, that the minor bump in the first-birth rates in 1987 may have been caused partly by this development in the housing market.[6]

Changes in Contraceptive Practice

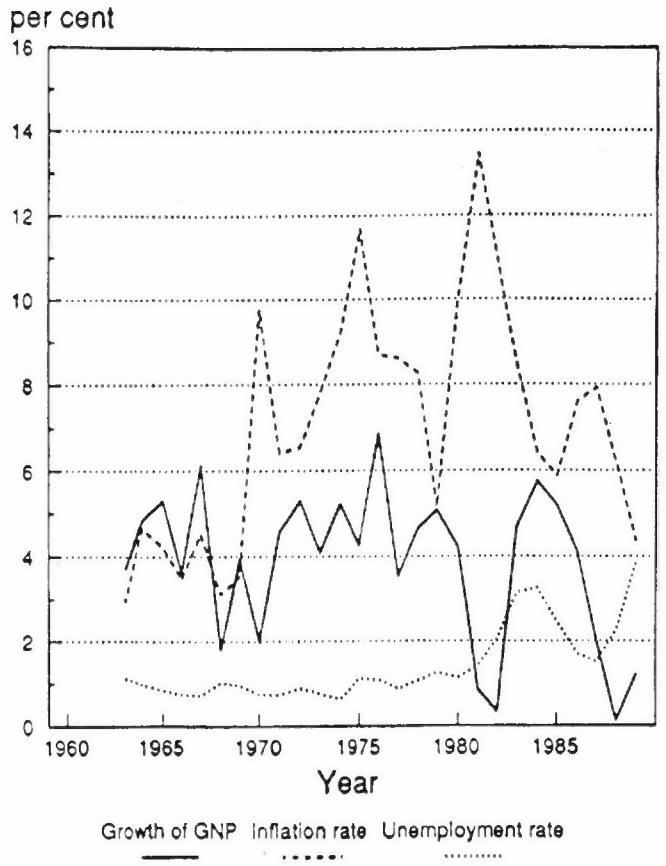
During the early and mid-1970s there was a sharp increase in the proportion using the pill or IUD in Norway (Østby, 1989). These innovations in birth control technology are exogenous to fertility and have probably helped to pave the way for the reduced birth rates. However, because of the trivial fact that contraceptive use reflects fertility desires, the increased use of the new methods should not be considered exclusively as causally prior to the fertility decline. (Besides, little is known about the efficiency with which the traditional methods would have been used in the absence of the new technology).

After the mid-1970s there seems to have been a more modest increase in the use of these methods. For instance, among Norwegian two-child mothers in their late twenties and early thirties, the proportion using the pill or IUD (among those who were fecund and sexually active) remained virtually constant from 1977 to 1988 (Central Bureau of Statistics, 1981, 1991). Contraceptive sterilization, however, has become more common (see also Blom et al., 1993).

Ideational Forces

To our knowledge, there are no indications of a reversal of the movement towards egalitarian sex role ideals in the Scandinavian countries. For instance, questions about women's roles in the 1977 and 1988 family surveys in Norway revealed a greater acceptance of gender equality (Central Bureau of Statistics, 1981, 1991). Nor are there any clear signs

Figure 10. Inflation rate, unemployment rate, and growth of the gross national product.



of a turn-around with respect to the so-called "individual secularization" (Lesthaeghe and Surkyn, 1988). On the contrary, results from the Norwegian Values Studies of 1982 and 1990 suggest that our respect for authorities is still diminishing (Listhaug, 1992).

It is noteworthy, however, that some dimensions of the family values seem to have changed slightly. According to the Norwegian Values Studies, a larger fraction disliked that "a woman wants to have children without having a partner" in 1990 than in 1982 (Listhaug, 1992). Of course, this does not necessarily reflect an increased preference for childcaring compared to alternative satisfaction, and one must bear in mind that actual family behaviour has changed considerably during the 1980s, with a continuing divorce boom and a growing prevalence of consensual unions (at least as a prelude to marriage).

A similar development of the family values has been reported from the United States, where Thornton (1989) found that the "weakening imperative to marry, remain married, and have children" was brought to an end during the early 1980s, whereas sex role attitudes continued their movement in a more egalitarian direction. On the other hand, Crimmins et al. (1991) found, on the basis of data for high school seniors, that material aspirations were even higher in 1986 than 10 years previously, and that the respondents saw less need to spend more time with the children. This may signal a further decline of cohort fertility.

CONCLUSION

Our parity-specific analysis has revealed that the recent fertility increase in Norway is largely a matter of tempo changes: During the 1980s a larger fraction of the women entered their late twenties and thirties as childless, and - presumably as a catching-up phenomenon - they also experienced higher age-specific first-birth rates. Besides, the decline of the first-birth rates among the younger women was brought to an end in 1984 or thereabout. In addition, there are some changes in the final parity distribution. A slightly growing proportion of a female birth cohort seem to end up with three or more children, possibly at the expense of higher childlessness. This increase in the third-birth rates dates back to about 1977.

In spite of the strong scientific efforts that have been made, there is still a very inadequate understanding of the forces behind the so-called "second demographic transition" in the industrialized world, which involves a reduction of fertility along with formidable changes in the nuptiality (van de Kaa, 1987). Admittedly, we are also far from understanding the reasons for the recent "renaissance" of the third child in Norway, which has taken place in spite of the continued movement away from the formal marriage[7]. Some factors that previously contributed to push fertility rates down may have stopped operating, or pro-natalist forces may be at work with renewed power. Even though the turning-points in reproductive behaviour stand out remarkably clearly, one should not expect to be able to pin them down to a few profound societal changes. We may well witness a confluent effect of a wide array of economic, social and cultural forces whose strength change in a non-parallel manner.

To some extent, the general increase in the higher-order birth rates may well be considered a reward for the consistent political efforts that have been made to mitigate the conflict between employment and childbearing. It is also thought-provoking that the 1977 turn-around coincides with a stabilization of the female real wages and apparently also with a more marked increase in the economic transfers to Norwegian families with children, channelled partly through the taxation system. One may well doubt, however, whether the economic impact of tax reforms are immediately well known to the public. Another crucial question is why such changes would influence only women who have had at least one birth

previously, and whether a similar development in the economic sphere has been experienced in non-Scandinavian countries where a stabilization of the third-birth rates apparently has occurred. Finally, it is a challenging fact that the increase in the second- and higher-order birth rates (except at short durations since previous birth) are of the same size in Norway as in Sweden in spite of the more generous support to working mothers in the latter country.

Finding relevant indicators of the satisfaction we receive from having children is notoriously difficult. Results from the Norwegian Values Studies may signal a stronger awareness of the merits of the "nuclear family" during the 1980s. However, we are not quite willing to interpret this as an indication of increased preferences for childcaring and childrearing compared to other activities that compete on our time- and money-budget.

Even though we have failed to identify very clearly the reasons why the birth rates took on a new course in 1977, and partly also in the mid-1980s, we believe that our approach based on parity-specific period rates is a promising avenue for further research. Comparable figures for other countries, which would necessarily have to be based on much smaller samples, would probably stimulate the generation of new and interesting hypotheses concerning the fundamental mechanisms of reproductive behaviour.

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NOTES

1.Duration since last previous birth (which, of course, is the age of the youngest child) is measured in completed years at the end of the calendar year. Age of the mother at previous birth is defined similarly.

2.There is no generally accepted term for this quotient. Pressat has referred to it as "rate of the second kind" (translated). Coale and McNeil have used the term "frequency".

3.In Sweden, the right to a maternity leave with almost full wage compensation can be extended to the next birth provided that the interbirth interval does not exceed a certain limit. This limit has increased from about 15 months to 30 months from the mid-1970s to the mid-1980s. It has thus become manageable to have two children sufficiently closely spaced to take advantage of the benefit.

4.When employment is defined as at least one hour of gainful work during a one-week reference period, as seeking work, or as temporarily absent from work, including maternity leave.

5.It is possible that the well-educated women have relatively high third-birth rates because they have the resources to move into practical and not too expensive arrangements that ease the inherent conflict between employment and family obligations.

6.A similar small bump because of economic conditions may have materialized in 1970. There was a very high inflation in 1970, which was due to an increase (from 13 to 20 per cent) in the Value Added Tax at the beginning of that year. Anticipation of this tax increase caused a booming sale of durable consumer goods during 1969 and extraordinarily low private savings, while savings were very high in 1970 (Central Bureau of Statistics, 1970, 1971). (In 1970 there was also a strong increase in real disposable income because of the compensations introduced in the wake of the increased VAT). It does not seem unlikely that such an investment rush may tend to defer the entry into parenthood. Such an effect of inflation has, for instance, been suggested by Ermisch (1988). It is somewhat surprising, however, that an effect can only be discerned for women aged 20-26. One should also bear in mind that a low first-birth rate, or a stand-still of the decline for higher birth orders, was observed in Sweden around 1970 (Hoem, 1992).

7.The relationship between divorce and fertility is actually very complex. A Norwegian study has revealed a slightly lower completed fertility among women who have divorced than among their contemporaries in stable marriages (Kravdal, 1991), and other studies conclude that women who are currently divorcees display a low birth rate (see e.g. Rindfuss and Parnell, 1989). However, there is a certain compensation after a remarriage (Brunborg and Kravdal, 1986), and to our knowledge it has not been adequately demonstrated that a woman who divorces has a lower *subsequent* fertility than another woman who has had the same reproductive career up to the age when the former dissolves her marriage.

Paper II

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The Importance of Economic Activity, Economic Potential and Economic Resources for the Timing of First Births in Norway

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INTRODUCTION

Changes in the aggregate number of births are determined both by the quantum and tempo of fertility at the individual level. For instance, the 'baby bust' experienced throughout much of the industrialized world after the mid-1960s was due to lower average cohort fertility, with progressively fewer births of third and higher orders, together with a higher age at first birth. This timing transition seems to have reached an end in some countries, which has led to a substantial upsurge of total fertility during recent years.[1] In addition to its effect on period fertility, age at entry into motherhood has implications both for a woman's subsequent reproductive behaviour, and for the emotional and economic well-being of parents and child.

Previous research has identified a number of factors that seem to have a bearing on the timing of parenthood. Above all, the woman's education has generally been found to be a very important determinant of the timing of first births, as well as lifetime fertility.[2] Its importance may even have increased during the last few decades.[3] Recent German research has shown that the delayed first births among the better-educated are largely linked with continuing educational activity, whereas a higher educational level has no net inhibiting effect on first birth rates.[4] According to the authors, this result is a challenge to the 'New Home Economics' and the notion that high earning capacity of females leads to low birth rates. Actually, there is only modest support for this notion in the theoretical models that have been developed to study the *tempo* of childbearing in particular, but empirical and theoretical investigations seem to indicate that a

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[1] J. M. Hoem, 'Social policy and recent fertility change in Sweden', *Population and Development Review*, **16** (4) (1990), pp. 735–748; Ø. Kravdal, *Hvor Mange Barn* (Oslo, 1991); Ø. Kravdal, Sociodemographic studies of fertility and divorce in Norway with emphasis on the importance of economic factors, Doctoral thesis (University of Oslo, 1993).

[2] J. D. Kasarda, J. O. G. Billy and Kirsten West, *Status Enhancement and Fertility* (New York, 1986); R. R. Rindfuss, L. Bumpass and C. St John, 'Education and fertility: implications for the roles women occupy', *American Sociological Review*, **45** (1980), pp. 431–447.

[3] D. E. Bloom and J. Trussell, 'What are the determinants of delayed childbearing and permanent childlessness in the United States?', *Demography*, **21**(4) (1984), pp. 591–609; Margaret L. De Wit and F. Rajulton, 'Education and timing of parenthood among Canadian women: a cohort analysis', *Social Biology*, **39** (1991), pp. 109–122.

[4] H.-P. Blossfeld and J. Huinink, 'Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation', *American Journal of Sociology*, **97** (1) (1991), pp. 143–168.

woman's higher earning capacity could be expected to reduce, rather than to raise, first birth rates. This rather blurred picture has motivated the present analysis.

Little is known about the impact of work experience on the timing of entry into motherhood. This is a subject of growing importance, because of the continuing high level of youth unemployment in much of the industrialized world. Results from previous empirical studies have been contradictory, and the few attempts that have been made to gain theoretical insight have not provided strong predictions.

In this paper, the Norwegian Family and Occupation Survey of 1988 is used to draw some general conclusions about the importance of current educational and occupational activity, economic potential, and economic resources. The data consist of individual biographies, and are a much richer source than most others that have been used to explore the onset of reproduction. The hazard model technique makes an efficient use of these data possible.

Another object is to learn whether recent trends in the timing of motherhood in Norway can be attributed to changes in work activity, education, and economic conditions among young adults, or to temporal shifts in the effects of these factors on fertility.

The focus is on women less than 30 years old, who have experienced the most pronounced changes in their first birth rates.

THE DEMOGRAPHIC SETTING

Individual maternity histories extracted from the Central Population Register of Norway, covering complete birth cohorts after 1935, have been used to estimate annual age-specific first birth rates (Figure 1).[5]

The period effects are striking. From about 1972, first birth rates fell sharply among women below the age of 25, whereas no downward trend is apparent at ages above 30. After about 1984, the decline stopped, except among teenagers. Among women older than 25 there has actually been an upturn during the second half of the 1980s. The median age at first birth increased from 22.8 in the 1950 cohort to 25.7 in that of 1963.

These trends have contributed to the sharp decline of total fertility during the early 1970s. Total fertility levelled off around 1977, when third birth rates stopped declining, and when there were also many births at ages above 25 among the progressively larger fraction of women who were childless at that age. After the decline in first birth rates among the younger women ceased, total fertility rose markedly, from the historical low of 1.66 in 1983 and 1984 to 1.89 in 1989, followed by a stable level in 1990–92. As yet, we do not know whether these trends in first birth rates also reflect a progressively higher proportion of permanently childless women. The proportion childless at age 35 has increased from 11 per cent in the cohorts 1940–50 to 14 per cent in that of 1954. This gap is likely to be reduced at later ages.

First birth rates have declined in other industrialized countries as well, and the average age at first birth is not particularly high in Norway by European or American standards.[6] It is interesting that the developments in Norway have been closely similar to those in Sweden, where there was also a turning point in about 1984.[7]

[5] For more details, see Kravdal, *loc. cit.* in fn. 1.

[6] Council of Europe, *Recent Demographic Developments in Europe* (Strasbourg, 1991); R. R. Rindfuss, S. P. Morgan and C. G. Swicegood, *First Births in America* (Berkeley, 1988); R. Chen and S. P. Morgan, 'Recent trends in timing of first birth in the United States', *Demography*, **28** (4), 1991, pp. 513–534.

[7] J. M. Hoem, *loc. cit.* in fn. 1.

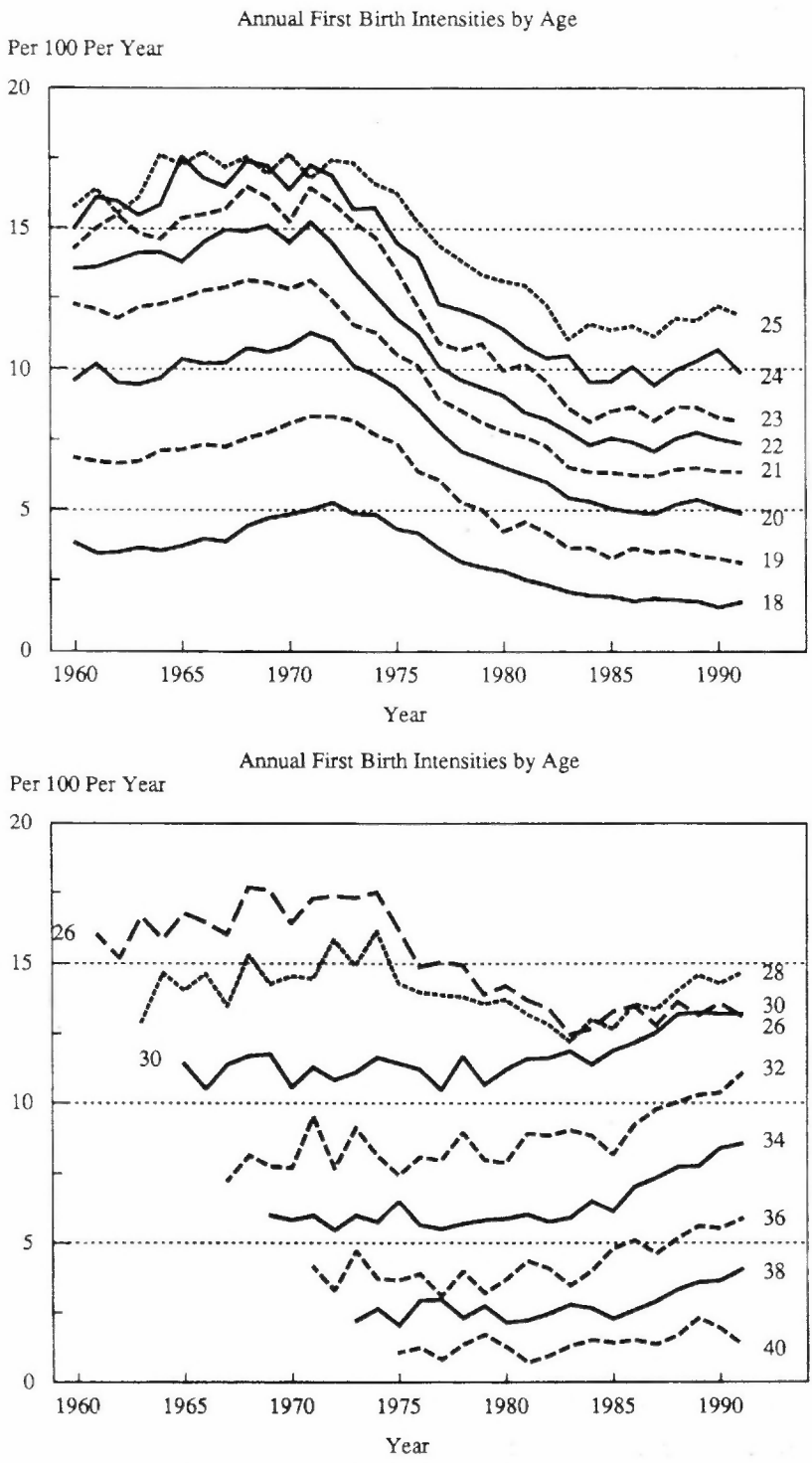

Figure 1. Annual first birth rates 1960–91, by age.

THEORETICAL CONSIDERATIONS

Micro-economic perspectives

Some studies based on aggregate data indicate that wages and incomes are important determinants of fertility. For instance, Butz and Ward[8] stressed the positive effect of men's earnings and the negative effect of women's earnings on birth rates. A similar pattern has been demonstrated for first births in a more recent British study.[9]

These results fit well with micro-economic theories which hold that high direct costs and opportunity costs of childbearing reduce the probability of having a(nother) child, whereas high incomes of men have the opposite effect, at least with a fixed level of child 'quality' requirements.[10]

Unfortunately, the theoretical studies have largely dealt with lifetime fertility, and may not be altogether relevant for our thinking about entry into parenthood. For a childless couple the fundamental issue is not only: 'Do we have a child now or do we not?'. The decision problem may equally well be formulated as: 'Do we have a child now or later?'. Voluntary childlessness is not very common, and it has, in fact, been suggested that it often is a result of sequential postponements.[11] This would lead an economically rational couple to pay special attention to the costs of having a child *now*, compared to those they would incur if they had the child *later*.

A particularly important element of the theory developed for first births is that the opportunity costs, which consist of mother's foregone income during her withdrawal from the labour force, and the long-term pay-penalty following this withdrawal, may depend on her age when the child is born. Both Happel *et al.*[12], and Cigno and Ermisch[13] have attempted to predict how various socio-demographic factors determine the timing that would maximize lifetime income (given certain constraints).

In addition, childbearing costs may have some influence on first birth rates even when they are independent of the timing of parenthood. Happel *et al.* have argued that imperfect capital markets would make it preferable to postpone entry into parenthood until the husband earns a higher income (because of diminishing marginal utility of consumption). They also stated that this deferment-incentive based on a desire for consumption-smoothing is particularly strong when the opportunity and direct costs of childbearing are high, or when the husband expects a steep rise in income. The consequence of this line of reasoning is that characteristics associated with generally high costs of childbearing, such as high earning potential of the female, according to traditional economic-demographic ideas, would lead to a delayed first birth, even

[8] W. P. Butz and M. P. Ward, 'The emergence of countercyclical U.S. fertility', *The American Economic Review*, **69** (3) (1979), pp. 318–328.

[9] E. De Cooman, J. Ermisch and Heather Joshi, 'The next birth and the labour market: a dynamic model of births in England and Wales', *Population Studies*, **41** (2) (1987), pp. 237–268. British and American investigations based on aggregate data have also shown that high unemployment rates, as well as high housing prices, lead to delayed first birth. See J. Ermisch, 'Explanatory models for fertility projections and forecasts', in N. Keilman and H. Cruijsen, *National Population Forecasting in Industrialized Societies* (Amsterdam, 1992); Nan Maxwell, 'Individual and aggregate influences on the age at first birth', *Population Research and Policy Review*, **10** (1991), pp. 27–46; Rindfuss *et al.*, *loc. cit.* in fn. 6.

[10] See e.g., G. S. Becker, 'An economic analysis of fertility', in National Bureau of Economic Research, *Demographic and Economic Changes in Developed Countries* (Princeton, 1960); R. J. Willis, 'A new approach to the economic theory of fertility behavior', *Journal of Political Economy*, March/April supplement (1973).

[11] Jean E. Veevers, 'Voluntary childless wives: an exploratory study', *Sociology and Social Research*, **57** (1973), pp. 356–366.

[12] S. K. Happel, J. K. Hill and S. A. Low, 'An economic analysis of the timing of childbirth', *Population Studies*, **38** (1984), pp. 299–311.

[13] A. Cigno and J. Ermisch, 'A microeconomic analysis of the timing of births', *European Economic Review*, **33** (1989), pp. 737–760.

though the costs would not be lower if the child were born when the woman is older. It must be pointed out, however, that the social differentials in the costs of childbearing may be smaller than is usually believed, or even run in an unexpected direction. It has been observed, both in Norway and some other countries, that high educational level tends to *increase* third birth rates.[14] Because purchased child care can be used as a substitute for mother's time, the total childbearing costs are not necessarily highest among the better-educated.[15]

The impact of current activity state

The impact of educational and occupational activity is very well established empirically. For instance, Rindfuss *et al.*[16] have provided a detailed individual-level analysis of the impact of various activity states, such as education, unemployment, employment, and homemaking. This clearly demonstrates that educational activity reduces first birth rates. Moreover, their study showed that women's unemployment in the United States had no impact on the timing of first births. (When similar calculations were performed for men, however, unemployment seemed to act as a disincentive to early first birth.) A Belgian exploration suggested a clearer negative effect of women's unemployment.[17]

Such effects can easily be explained within the income-maximization framework sketched above, since current activity state must be a strong determinant of the costs involved when having a child *immediately*, compared to those that would be incurred if the birth were *postponed*. For instance, it is probably widely recognized among young women that childbearing may inhibit a planned transition to a higher educational level,[18] which in turn is likely to have an adverse effect on income prospects, and also entails certain non-economic sacrifices.

The impact of work experience

Studies based on the income-maximization framework have provided conflicting predictions about the impact of work experience. Whereas Happel *et al.* argued that long work experience before marriage would lead to a higher age at first birth, Cigno and Ermisch predicted that longer work experience (as a human-capital indicator along with educational level) would tend to speed up fertility. However, the latter prediction was not well supported by the British data. Even without a control for material wealth at marriage, no significant effects of work experience were shown. Happel *et al.* did not have access to suitable data in their American study, and had to use age at marriage as a proxy for work experience.

Unfortunately, it is not only the theoretically oriented economic-demographic studies that have given contradictory results. For instance, Hoem and Hoem[19] found that work

[14] Ø. Kravdal, 'The emergence of a positive relation between education and third birth rates in Norway with supportive evidence from the United States', *Population Studies*, **46** (1992), pp. 459–475.

[15] See e.g. J. Ermisch, 'European women's employment and fertility again', *Journal of Population Economics*, **3** (1990), pp. 3–18.

[16] Chapter 8, *loc. cit.* in fn. 6.

[17] K. K. Impens, 'The impact of female unemployment on fertility in Flanders', in Cliquet *et al.*, *Population and Family in the Low Countries* (The Hague, 1989).

[18] See e.g., Margaret Marini, 'Women's educational attainment and the timing of entry into parenthood', *American Sociological Review*, **49** (1984), pp. 491–511; Jay D. Teachman and Karen A. Polonko, 'Marriage, parenthood, and the college enrolment of men and women', *Social Forces*, **67** (2) (1988), pp. 513–23. In fact, motherhood and school enrolment is a combination that may be considered even more difficult than motherhood and employment, since the child-care expenses cannot be covered by an income.

[19] Britta Hoem and J. M. Hoem, 'Patterns of deferment of first births in modern Sweden', Stockholm Research Reports in Demography 42 (Stockholm University, 1987).

experience increased first birth rates among better-educated Swedish women, whereas Blossfeld and Huinink found a negative effect of career resources, defined as work experience weighted by job prestige scores, in their German data. The interpretation of the latter result was that the experience variable was a proxy for wage potential. Finally, Martin reported from Spain that some pre-marital work experience was associated with low first birth rates.[20]

In the present analysis, the intention is to separate the effect of work experience from that of educational level. If earning potential turns out to be negatively associated with fertility, such an effect is probably captured primarily, but not exclusively, by the latter variable. The crucial question is whether various counteracting mechanisms will dominate and even produce a positive effect of work experience. There are two important reasons to expect this: first, maternity benefits in Norway are conditional on prior work experience, which means that a woman who has never been in gainful employment will benefit more economically (in the short term) by postponing the first birth, than a woman who is already well established in the labour market. Secondly, work experience is closely related to wealth accumulation. Cigno and Ermisch predicted that wealth at marriage, defined as financial assets plus the present value of husband's lifetime earnings, would increase first birth rates. It is more or less common wisdom among demographers that people have traditionally been inclined to delay parenthood until they can afford it (given certain standards),[21] but apparently the importance of wealth accumulation has not been substantiated empirically with modern individual-level data.

The impact of economic potentials

There is conflicting evidence about the importance of women's earning potential. This appears, for example, in studies where the impact of educational level (which, of course, also captures characteristics other than earning capacity) is considered. On the basis of the income-maximization theory referred to above, Cigno and Ermisch predicted that high educational level would raise the tempo of fertility, and also found empirical indications of such an effect in their British data. No effect of first birth rates was found in Germany when educational activity was controlled, but a positive effect showed up when career resources were also included in the model.[22]

Other results point more strongly towards a fertility-inhibiting effect of women's economic potential. For instance, Cigno and Ermisch predicted that a higher return to human capital leads to a later first birth, and Blackburn, Bloom, and Neumark[23] concluded from theoretical and empirical models that women who earned higher wages tended to delay their first birth. In an unpublished study by Walker[24] it was found that first birth rates among Swedish women who earned high wages were relatively low, and a similar conclusion was reached by Groot and Pott-Buter in an analysis relating to the Netherlands.[25] Both these studies were based on wage predictions derived from

[20] Teresa C. Martin, 'Delayed childbearing in contemporary Spain: trends and differentials', *European Journal of Population*, **8** (1992), pp. 217–246.

[21] See e.g. references in Rindfuss *et al.*, Chapter 2, *loc. cit.* in fn. 6.

[22] Blossfeld and Huinink, *loc. cit.* in fn. 4.

[23] M. L. Blackburn, D. E. Bloom and D. Neumark, 'Fertility timing, wages, and human capital', *Journal of Population Economics*, **6** (1993), pp. 1–30.

[24] J. R. Walker, 'Maternity benefits, fertility and female labor supply', presented at the Fourth Annual Conference of the European Society for Population Economics, held at the University of Pisa, June 1991.

[25] W. Groot and Hettie A. Pott-Buter, 'The timing of maternity in the Netherlands', *Journal of Population Economics*, **5** (1991), pp. 155–172.

individual income data. Individual-level models with aggregate wage data have also indicated that there may be a negative impact of women's wages.[26]

The findings with respect to the effect of woman's expected earning profile are quite diverse. Happel *et al.* predicted that occupations in which wages were relatively insensitive to work interruption would be associated with a late first birth. On the other hand, the study by Teachman and Schollaert,[27] in which aggregate data on wage rises were used, and that by Cigno and Ermisch, suggest that a steep wage profile (i.e. one in which wage is strongly dependent on work experience) leads to a late first birth.

DATA AND METHODS

Survey and income data

This analysis is based on interviews from the Norwegian Family and Occupation Survey of 1988, which contain individual biographies of pregnancies, births, marital and non-marital unions, educational activity, and employment for 4019 women born in 1945, 1950, 1955, 1960, 1965, and 1968.[28]

Recorded annual income and taxes were available from the Directorate for Taxation for each of the years 1967 to 1988, and have been included for all respondents. The focus is on the income component on which contributions to the public pension system are based. The income figures have been converted to 1990 prices by using the Norwegian consumer price index.

Methodological framework

A hazard regression framework is used to estimate the net impact of various covariates on the first birth rate. The women in the survey are followed from age 17. Very few first births occur before that age. The observations are censored at age 30, or at interview, which took place between October 1988 and March 1989. First birth rates are assumed to be piecewise constant over one-year intervals. Even though some of the important covariates are strongly age-dependent, this proves to be a sufficient control for age.

The LOGLIN program developed at Harvard is used in the estimation, and hierarchical models are compared by likelihood-ratio tests. Throughout the analysis, a five per cent significance level is chosen for each individual test.

Women's age turns out to interact with many other covariates, and models have therefore been estimated separately for three broad age groups, as well as for the entire sample.

The role of marital status

It is a trivial fact that the birth or conception intensity of women who are currently married or living in a consensual union is much higher than that of their contemporaries who are living in a stable sexual relationship. (In the following, those who are neither

[26] J. J. Heckman and J. R. Walker, 'The relationship between wages and income and the timing and spacing of births: evidence from Swedish longitudinal data', *Econometrica*, **58**(6) (1990), pp. 1411–1441; S. J. South and K. M. Lloyd, 'Marriage markets and nonmarital fertility in the United States', *Demography*, **29** (2) (1992), pp. 247–264.

[27] Jay D. Teachman and P. T. Schollaert, 'Economic conditions, marital status, and the timing of first births: results for whites and blacks', *Sociological Forum*, **4** (1) (1989), pp. 27–46.

[28] Central Bureau of Statistics, *Familie- og Yrkesundersøkelsen 1988*, NOS B 959 (Oslo, 1991). For details about the data quality, see also Ø. Kravdal, 'Forgone labor participation and earnings among Norwegian women', *Demography*, **29** (4) (1992), pp. 545–564.

cohabiting nor married are denoted as 'single'.) Besides, other factors may be important in the decision-making when there is no partner to rely on for economic and social support. For instance, the economic theories that have been developed for timing of first births have been focused on married couples. They are, of course, also relevant for other couples living in stable unions, but some predictions would probably not hold for women involved in more volatile relationships.

On the other hand, a consensual union or marriage may have been entered into because the couple wanted to begin their reproductive career, or because the woman was already pregnant. Because of the simultaneity between first birth and marriage, Rindfuss and his colleagues decided not to include marital status as a determinant of first birth in their models.[29] In this investigation, a less rejective strategy has been preferred, not least because there is also information on consensual unions, whose initiation is more likely to be causally prior to first birth. Attention is devoted primarily to models that are estimated for all women in the sample, without regard to their union status, but some models are also estimated separately for single women, and for women who have a partner. There is no distinction between marriages and consensual unions. The latter are very common in Norway, not only as a (not particularly stable) union between men and women, but also as a frame for childbearing and child rearing.[30]

Detailed account of the variables

Because an impending birth may affect employment and educational activity, and because a decision to have a child must have been taken more than nine months before birth under the influence of structural and individual factors operating at that time, all the covariates have been lagged nine months. Preliminary estimates show that regressors that refer to the situation 18 months before the birth give closely similar results.

The following categories are defined for the *activity state*:

(i) neither employed nor in education (those who reported homemaking or unemployment are grouped here without exception)
(ii) employed and not in education
(iii) in education (with or without concomitant employment).

A fairly large fraction of the exposure and of first births occurs in Category (i). This is true both for married or cohabiting women, and for the single. Many of these 'non-active' women are probably supported economically by their parents or their partner, and may be involved in domestic tasks, or assist in various occupational activities.[31]

Very few of these 'non-active' women reported themselves as unemployed. Because of considerable underreporting, the numbers of unemployed were even smaller than expected, and such women cannot be treated as a separate group in the analysis.

Educational level refers to the respondent's highest completed education, and is grouped into three categories, according to the time it takes to reach this level with a 'normal' progression. Nine years of education are compulsory in Norway (seven years before 1974).

[29] See e.g. R. R. Rindfuss, C. Gary Swicegood and Rachel A. Rosenfeld, 'Disorder in the life course: how common and does it matter?', *American Sociological Review*, **52** (1987), pp. 785–801.

[30] S. Blom, Turid Noack and L. Østby, *Giftermål og barn – bedre sent enn aldri?*, SØS 83 (Central Bureau of Statistics, Oslo, 1993).

[31] As many as 19 per cent of the 1945 cohort were 'non-active' for more than six months before the first conception which resulted in a live birth. The proportion was particularly high among women from Northern Norway, among those with a farm or fishing background, and among the religiously active (regression data estimates not shown). The figures are lower in younger cohorts.

The *labour market experience*, in full-time equivalents,[32] is cumulated from age 17. There is, of course, a close correlation between work experience and educational level. At a given age, women who have reached a higher educational level must have spent, on average, less time in market work. However, it is clearly seen in cross-tabulations by age, activity state, educational level, and work experience (not shown) that individual values of these covariates also vary considerably. For instance, at a given age and educational level, some women have a particularly long work experience because they have worked while attending school, or because they progressed quickly through the school system up to that level, whereas others concentrated their activities more narrowly on schooling or experienced spells of non-employment after graduation. This means that it becomes possible to split the effects of work experience and educational level, which is important from the theoretical perspective taken in this piece of research.

Wages are not readily available in these data, since there is only information on annual income and fairly broad categories of working hours on a month-to-month basis. Two different procedures were used, and fortunately give very similar results. Both are based on the assumption that all men and women who reported 35–40 hours employment weekly throughout a complete calendar year actually worked full-time, so that their recorded income in that year is equal to their full-time annual salary.

The main procedure (Approach A) is to use hourly wages that were predicted by Rønsen on the basis of period-specific regression models for women in this survey.[33] These wages are those that would be expected according to age, education, and work experience. The predictions were based on data for years between 1967 and 1987 in which the woman worked full-time continuously, and were adjusted for possible selection bias introduced by this restriction. The predictions are assumed to hold also for 1988, but observations before 1967 are excluded (i.e. women born in 1945 are included only from age 22).

The alternative procedure (Approach B) is to include the women in the hazard model only during years in which they worked 35–40 hours weekly continuously, so that the total exposure time is much lower than in Approach A.[34] Their recorded income for that year (divided by 12) is used as their actual (monthly) wage.

Occupation is included as an indicator of the expected *wage profile* for women. OLS regression models for income during 'full-year and full-time' work, with year, age, and work experience as regressors, have been estimated for various broad occupational groups. On the basis of these calculations it has been decided to focus on three categories:

(i) Medical and teaching
(ii) Sales work, manufacturing and some occupations within the service sector (hotel and restaurant work, and cleaning)
(iii) All other occupations.

The income profile is more sensitive to work experience in the third than in the first two groups. Moreover, average income is higher in Group (i) than in Group (ii). It is also characterized by a higher proportion of those employed in the public service.

[32] For definition see Kravdal, *loc. cit.* in fn. 28.

[33] Marit Rønsen, 'Norwegian women's labour force participation one year after first birth'. Paper presented at the Nordic Demographic Symposium, Lund, August 1992. Arbeidsnotat fra avdeling for personstatistikk 4 (Central Bureau of Statistics, Oslo, 1992).

[34] A nine-month lag is, of course, not acceptable under these restrictions, but fortunately it turns out that a longer lag gives virtually the same estimated effects for this variable also.

Registration-based investigations from Norway (recall Figure 1) as well as a number of fertility studies from other countries have suggested that *period* effects are very important in respect to first births. For that reason, current year (in broad groups that mirror the trends in the annual birth rates well) is included as a time-varying covariate in this analysis, instead of birth cohort.

Social control factors

Social background factors have been thought to have an independent effect on the timing of parenthood, in addition to that operating through the woman's own education or activity state.[35] In the present analysis, controls for such factors were included in some preliminary models, but the estimated effects were small, and inclusion of these variables did not affect any of the parameter estimates on which the analysis is focused.

Period interactions

The effects that activity state, educational level, labour market experience, and wages exert on first birth rates may have been subject to temporal shifts in response to social reforms and variations in macro-economic conditions. In Norway, there have been a number of changes in factors that contribute to the economic burdens of childbearing, and that affect the compatibility between employment and familial obligations. During the 1980s and late 1970s, maternity benefit has been slightly extended, other rights for employees with small children have been gradually developed, and the supply of subsidized private and public child-care facilities has improved.[36] In addition, women's real wages have increased, although less markedly after the mid 1970s. Unemployment rates were very low during the 1960s and 1970s, peaked in 1983–84 at an average level of about three per cent (eight per cent among women aged 20–24), fell to a lower level in 1986, and then increased again.

In this paper, no attempt is made to generate *a priori* hypotheses about the impact of these macro-level changes on the relationship between individual economic variables and first birth rates. It is merely checked systematically for period interactions.

RESULTS

Current activity state

Table 1 is based on all female respondents in the survey, without regard to union status. As expected, first birth rates differ widely between women who are employed and those who attend school. In fact, none of the other variables included in the model have such a strong effect, as judged by the maximum and minimum level of the relative rates.

First birth rates are highest in the fairly large group of women who neither attend school nor have a job (except at the highest ages considered). This is not because a larger

[35] Eva Bernhardt, 'Avoir un enfant à Stockholm avant 30 ans', *Population*, **45** (6) (1990), pp. 1013–1036; Joan R. Kahn and Kay E. Anderson, 'Intergenerational patterns of teenage fertility', *Demography*, **29** (1) (1992), pp. 39–57; Kathleen E. Kiernan and I. Diamond, 'The age at which childbearing starts – a longitudinal study', *Population Studies*, **37** (1983), pp. 363–380; R. T. Michael and Nancy B. Tuma, 'Entry into marriage and parenthood by young men and women: the influence of family background', *Demography*, **22** (4) (1985), pp. 15–44; Rindfuss *et al.*, *loc. cit.* in fn. 6.

[36] See also Kravdal, *loc. cit.* in fn. 28.

Table 1. *Relative first birth rates among Norwegian women, by age. All women, regardless of union status*

Age	17–30		17–20		21–25		26–30	
	Esti-mate[a]	No. of first births	Esti-mate[a]	No. of first births	Esti-mate[a]	No. of first births	Esti-mate[a]	No. of first births
Period								
–1972	1.25	703	1.00	257	1.35	377	1.48	69
1973–1977	1.28	518	1.26	150	1.23	238	1.40	130
1978–1982[b]	1.00	475	1.00	116	1.00	231	1.00	126
1983–1985	0.93	289	0.89	86	0.91	131	0.92	92
1986–1988[c]	0.91	330	0.86	73	0.94	133	0.95	24
Activity								
None	1.82	311	1.84	119	2.10	157	0.98	35
Employed, not in education	1.00	1701	1.00	414	1.00	843	1.00	443
In education	0.41	303	0.33	149	0.46	111	0.50	43
Work experience								
0–12 months	0.44	486	0.45	328	0.43	139		
13–24 months	0.79	393	0.82	190	0.71	173	1.00	145
25–48 months[b]	1.00	662			1.00	403		
49–72 months	1.14	399	1.00	164	1.11	282	1.21	115
73–96 months	1.21	227			1.11	114	1.43	124
97+ months	1.08	148					1.39	137
Educational level								
7–9 years[b]	1.00	586	1.00	333	1.00	2.08	1.00	44
10–11 years	0.88	1401	0.84	349	0.84	786	1.06	265
12+ years	1.04	328		0	0.81	116	1.52	212

[a] Hazard model estimates when controlling for age (one-year age groups).
[b] Baseline category.
[c] There were only four first births in 1989.

fraction of these women have a partner. A strong effect of 'non-activity' is actually seen both among cohabiting or married women and among the single (see Table 2).

Work experience

The general pattern is that first birth rates increase sharply up to about four years of work experience, with a particularly low level among women who spent less than one year in the labour force. Experience beyond six years does not speed up the first birth any further. (The hypothesis that there is a plateau was far from being rejected.) There are some modifications, however: the positive effect that shows up in the highest age group is non-significant, and a relatively weak, although significant, effect is found for among women who reported that they were living in a union.

Such a clear trend has never been documented in the very diverse previous investigations. While Blossfeld and Huinink argued that women's status-weighted work experience reduces first birth rates, possibly because of its correlation with wages, there is little support in the Norwegian data for an inverse relationship between women's wages and first birth rates (see following sub-sections). Any negative effect of wages, which probably would have been captured primarily by educational level anyway, must be outweighed by forces that tend to produce a higher first birth rate among women with some work experience.

Table 2. *Relative first birth rates among Norwegian women aged 17–30, by union status*

	All women			Cohabiting or married		Single	
	Estimates[a]						
	Mod. 1	Mod. 2	No. of first births	Esti-mate[a]	No. of first births	Esti-mate[a]	No. of first births
Period							
–1972	1.25	1.75	703	1.99	305	1.39	398
1973–1977	1.28	1.45	518	1.49	326	1.30	192
1978–1982[b]	1.00	1.00	475	1.00	328	1.00	146
1983–1985	0.93	0.86	289	0.87	216	0.81	73
1986–1988	0.91	0.87	330	0.95	257	0.68	73
Activity							
None	1.82	1.49	311	1.54	208	1.52	103
Employed, not in education	1.00	1.00	1701	1.00	1088	1.00	612
In education	0.41	0.45	303	0.54	136	0.39	167
Work experience							
0–12 months	0.44	0.57	486	0.71	192	0.48	294
13–24 months	0.79	0.84	393	0.84	208	0.84	185
25–48 months[b]	1.00	1.00	611	1.00	431	1.00	230
49–72 months	1.14	1.08	399	1.03	296	1.31	103
73–96 months	1.21	1.08	227	0.98	183	1.65	44
97+ months	1.08	0.99	148	0.91	122	1.48	26
Educational level							
7–9 years[b]	1.00	1.00	585	1.00	232	1.00	353
10–11 years	0.88	0.89	1410	1.05	910	0.73	491
12+ years	1.04	1.03	328	1.25	290	0.54	38
Cohabitational status							
Cohabiting or married[b]		1.00	1432				
Single		0.18	882				

[a] Hazard model estimates when controlling for age (one-year age groups).
[b] Baseline category.

There seems to be little empirical knowledge about the consequences of first-birth timing for cumulated lifetime income. It has been demonstrated that women with some work experience re-enter the labour market relatively quickly after giving birth,[37] but that does not necessarily mean that a few years of gainful work before motherhood will increase lifetime income, or cumulated income over a shorter span, for an individual woman. On the basis of income-maximization models, Cigno and Ermisch and Happel *et al.* did, in fact, reach opposite conclusions about the effect of work experience on first-birth timing. The possibility cannot, however, be ruled out that Norwegian women *believe* that it would be economically advantageous for them to drop out of the labour market temporarily after having gained some experience, rather than shortly after entry into employment. In particular, it might be expected that better-educated women are eager to see their educational investments transformed into job skill (also for non-economic reasons), but the effect of work experience actually shows up for all educational groups (not shown).

A more important explanation for the stimulating effect of previous employment is probably that young Norwegians consider it important to accumulate some wealth

[37] See e.g. Rønsen, *loc. cit.* in fn. 33.

before starting family-building. It was stated in the theoretical section that a positive effect of work experience may also have been spurred by the maternity-leave system, but this seems less likely on the basis of the empirical results. Only about half a year of continuous work experience before birth is required to receive full maternity benefit, so the proportion with maximum rights is probably not much higher among women with, say, three years of work experience than among those with two years. Besides, women with very little work experience at the time of conception may be able to establish full rights during pregnancy.

It seems that union status plays a certain role as a mediator. Work experience affects the rate of entry into marriage or consensual union, and a relatively small impact on the first birth rate remains when it is conditioned on living in a union. However, this may well be interpreted as two closely similar effects. Becoming a parent and entering a union (especially a marriage) may be considered integral parts of one broad family transition that entails certain costs, and that for reasons discussed above may be more attractive to women with some work experience.

The strong relationship between work experience and first birth rates that is revealed in the Norwegian data may not hold generally. For instance, a possibly negative impact of wages may be more dominant in countries such as Germany, where there is a longer spell of non-employment following childbirth. This may partly explain the discrepancy between the results shown in this paper and those reported by Blossfeld and Huinink. Also, the housing situation for young adults and access to credit are among the factors that may determine the importance of cumulated economic resources in the different countries.

At present, a comparison between countries is difficult because methods used in previous studies have been extremely diverse. The definition of first birth timing as well as the use of control variables have differed widely. Also, the focus has often been on duration of marriage or time elapsed since entering a consensual union, and on the work experience that has been cumulated only up to the date of union formation.

Educational level

The net effect of educational level is strongly dependent on age and union status, but, on the whole, there is not much evidence for a fertility-inhibiting impact of a higher education (see concluding section for theoretical implications). Generally, the effects would have become more clearly negative if it were not controlled for the shorter work experience among the better educated.

When women aged 17–20 are considered irrespective of union status, it is found that first birth rates are significantly lower among those with a medium education, than among their less educated counterparts. The direction of the estimated effects is the same at ages 21–26, and had it not been for the control for work experience, the effect would have been significant. Among older women, a significant positive trend appears. This change across ages is similar to that observed by Rindfuss *et al.* when they estimated the effects of educational level without any control for activity state,[38] and it also appeared in a Swedish investigation where activity state was controlled.[39]

The negative effects of education are largely confined to single women (significant at ages 17–20 and 21–25, non-significant negative trend at ages 26–30). Among those who

[38] R. R. Rindfuss, S. P. Morgan and C. G. Swicegood, 'The transition to motherhood: the intersection of structural and temporal dimensions', *American Sociological Review*, **49** (1984), pp. 359–372.

[39] Bernhardt, *loc. cit.* in fn. 35.

are cohabiting or married, no traces of negative education effects appear in any age group: when one model is estimated for all ages, there is a positive non-significant trend, but at ages 26–30 it is significant. No effects can be discerned at lower ages. These differences by union status are consistent with results reported by Rindfuss and Parnell.[40]

Much of the negative education effect among single women disappears when the predicted wage is included in the model (see below). What remains may partly be a manifestation of a higher prevalence of unwanted pregnancies among the lower social strata during much of the period under investigation.[41]

The more positive educational effect that appears at higher ages for both single women and for those who have a partner may be explained as a selection or catching-up phenomenon: well-educated women in their late 20s may tend to 'make up for' their low fertility during previous enrolment, whereas women with low eduction who are still childless at these ages form a more select group.

Current wages

When one model is estimated for all ages, and union status is disregarded, there is a significant effect of the *woman's predicted current wage*, but there is no clear trend and the parameters do not differ much from 1 (Table 3, panel A). Occupation, as a proxy for steepness of income profile, is also included in the model, but that does not affect the estimates. No significant wage effects show up in the three broad age groups either, but surprisingly there are indications of a higher first birth rate among teenagers with a high predicted wage (not shown).

A distinction between single women and those living in a union turns out to be very important. The predicted wage has a significant negative effect for single women, which actually explains much of the negative effect of their educational level. This may partly be attributed to the financial support provided through the social security system. A fixed amount is granted to non-employed lone mothers irrespective of their earning potential, and costs of childbearing are probably rather low for women with poor income opportunities. Among those in more stable unions, there is no evidence that a higher wage is associated with a later onset of reproduction.

Presumably, failure to control for husband's educational level or income has not masked a negative effect of women's wages. Some studies based on aggregate wage data have shown that higher income of the husband may speed up the first birth,[42] but the evidence from micro-studies is quite weak. Cigno and Ermisch, and Groot, and Pott and Buter[43] have found a negative effect of husband's income on first birth rates, and Blossfeld and Huinink have found a negative effect of husband's educational level. A negative income effect has also been found for *third* births in Norway.[44]

When the focus is on the *actual current wage of the woman*, the results are very close to those obtained with predicted wage (Table 3, Panel B). The same negative, but now non-significant, effect shows up among single women in Approach B as in Approach A. Among cohabiting or married women, the parameters display an inverse U-shape, but significance is far from being attained.

[40] R. R. Rindfuss and A. M. Parnell, 'The varying connection between marital status and childbearing in the United States', *Population and Development Review*, **15** (3) (1989), pp. 447–477.

[41] See e.g. W. F. Pratt, W. D. Mosher, Christine A. Bachrach and Marjorie C. Horn, 'Understanding U.S. fertility: findings from the National Survey of Family Growth, Cycle III', *Population Bulletin*, **39** (5) (1984).

[42] See e.g. Heckman and Walker, *loc. cit.* in fn. 26.

[43] *loc. cit.* in fn. 13 and fn. 25, respectively.

[44] See Kravdal, *loc. cit.* in fn. 14.

Table 3. *Relative effects of wage variables on first birth rates among Norwegian women aged 17–30, by union status*

	All women		Cohabiting or married		Single	
	Estimate	No. of first births	Estimate	No. of first births	Estimate	No. of first births
			Panel A			
Activity						
None	1.70	275	1.60	188	1.27	87
Employed, not in education:						
Medical, teaching	1.11	337	1.35	272	0.76	65
Sales, manufacturing service[b]	1.00	598	1.00	317	1.00	281
Other	0.92	624	1.01	462	0.74	162
In education	0.39	278	0.59	131	0.31	147
Educational level						
7–9 years[b]	1.00	489	1.00	203	1.00	286
10–11 years	0.89	1291	1.06	872	0.80	419
12+ years	1.05	327	1.20	290	0.84	37
Predicted wage per hour (NOK at 1990 prices)						
0–50	0.95	411	1.08	142	1.32	269
50–70	0.84	541	0.79	292	1.12	248
70–80[b]	1.00	416	1.00	290	1.00	126
80–90	0.96	428	0.97	353	0.76	75
90+	0.84	312	0.88	288	0.41	24
			Panel B[c]			
Actual wage per month (1000 NOK at 1990 prices)						
0–5	0.83	109	0.69	45	1.23	64
5–9	0.84	230	0.87	134	1.04	96
9–11[b]	1.00	233	1.00	181	1.00	52
11–13	0.93	188	0.95	163	0.78	25
13+	0.77	151	0.79	137	0.64	14

[a] Controlled for period, work experience and age (one-year age groups). Exposure before 1967 was excluded, but that did not change the estimated effects compared to those reported in Tables 1 and 2.

[b] Baseline category.

[c] Controlled for period, work experience, educational level, and age (one-year age groups). Only exposure after 1967 and during years when the respondent has worked full-time has been included. That restriction increased the estimated effects of educational level among the cohabiting or married. Additional control for occupation was not important.

Prospective wages

The woman's occupational category is included in an attempt to capture the effect of the steepness of her wage profile. Occupation is also correlated with her current wage, but the effect of that variable seems to be modest. In fact, control for predicted current wage (Table 3, Panel A), as well as control for actual current wage (not shown), does not influence the estimates associated with occupational group.

The few previous authors who have considered this issue reached different conclusions. The estimates in Table 3 give some support to the idea that women who are faced with the prospect of a slowly rising wage, e.g. those employed in medicine or education, or who are engaged in sales, service, or manufacturing work, tend to have their first birth earlier than their contemporaries in other occupations. When one model

Table 4. *Relative net[a] and gross[b] effects of period on first birth rates among Norwegian women, by age. All women, regardless of union status*

Age	17–30		17–20		21–25		26–30	
	Net	Gross	Net	Gross	Net	Gross	Net	Gross
Period								
–1972	1.25	1.51	1.00	1.34	1.35	1.57	1.48	1.48
1973–1977	1.28	1.32	1.26	1.40	1.23	1.27	1.40	1.39
1978–1982[c]	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1983–1985	0.93	0.86	0.89	0.76	0.91	0.87	0.92	0.95
1986–1988	0.91	0.85	0.86	0.70	0.94	0.86	0.95	0.93

[a] Same estimates as in Table 1.
[b] Only age controlled.
[c] Baseline category.

is estimated for all women, occupation has a significant effect, but the parameter estimates do not differ much from 1.

The slightly higher birth rate among women employed in medicine or education than among those engaged in sales, service, or manufacturing may indicate that they have somewhat better access to child-care and that also for other reasons incompatibility between job and family obligations is less pronounced for them. In particular, a shorter spell of non-employment after delivery tends to reduce the costs of childbearing, and this could lead to an earlier first birth, according to existing theories. Non-economic factors (such as convenience and the general affinity to the caretaker role) may, of course, also be responsible for the fertility differences between these two broad occupational groups.

Decline and stabilization of first birth rates

The downward trend in first birth rates, followed by stabilization, seems to have been experienced by the entire population, regardless of their economic activity, potential, or resources, However, there has been a change in the proportion who are economically active during their young adult years that has been important in shaping the trajectories of the aggregate age-specific first birth rates.

In the total sample, none of the covariates interacts significantly with period, but among single women the interaction between predicted wage and period improves the model fit significantly (not shown). Possibly as a result of changes in the social support system, in access to child care, and in job opportunities, predicted wages appear to have had a less pronounced negative effect during the 1980s than in previous decades.

The interaction between activity state and period indicates that first birth intensities were relatively high after 1986 for employed mothers, but this effect is of doubtful importance. First, the interaction is non-significant. Secondly, political attempts to ease the burdens of child caring, and which may have been beneficial for employed women in particular (in terms of costs and convenience), were not confined to the late 1980s.

As judged by the estimated parameters, the turn-around of the downward trend in the first birth rates has occurred exclusively among women in marriage or consensual unions (Table 2). Among single women, there appears to have been a continuing decline. However, neither the increase among married or cohabiting nor the decline among single women is significant.

In Table 4, the net period effects shown in Table 1 are compared with effects estimated from models where only age is controlled for (gross period effects). A considerable part

of the downward trend among young women during the 1970s is explained by the higher proportion who continue education beyond the compulsory level, and who thus spend more time in school and receive less labour market experience. 'Non-activity' has become less common during the last three decades, presumably because of better job opportunities for young women throughout the country, and because of less need for their assistance in the parental home. However, this seems to have had very little influence on aggregate birth rates.

A fairly modest increase in the proportion who attend school among women aged 17–25 among 1983 and 1988, along with a constant first birth rate among both employed and non-employed women (disregarding a non-significant interaction), is consistent with the fact that there is no marked decline in aggregate rates.

SUMMARY AND CONCLUSION

Empirical findings

The hazard models of female Norwegian birth cohorts have confirmed that young women's occupational and educational activities are very important determinants of the timing of first births. As expected, women who are attending educational institutions are much less likely to become mothers at that time, than those who are in gainful employment.

It also turns out that there is a strong relationship between cumulated labour market experience and first birth rates. At a given age and educational level, first birth rates of women who have had at least a few years of work experience are much higher than those of other women. So pronounced an effect of work experience has not been documented before. Theoretical studies based on the income-maximization framework, as well as various empirical explorations, have given conflicting results. As yet, one cannot know whether this is due to the widely different methods that have been used, or whether it reflects substantial cross-national differences.

In contrast to the large effects of activity state and work experience, the effects of educational level estimated in this study are very moderate. There are also small effects of occupation, which has been included as a proxy for expected wage increase. Certainly, there are indications that a higher educational level of women leads to lower first birth rates, even when the shorter work experience that goes hand in hand with more time spent in school is controlled. However, this negative gradient seems to be restricted to single women. Apparently, much of it can be attributed to the poor income prospects of single women with little education. Among married and cohabiting women, there is a positive educational gradient at the higher ages, possibly because of selection or catching-up. Actual or predicted wages seem to have no effect among women who reported having a partner.

Unfortunately, unemployment could not be included as a separate activity state. Previous authors have pointed to a fertility-inhibiting effect of unemployment, but have rarely distinguished between men's and women's unemployment. The high fertility in the Norwegian data among women who reported neither employment nor school enrolment suggests that unemployment may actually increase the rate of entry into motherhood. In fact, many women who are unemployed at the time of conception are also likely to be unemployed after the child has been born, and in that situation a large fraction would have an income (unemployment benefit) without being separated from their child. Thus, they may even be at an advantage compared to others who report being 'non-active'. However, the strong effect of work experience supports the opposite

conclusion. A crucial question in this context is, of course, whether unemployment benefits can make up for the loss of work experience.

Theoretical implications

To summarize, the attempt to separate the effects of educational level and work experience show that the former is weak and the latter strong. A plausible interpretation is that accumulated economic and material resources are of considerable importance in the decision regarding the timing of the first birth, whereas economic potential has little influence. This view can be accommodated within existing theoretical frameworks, but certain revisions seem to be called for. According to Happel *et al.*, a desire for consumption smoothing creates an incentive to postpone the first birth until the husband's income is sufficiently high, given that the capital market is imperfect. During much of the period investigated in the present study, the penalty for borrowing has been very small in Norway, but access to such capital has often been conditioned on prior savings. This means that there will be an incentive to accumulate wealth and financial assets before taking on family responsibilities. More importantly, economic resources do, of course, allow for a reasonably high consumption in the initial stages of family-building even in the absence of borrowing.

According to Happel *et al.*, high expected costs of childbearing tend to strengthen this economic motive for postponing the first birth. The fact that economic potentials do not appear to have an effect in the Norwegian data, may suggest that the costs associated with having a first child are only weakly influenced by earning capacity, especially among married or cohabiting women. If this were the case, the reason may be a speedier re-entry into the labour market after birth among the better-educated, combined with higher, but not altogether dominating, direct costs of childcaring. Alternatively, higher total childbearing costs among the better-educated do not lead to postponement of the first birth, because less time is also needed to reach a sufficient level of wealth, or higher costs may be set off against various non-economic advantages that are yet to be identified.

An additional explanation of the weak estimated effects of educational level and the wages, is that earning capacity may be virtually unrelated to the timing of the first birth that would maximize lifetime income. At least, it seems plausible that any such impact on the optimal timing is unknown to the couple at the time of decision-making. By contrast, an important part of the explanation for the low birth rate among those enrolled in education and the high rate among the 'non-active' is probably that these women recognize that certain penalties or benefits are associated with having a child *now* rather than *later*. Current activity state could well deserve to be taken more explicitly into account in future efforts to refine the theoretical models centred around the idea of lifetime maximization.

Explaining the temporal trend

One of the objectives of this research was to explain the trends in first births in Norway during the most recent decades. The study has shown that longer time spent at school has been an important factor in the deferment of parenthood during the 1970s and early 1980s, just as Blossfeld and Huinink so clearly demonstrated with German data. To explain the subsequent stabilization of first birth rates in Norway is, indeed, difficult. Forces that previously contributed to push the rates down may have ceased operating, or may have been counterbalanced by certain fertility-promoting factors. With respect

to the former mechanism, future research might, for instance, address the possible impact of changes in contraceptive use and abortion. Introduction of modern contraceptives is often thought to have played an important role in the transition towards a higher age at first birth, and one may well speculate whether there has been some sort of saturation during the 1980s, even though the abortion figures clearly signal that we are still far from the 'perfect contraceptive society'.

Pro-natalist forces operating from about 1984 cannot easily be identified from the present analysis. Interestingly, an increase in the relative first birth rates for employed women can be seen in the data, but is not significant. Besides, there is no obvious explanation for such an increase. Maternity leave has been extended, the supply of child-care facilities has improved, and there have also been other changes that have mitigated the incompatibility of family and work. This development must have reduced the costs and inconvenience of childbearing for all women, and in particular for employed women. However, all this occurred over a fairly long period, with no clear milestone in the mid-1980s. Hopefully, the reproductive implications of contemporary family policies will attract much attention in future scholarly projects and be better understood.

It is not completely impossible that higher unemployment rates after about 1983 compared to previous years have contributed to the stabilization of first birth rates both among those who reported being 'non-active' and among other women (a fraction of whom may actually have been unemployed). A wave of unemployment occurred in 1983 and 1984 both in Sweden and in Norway, where trends in timing of first births have been closely similar. However, only the high fertility of the 'non-active' women suggests that unemployment tends to speed up the tempo of childbearing. As mentioned above, other findings of this analysis indicate a fertility-inhibiting effect of women's unemployment. Moreover, the unemployment rates in both countries soon dropped to a low level, to be followed by a new increase later in the 1980s. This development is not mirrored by the annual aggregate first birth rates. Finally, men have experienced the same trends, and it seems reasonable to expect that men's unemployment reduces both tempo and quantum of fertility.

Paper III

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The Emergence of a Positive Relation Between Education and Third Birth Rates in Norway with Supportive Evidence from the United States

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INTRODUCTION

It has repeatedly been shown that women's educational attainment is closely correlated with several aspects of demographic behaviour, including the reproductive process. Although curvilinear relations between mothers' education and fertility have been reported from some countries,[1] the general pattern seems to be that every additional year of mother's schooling leads to a reduction in the number of children she bears.[2]

It has been widely accepted that education is conducive to low lifetime fertility, because it opens alternatives to woman's role of mother and wife. Educated women find it easier to obtain jobs in the labour market, their earning potential is higher, and possibly their jobs are emotionally more satisfying. They, therefore, have more to lose by withdrawing temporarily from the labour force after childbirth. Whilst the higher income of a well-educated woman and her husband may increase their demand for children,[3] the higher opportunity cost of childbearing is often assumed to more than compensate for this.[4] Moreover, better knowledge and more efficient use of birth control have probably contributed to the relatively low fertility of the higher social strata.[5] Finally, highly educated parents may have higher aspirations for their children, which increase the cost of rearing them; or they may prefer alternative satisfactions to those yielded by children. All this may lead to delaying the first birth,[6] or to an increased propensity to remain childless, but both the tempo and quantum of later parity transitions are also likely to be influenced by mothers' educational level. In addition, more time spent in the education system may itself lead to a postponement of the first birth.

Research on this subject has been focused on educational differences in lifetime

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[1] R. Andorka, *Determinants of Fertility in Advanced Societies*. (London, 1978); J. D. Kasarda, J. O. G. Billy and K. West, *Status Enhancement and Fertility* (New York, 1986).

[2] Cf., e.g., J. A. Sweet and R. R. Rindfuss, 'Those ubiquitous fertility trends: United States, 1945–1979', *Social Biology*, **30**(2) (1983), pp. 127–139.

[3] A very influential paper was that by G. S. Becker, 'An economic analysis of fertility', in National Bureau of Economic Research, *Demographic and Economic Change in Developed Countries*. (Princeton, 1960).

[4] Cf., e.g., J. Mincer, 'Market prices, opportunity costs and income effects', in C. Christ *et al.*, *Measurement in Economics* (Palo Alto, 1963). For a recent assessment of opportunity costs in Britain see Heather Joshi, 'The cash opportunity cost of childbearing. An approach to estimation, using British data', *Population Studies*, **44** (1990), pp. 41–60.

[5] For a description of the situation in the United States, see C. F. Westoff and N. B. Ryder, *The Contraceptive Revolution* (Princeton, 1977); C. F. Westoff, 'The decline in unwanted fertility, 1971–76'. *Family Planning Perspectives*, **13**(2) (1981), pp. 70–71. The Norwegian trend is discussed by T. Noack and L. Østby, *Fruktbarhet Blant Norske Kvinner*, SØS 49 (Central Bureau of Statistics, Oslo, 1981).

[6] R. R. Rindfuss, L. L. Bumpass and C. St. John, 'Educational fertility. Implications for the roles that women occupy', *American Sociological Review*, **45** (1980), pp. 431–447.

fertility and on the time of the first birth.[7] It would seem interesting, however, to build up a more complete picture of the effect of educational attainment on various aspects of the reproductive process, and in this paper we report some recent findings on the subject of third-birth rates. Low fertility in contemporary industrialized societies is to a large extent due to an increasing tendency to finish reproduction after the second birth.[8]

There have been few studies of this subject, and these have generally only formed a minor part of a broader exploration of parity progression ratios. In Britain, it has been shown that mothers' education has no effect on the third-birth rate,[9] whilst in the United States a diminishing negative effect in successive birth cohorts has been reported.[10] In another study, an indication of a positive relation between educational attainment and parity progression ratios in general during the later 1970s was found.[11] However, as regards third-parity progression ratios in particular, the authors claimed that there was no such effect of mothers' education during the 1960s and 1970s. In a Swedish study it has been shown that mothers' education was positively related to the intensity of third births, when age at second birth and some other controls were included.[12] The positive relationship was less convincing for a gross effect of education within female birth cohorts.[13]

The relationship between mothers' education and the reproductive process may differ in different countries, for it may depend on a variety of factors, such as use of contraception, the employment rights of mothers, the cost and availability of child care, and the relative economic position of the highly educated. The somewhat unexpected positive relationship found in Sweden may be a manifestation of the position of that country as a 'demographic forerunner',[14] though it is by no means obvious that a well developed social welfare system and acceptance of non-traditional attitudes should have this effect on fertility differentials. An analysis of Norwegian data should thus be of interest, as Norway resembles Sweden in many respects, and above all, because there exists an exceptionally rich data set with individual birth and marriage histories for *complete* cohorts of women. For the sake of comparison, we have also explored data from a survey in the United States, collected in 1987 and 1988, which make it possible to focus on the experience of women who had their second births about 1980. The pattern of childbearing among these women may have been different from that of women who had their second child earlier.[15]

We have calculated parity progression ratios for birth cohorts and for second-parity cohorts (i.e. women who had a second birth during a given year). The latter approach is likely to provide the best insight into recent trends. To study the impact of education,

[7] Cf. M. M. Marini, 'Women's educational attainment and the timing of entry into parenthood', *American Sociological Review*, **49** (1984), pp. 491–511.

[8] N. B. Ryder, 'Observations on the history of cohort fertility in the United States'. *Population and Development Review*, **12**(4) (1986), pp. 617–643; France Prioux, 'Fécondité, dimensions des familles en Europe occidentale', *Espace, Populations, Sociétés*, **2** (1989), pp. 161–176; Ø. Kravdal and H. Brunborg, 'Recent fertility trends in Norway'. *Scandinavian Population Studies*, **8** (1988), pp. 55–72.

[9] R. E. Wright, J. F. Ermisch, P. R. A. Hinde and Heather Joshi, 'The third birth in Great Britain', *Journal of Biosocial Science*, **20** (1988), pp. 489–496.

[10] H. Wineberg and J. McCarthy, 'Child spacing in the United States. Recent trends and differentials', *Journal of Marriage and the Family*, **51** (1989), pp. 213–228.

[11] R. R. Rindfuss and A. M. Parnell, 'The varying connection between marital status and childbearing in the United States'. *Population and Development Review*, **15**(3) (1989), pp. 447–470.

[12] Britta Hoem and J. M. Hoem, 'The impact of female employment on second and third births in modern Sweden'. *Population Studies* **43**(1) (1989), pp. 47–67.

[13] Britta Hoem, 'Alla gode ting är tre? Tredjebarnsfödslar bland svenska kvinnar födda 1938–1950', Stockholm Research Reports in Demography, No. 59 (University of Stockholm, 1990).

[14] D. Popenoe, 'Beyond tradition. A statistical portrait of the changing family in Sweden', *Journal of Marriage and the Family*, **49** (1987), pp. 173–183.

[15] This is suggested by the analysis in the paper by Rindfuss and Parnell, *loc. cit.* in fn. 11.

we have also used regression models in which economic as well as other socio-demographic variables were used.

THE SITUATION IN NORWAY AND THE UNITED STATES

In the United States total period fertility exceeded 3.5 during most of the 1950s, and reached a maximum of about 3.7. Since the mid-1970s, the figures have remained relatively stable, close to a level of 1.8. Cohort fertility was less variable, but was as high as 3.2 for women born during the mid-1930s.[16] In Norway, the baby boom and the subsequent 'second demographic transition'[17] were less pronounced. Total period fertility was almost 3.0 during the mid-1960s, and cohort fertility reached a maximum of 2.5 for women born during the mid-1930s.[18] The average number of births to women born in 1945 was 2.2, and for those born ten years later is likely to be about 2.0. Total period fertility dropped to a low of 1.66 in 1983 and 1984, having been below 1.8 since 1977, but has recently risen to 1.89 in 1989.

In the United States parity progression ratios from the second to the third birth dropped substantially from the mid-1950s to about 1970 (see Table 1). During the early 1970s the decline was smaller, and the subsequent fertility of women who had a second birth by the end of the 1970s seems to have been higher than that of their predecessors who bore their second child some five years earlier. The upturn was significant at the 0.05 level (not shown). In the United States it has also become more common not to 'fulfil

Table 1. *Proportion of American women who have had a third child within five or ten years after the second (per cent)*

Year of second birth	Within five years			Within ten years		
	Age 20–24	Age 25–29	All ages	Age 20–24	Age 25–29	All ages
1955–59	75.5	59.1	64.4	82.4	73.7	74.1
1960–64	64.6	48.3	55.8	73.8	57.4	65.0
1965–69	47.1	40.9	42.5	54.8	47.0	50.1
1970–74	39.3	31.3	35.5	49.4	45.8	46.8
1975–79	46.4	36.1	40.9	54.1*	44.0*	49.0*

* Not full ten years of exposure.

the two-child norm': the proportion of white women with fewer than two children increased from 14 per cent among those born between 1930 and 1934 to 19 per cent for those born between 1940 and 1944.

In Norway the pattern was similar, though the decline was confined primarily to third and higher parities.[19] In Figure 1 it is shown that the proportion of women who had a third child within ten years of the birth of their second fell until about 1975, and then levelled off. A clear increase in the proportion of women going on to a third birth within five years of the second is apparent for recent years. There are indications that this increase may have coincided with a small increase in the proportion of women who remain permanently childless.

[16] National Center for Health Statistics, *Vital Statistics for the United States*. Vol. 1. *Natality* (Government Printing Office, Washington, 1987); N. B. Ryder, *loc. cit.* in fn. 8.

[17] D. J. van de Kaa, 'Europe's second demographic transition'. *Population Bulletin* **42**(1), 1987.

[18] H. Brunborg, *Kohort – og Periodefruktbarhet i Norge, 1845–1985*. Report 88/4 (Central Bureau of Statistics, Oslo, 1988).

[19] Kravdal and Brunborg, *loc. cit.* in fn. 8.

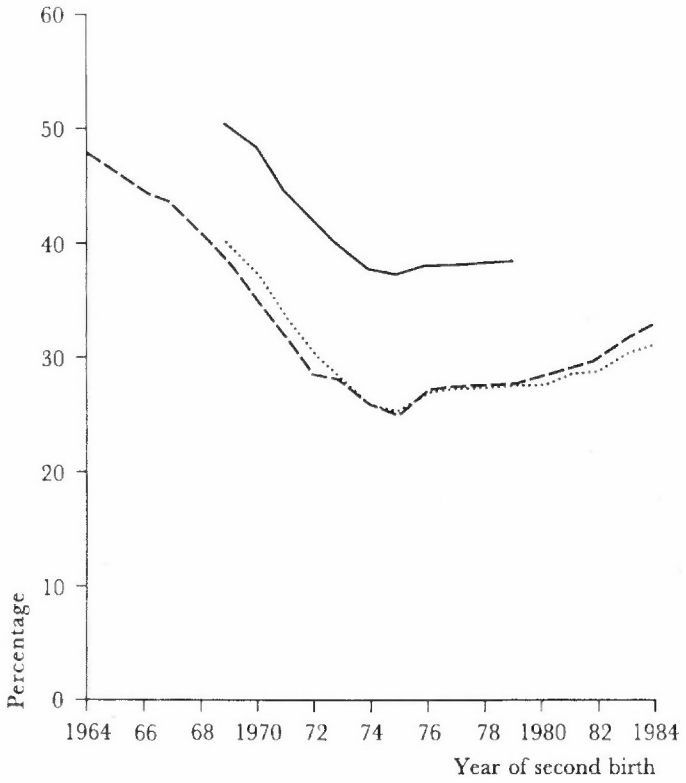

Figure 1. Third-birth probabilities in Norway by year of second birth (per cent). Probability of having a third birth within: —— 10 years after the second birth; – – – 5 years after the second birth for women aged 25–29 at second birth; ..... 5 years after the second birth. Due to limitations of the data set the progression probability could only be calculated for years after 1969, when all age groups are merged together.

DATA AND METHODS

Outline of the Analytical Approach

Our main interest is in the subsequent reproductive behaviour of women who have already had two children. This approach has been used in a number of previous studies,[20] but we recognize, of course, that it excludes a considerable proportion of the female population. Among currently middle-aged women, some 80 per cent have had two children, but women of low parity are disproportionately represented among the highly educated. We have calculated the probability that a woman who has had two children will have a third within five years or ten years after the birth of her second child, and will model this probability within a multivariate logistic regression framework. We shall only discuss the regression estimates for probabilities of having a third child within five years of the second; those for the ten-year intervals are substantially similar.

The Norwegian Data

The analysis is based on complete individual marital and reproductive histories obtained from the Central Population Register of Norway. All Norwegian females born between 1935 and 1965 are included in the life history files, and the data cover the period up to

[20] Cf. for example, C. F. Westoff, R. G. Potter and P. Sagi, *The Third Child. A Study in the Prediction of Fertility* (Princeton, 1963).

1989. The bulk of the data come from a file in which birth histories are matched with information from the education register. However, for the regression models we had to use a file in which marital and reproductive histories up to 1984 were matched with data from the censuses of 1960, 1970, and 1980. Unfortunately, the definition of educational level used in these two sources was different. Some teachers, nurses, and engineers were allocated to a higher level in the education register than in the Census. However, the effect of these differences on our results is slight.

The U.S. Data

The information comes from the 1988 National Survey of Families and Households, in which 13,017 so-called primary respondents were interviewed between March 1987 and May 1988.[21] In addition, a shorter questionnaire was given to the spouse or co-habiting partner for completion. In the present study only cases in which the woman was the primary respondent have been included (7789). The sample consists of white women born between 1930 and 1954, or those who delivered their second child between 1955 and 1979. Five quinquennial cohorts of women who had their second child between 1955–59, 1960–64, 1965–69, 1970–74 and 1975–79 respectively are defined, each of which consists of between 260 and 390 cases.

Definition of Educational Level

The education register shows the highest educational level attained in October 1988, whereas the education variable in the regression model refers to the situation at census date – on average 15 months after the second birth. In the American data the education variable relates to the period 15 months after the second birth, or at the date of interview.

The educational systems in Norway and the United States are different. In Norway, compulsory school attendance lasts for nine years (seven years before 1974), and in the second-parity cohort of 1979, 34 per cent of the women had achieved a higher level than this. In the United States, there are fairly strong incentives to obtain a high school diploma, which normally requires enrolment for 12 years. Only 16 per cent, on average, of the women in the second-parity cohorts had completed less than 12 years of education. We shall, for the sake of simplicity, refer to all women who had received more than 12 years of schooling as college-educated.

Regression Model

The specification of the model depended on the data available in Norway. Employment and income could be incorporated, but we did not have information about use of contraception, which could be a key intervening factor in the relationship between fertility and mothers' education. The regression analysis on the Norwegian data is confined to women who had a second birth in 1969 or 1979. From the Censuses of 1970 or 1980 socio-demographic information on these women could be obtained. In the U.S. model, all women who had a second birth between 1955 and 1979 are included.

The analysis for Norwegian women is restricted to those who were still in their first marriage at the time when their second child was born, and remained married five years

[21] J. A. Sweet, L. L. Bumpass and V. Call, 'The Design and Content of the National Survey of Families and Households', NSFH Working Paper 1, 1989. Center for Demography and Ecology, University of Wisconsin at Madison.

later. This number came to about 15,000 in the 1969, and 14,000 in the 1979 second-parity cohort. The restriction makes it possible to include some information about the fathers. Although a considerable proportion of women were excluded by this restriction,[22] it did not distort the estimates of the education effect.

The U.S. model, too, is restricted to married women. Further restriction to women who were in the same marriage at interview would have yielded information about their husbands' incomes at the time, but we regarded this measure as relatively uninteresting, and have focused on models in which the labour-force variable and some other socio-demographic variables were included.

Because of the low fertility of teenagers and the limitations in the Norwegian data, the regressions were estimated only for women who were between 20 and 34 years old when they had their second birth – the overwhelming majority among second-parity women. This implies that some 15 per cent of women who had a second birth between 1955 and 1979 in the U.S. were omitted, but the restriction does not affect the results.

The variables in the Norwegian regression model included age of mother at second birth, interval between first and second birth, educational levels of both spouses, woman's labour-force participation, and husband's income. Place of residence, religious denomination, age difference between spouses, and educational level of the woman's parents were also included, but even though some of these variables have a strong net effect on the third-birth rate, they could have been omitted without affecting the estimates of other effects appreciably.

Multicollinearity was not a problem. A variety of models in which only a sub-set of the variables was used were estimated, and the parameters appeared to be stable. Standard errors for the parameters are shown for most models. The null-hypothesis (that the value of the parameter was 0) was rejected at the five per cent level, when the parameter estimate exceeded twice its standard error.

Socio-economic Variables

The Norwegian data provide information on the woman's labour-force participation during the 12 months preceding the census, i.e. the year after she had her second birth.[23] This variable is presumably a reasonably good indicator of work intentions and preferences.[24] It is possible, however, that some women with a very strong commitment to work may have found it impossible to resume employment because they could not make adequate arrangements for child care.

A similar measure of employment has been established in the analysis of the American data, where we have concentrated on the period between three and 15 months after the second birth. A measure of the total number of woman-months worked during that period has been constructed. Values of six months or less have been coded as part-time, those of more than six months as full-time employment.

In the Norwegian data we have also included a measure of husband's income. There are limitations to this information, as income may change even during a short section of the life-course. Moreover, the economic situation of the family at a time when the

[22] Among women who were between 25 and 29 years old at the time of their second birth in 1979, 87 per cent were in their first marriage and remained so for five years afterwards. The probability of having a third birth was slightly lower for the remaining 13 per cent.

[23] Note that a very small proportion of the women will already have had their third child during this period. Exclusion of these women does not affect the estimates appreciably.

[24] F. L. Mott and D. Shapiro, 'Complementarity of work and fertility among young American mothers', *Population Studies*, **37** (1983), pp. 239–252; M. Ní Bhrolcháin, 'Women's paid work and the timing of births. Longitudinal evidence', *European Journal of Population*, **2** (1986), pp. 43–70.

additional child leads to heavy demands will also depend on the amount borrowed, savings, and the transfer of wealth from the parental generation. But we believe the variable is reasonably adequate, when compared with those traditionally used in analyses of this kind. As the U.S. data only contain information on husband's income at the date of interview, we do not report on models in which this variable has been included.

THE GROSS EFFECT OF MOTHERS' EDUCATION ON THIRD BIRTHS

Education and Third-Birth Rates in Norwegian Birth Cohorts

Mothers' education and total fertility are inversely related in Norwegian cohorts. The average number of children born to women who were 35 years old in 1980 was 2.39 for those who had been educated for the compulsory period only (26 per cent of the total), compared with 1.78 for women who had received more than 15 years of education (8 per cent of the cohort). At the age of 40, the figures in the same birth cohort (i.e. 1985) were 2.46 and 1.95 respectively.

The slope of the line is only very slightly less steep for women born in 1954 (the last cohort we can observe at the age of 35), when the average was 2.06 children per woman with compulsory education only (19 per cent of the cohort), and 1.58 for those who had had more than 15 years' schooling (10 per cent of the cohort).

The lower average number of children born to women as their level of education increases is to a large extent due to differences in the proportion of childless women (Table 2). The parity progression ratio from first to second birth is also somewhat lower among the better-educated. The figures also show that childlessness at the age of 35 has been increasing in recent cohorts, and that the increase has been slightly higher for the highly educated than for their less educated counterparts, the proportion having increased by about two percentage points more between the mid-1940 cohorts and the cohort of 1954 in the former group. There are good reasons to believe that the picture will be similar when these women have reached the end of their fertile period.

Table 2. *Proportion of Norwegian women who are childless at age 35, by birth cohort and education (per cent)*

Birth cohort	Education (years)					Birth cohort	Education (years)				
	7–9	10	11–12	13–14	15+		7–9	10	11–12	13–14	15+
1935	8.8	9.9	13.0	17.6	18.0	1945	7.5	8.7	11.5	13.2	16.8
1936	8.3	9.9	15.1	17.1	19.2	1946	7.6	7.8	11.4	13.4	17.9
1937	8.3	9.8	12.3	16.3	17.4	1947	7.5	8.6	11.6	13.7	18.4
1938	8.3	9.3	12.1	15.6	17.1	1948	7.6	8.5	11.5	13.5	18.7
1939	8.3	8.1	13.5	13.5	16.7	1949	8.1	8.9	11.5	14.3	18.0
1940	8.2	9.1	11.8	14.6	16.5	1950	7.4	8.8	12.3	15.3	19.0
1941	7.8	8.7	10.2	13.1	19.4	1951	7.5	9.0	11.9	16.2	19.9
1942	8.0	9.3	12.2	14.0	17.4	1952	8.7	10.2	12.5	15.0	20.4
1943	8.3	8.8	12.1	14.2	17.8	1953	8.5	10.4	14.0	15.9	20.4
1944	7.4	9.0	12.1	13.9	16.9	1954	8.7	11.0	14.4	18.7	21.8

Education also inhibits reproduction at the later stages of the reproductive process. In Table 3 we show the probabilities of having a third birth within five or ten years of the second birth (or before the end of 1989, if that corresponds to a shorter interval) for women born between 1935 and 1954. These probabilities are lower for women who have

had more than 12 years of schooling than for those who only received compulsory education, and the effect is most pronounced for cohorts from the 1940s.[25] However, parity progression ratios for college-educated women born after 1952 during the first five years after their second birth were *higher* than for other women in the same cohort. When the interval of observation is ten years, the ratios are highest among those with the least education, but the well-educated are close behind. At the end of the reproductive period, the negative effect of mothers' education will be weaker[26] and may even be positive, at least at the level corresponding to 13–14 years of schooling. The diminishing impact of mothers' education on third-birth probabilities is likely to be stronger than the opposite effect of increased childlessness among college educated women and will contribute to a reduction of the educational gradient in the total number of children, when 40-year old women born between 1945 and 1954 are compared.

Table 3. *Proportion of Norwegian women who have had a third child within five or ten years after the second,* by education and birth cohort (per cent)*

Birth cohort	Within five years					Within ten years				
	Education (years)					Education (years)				
	7–9	10	11–12	13–14	15+	7–9	10	11–12	13–14	15+
1935	47.7	46.4	42.5	45.7	49.7	62.4	59.4	53.9	55.1	58.0
1936	48.9	46.7	42.7	48.0	47.5	63.1	59.8	54.4	57.5	55.0
1937	49.0	47.0	44.6	47.6	46.7	61.9	59.1	54.1	58.1	54.7
1938	49.7	47.3	45.0	44.3	45.5	62.5	59.5	55.4	52.8	53.6
1939	50.9	45.5	41.6	43.1	45.1	63.0	57.3	50.8	52.1	52.9
1940	50.3	44.6	41.4	42.9	41.7	62.2	55.3	50.6	51.5	50.5
1941	50.1	44.4	41.2	41.6	38.9	61.5	54.8	50.9	49.4	46.9
1942	48.1	42.7	37.1	40.2	35.7	59.5	52.8	46.6	49.1	43.7
1943	47.0	39.7	33.4	35.1	31.3	57.6	49.7	44.3	43.7	40.4
1944	45.0	37.8	33.7	33.9	30.9	55.2	47.9	41.9	42.3	39.2
1945	43.7	34.6	30.2	32.2	28.3	54.5	44.3	37.8	41.9	35.4
1946	41.3	32.1	27.9	29.8	28.1	52.2	42.3	36.6	39.2	35.6
1947	39.2	30.2	28.5	28.6	28.0	49.9	40.3	38.8	37.5	36.7
1948	36.6	27.9	25.9	30.2	28.4	47.1	39.0	36.2	40.0	36.8
1949	35.2	27.3	24.6	29.0	27.8	46.7	38.0	33.7	37.0	37.2
1950	32.5	24.8	22.6	28.1	27.7	43.8	36.1	31.2	38.5	36.1
1951	30.8	25.2	23.5	30.7	27.1	43.4	36.4	32.7	39.5	34.6
1952	28.9	24.3	24.1	30.2	27.0	41.8	35.4	32.5	38.8	34.9
1953	27.5	23.5	23.1	29.7	29.0	40.1	35.1	31.6	37.0	35.6
1954	26.2	24.5	25.3	29.6	26.5	38.6	34.8	34.4	35.1	31.7

* Or before the end of 1989, if that corresponds to a shorter interval.

Education and Third-Birth Rates in Norwegian Second-Parity Cohorts

Within a given birth cohort, women who have received more education tend to have their second births at a later age than those who had only been at school for the compulsory period. Thus, during a period of declining fertility the effect of mothers' education may be different for women in second-parity cohorts from that in birth cohorts. A positive relation between mothers' education and third-birth rates is clearly

[25] The effect appears more clearly for the ten-year interval than for that of five years. The older age at second birth among the better educated women has a particularly strong effect on fertility during the second five years after the second birth.

[26] This can be seen in calculations carried out at different ages for older cohorts, and may be explained – somewhat simplistically – as a consequence of deferred childbearing among the well-educated.

apparent for some young second-parity cohorts. Probabilities of having a third birth within five or ten years for women who had had a second birth after 1969 are shown in Table 4. Those who had their second birth earlier have been omitted, because of limitations in the data. The probabilities of having a third birth within five years for women who had their second birth after 1975 are highest for those who had received 13–14 or 15 or more years of schooling. This pattern also holds for ten-year probabilities for some of the years between 1975 and 1979. In other words, there is not just a spacing effect, but an indisputable trend among highly educated mothers of two children to proceed to a third birth more frequently than their less educated counterparts.

Table 4. *Proportion of Norwegian women who have had a third child within five or ten years after the second, by education and year at second birth (second-parity cohort) (per cent)*

Second-parity cohort	Within five years					Within ten years				
	Education (years)					Education (years)				
	7–9	10	11–12	13–14	15+	7–9	10	11–12	13–14	15+
1969	43.1	38.1	38.1	42.4	38.1	53.6	48.8	46.9	52.7	48.3
1970	39.9	36.0	33.7	39.7	36.1	51.1	47.3	43.8	49.4	46.6
1971	36.4	32.3	30.1	34.7	32.4	47.3	43.1	41.5	46.5	41.9
1972	33.5	27.6	28.0	33.6	29.2	44.8	39.9	39.1	45.8	38.8
1973	29.1	26.5	26.2	29.9	27.9	41.6	38.8	36.3	39.7	37.7
1974	27.3	23.8	22.8	31.0	26.2	40.1	35.8	33.4	41.9	37.1
1975	25.6	22.9	22.3	31.2	26.5	38.5	36.0	32.6	41.7	36.6
1976	25.1	24.7	24.6	31.1	31.3	37.7	36.7	34.3	41.3	39.5
1977	26.4	25.4	22.5	31.2	28.4	38.9	36.9	33.1	41.4	37.8
1978	26.3	25.3	23.5	31.1	29.6	38.5	36.7	34.4	41.1	40.9
1979	27.2	25.1	24.2	31.6	28.7	38.8	36.9	35.7	40.9	39.2
1980	26.9	25.7	24.6	30.5	29.7					
1981	27.1	26.3	26.3	32.5	29.9					
1982	25.9	26.6	28.4	32.4	30.1					
1983	26.8	27.5	30.1	34.8	34.5					
1984	29.7	28.5	30.3	32.6	35.2					

As was shown in a previous section, overall probabilities of having a third birth within five or ten years of the second stopped declining towards the end of the 1970s, and have increased during recent years. The movement has been similar in all educational groups, but the downward trend ended somewhat earlier among women who had completed 12 or more years of education, so that when the third-parity progression ratios had reached their lowest level, the effect of mothers' education was positive. However, since relatively few women did receive a higher education, and because educational differences are small, the positive effect of mothers' education and the rise in general educational levels were only responsible for a small upward movement in the overall third-birth rate.

EXPLAINING THE POSITIVE EFFECT OF MOTHERS' EDUCATION

The multivariate analysis was undertaken to see whether economic factors could explain the positive effect of mothers' education. Even in relatively egalitarian societies, economic factors may have become more important as determinants of reproduction at a time when differences in the practice of contraception in different social groups have probably been reduced.

The basic idea is that the income effect during recent years may have more than balanced the opportunity cost effect. This could have happened because nursery schools and other facilities with a price that is relatively independent of women's income have become more easily available and are considered adequate substitutes for parental care during working hours. We have included husband's income, as well as his education, among the variables, as our objective was to find out whether the positive effect of the mother's education can be accounted for by a positive effect of father's education, which in turn can partly be ascribed to an income effect.

The labour-force variable has been taken as a proxy for the woman's degree of commitment to work outside the home. Women who are strongly motivated to gainful employment have more to lose from the birth of a child, than do women who give higher preference to a purely maternal role. The nature and importance of this loss will depend on the economic situation of the family, and the woman's motivation for work. Thus, it would seem reasonable that the relation between employment and fertility may differ for women who have received different levels of education.

Moreover, the highly educated may take jobs in which it is easier to combine motherhood and gainful employment. In Norway, teachers can do some of their work at home, nurses often have reasonably good access to nursery schools, and others in the public or private sector may be in a more flexible working situation that makes it easier to fulfil their obligations to their families. All this would be expected to stimulate fertility.

We wish to investigate whether the third-birth rate among college educated women, who are more likely to be in the labour force shortly after their second birth, is high because the negative effect of employment is weaker in the type of work they do. In a recent Swedish study it has been suggested that the effect of work on fertility is particularly weak for highly educated women, whilst results from the United States point in the opposite direction.[27]

The regression coefficients in the model of five-year probabilities are shown in Table 5 for women who had a second birth in 1969 or 1979. Among the former, extended education does not appear to have a gross effect, among the latter the effect is positive (see Table 4).

First, we note the large effect of the purely demographic variables. Controlling for age at second birth (but for no other covariate) increases the estimated effect of education (not shown). In both cohorts (1969 and 1979) the effect of having received more than 12 years of education turns out to be positive. This is not surprising as highly educated women tend to have their children at later ages and this is known to affect the tempo of subsequent fertility negatively. When other variables are added, among them husband's income and education and the woman's labour-force participation, the estimated effect of education changes only in the second-parity cohort of 1979, but remains significantly positive.

In the Norwegian 1979 cohort, the effect of mother's education os attenuated when the husband's education is included in the model, but both these variables show a significant positive effect. In the 1969 cohort, third-birth rates are particularly high only for women married to men with education of a very high level. In other words, the factors which result in a positive effect of husband's education may also explain part of

[27] Britta Hoem, 'Faktorer som påverkar tvåbarnsmödrarnas planer på vidare barnefodande', Stockholm Research Reports in Demography 54, 1989 (University of Stockholm); R. H. Weller 'Wife's employment and cumulative family size in the United States', *Demography*, **14**(1) (1977), pp. 43–65.

Table 5. *Parameter estimates with standard errors in logistic regression models for the probability of having a third child within five years of the second. Norwegian women who had a second birth at ages 20–34, and lived in first marriage at their second birth and five years afterwards*

	Second birth 1969		Second birth 1979	
	Net[a]	Gross[c]	Net[a]	Gross[c]
Woman's age				
20–22 yr	0.07 (0.05)	0.26	0.24 (0.07)	0.37
*23–25 yr	0	0	0	0
26–28 yr	−0.06 (0.05)	−0.16	−0.10 (0.05)	−0.13
29–31 yr	−0.24 (0.06)	−0.44	−0.35 (0.07)	−0.37
32–34 yr	−0.57 (0.09)	−0.83	−0.65 (0.09)	−0.66
Interval between first and second birth				
0–23 mth	0.52 (0.04)	0.63	0.70 (0.06)	0.82
*24–47 mth	0	0	0	0
48 + mth	−0.44 (0.05)	−0.59	−0.54 (0.05)	−0.73
Woman's education				
*7–9 yr	0	0	0	0
10 yr	−0.18 (0.04)	−0.27	0.10 (0.05)	0.28
11–12 yr	0.15 (0.07)	−0.03	0.18 (0.07)	0.32
13–14 yr	0.27 (0.08)	0.03	0.43 (0.08)	0.55
15+ yr	0.40 (0.16)	0.08	0.38 (0.10)	0.56
Woman's labour force participation				
*Not employed	0	0	0	0
100–999 hours	−0.02 (0.06)	0.07	−0.01 (0.05)	0.01
1000+ hours	−0.21 (0.07)	−0.19	0.01 (0.07)	−0.01
Husband's education				
*7–9 yr	0	0	0	0
10 yr	−0.12 (0.05)	0.16	0.09 (0.06)	0.10
11–12 yr	−0.11 (0.05)	−0.31	0.13 (0.06)	0.11
13–14 yr	−0.13 (0.07)	−0.35	0.19 (0.08)	0.10
15–16 yr	−0.03 (0.12)	−0.21	0.46 (0.10)	0.48
17+ yr	0.19 (0.10)	−0.01	0.61 (0.09)	0.49
Husband's income[b]				
Very low	0.32 (0.06)	0.55	0.23 (0.07)	0.35
Low	0.15 (0.06)	0.26	0.16 (0.07)	0.16
*Medium low	0	0	0	0
Medium high	0.01 (0.06)	−0.07	−0.05 (0.07)	−0.09
High	0.01 (0.06)	−0.13	−0.04 (0.07)	−0.07
Very high	0.06 (0.06)	−0.10	0.09 (0.07)	0.07

[a] Place of residence, couple's religion, education of woman's parents and age difference between the spouses were also included in the model, but could have been excluded without affecting the other estimates appreciably.

[b] Distribution over the groups: 15–18 per cent in each group. Group definitions in 1000 NOK may be obtained from the author.

[c] Standard errors almost equal to those for net models.

* Baseline groups.

the effect of the mother's education, though the latter variable also has an independent effect.

Evidently, higher income does not explain why third-birth fertility is higher among women married to men with a university education. On the contrary, our data have

shown that third-birth rates are positively, but weakly, related to having a *low* income. This might seem surprising, as the traditional view is that a higher family income, net of the confounding effect of contraceptive knowledge and use, would tend to increase the demand for children as a 'consumption good'. However, this theory has met with some criticism,[28] and although positive effects of actual or relative income have been reported,[29] the empirical support for such a positive effect is fairly modest.[30] Moreover, several authors have stressed the existence of an interaction with parity,[31] and it seems that negative income effects are particularly likely to show up among couples who already have at least two children.

We conclude that, considering the absence of a positive effect of husband's income, it is not plausible that the *wife's* contribution to the family income can have a positive effect which would outweigh the effect of opportunity cost.

Our labour force variable, too, is only weakly related to third-birth rates. We find a small negative effect of full-time employment in the second-parity cohort of 1969. Thus, the estimated effect of mothers' education does not change appreciably when labour market activity is controlled, in spite of the fact that the proportion of mothers of two children who are in gainful employment increases with their educational attainment.

We shall not speculate about the weak effect of employment, but note that previous findings on the subject have not been consistent. Attempts have been made to model both directions of the employment-fertility relationship, and there appears to be more support for the existence of a negative effect of (small) children on labour-force participation of the mother than the reverse.[32] Among those who have focused on the transition to the third parity in particular, some have concluded that the effect of employment was negative,[33] others have claimed that there is virtually no effect.[34]

We found no clear differences in the effect of labour force participation at different levels of mothers' education. Interaction between education and labour force participation improved the fit of the model for the second-parity cohort of 1979, but there was not a particularly strong negative effect of gainful employment among women with little education (Table 6). The same conclusion applies to the second-parity cohort of 1969, where the inclusion of an interaction term did not significantly improve the fit of the model (Table 6). In other words, the view that high third-birth rates among educated women result from a weaker negative influence of labour-force participation is not supported by the evidence.

[28] Cf., e.g., Judith Blake, 'Are babies consumer durables?', *Population Studies*, **22** (1968), pp. 5–25; B. A. Turchi, 'Microeconomic theories of fertility. A critique', *Social Forces*, **54**(1) (1975), pp. 107–125.

[29] L. J. Cho, 'Income and differentials in current fertility', *Demography* **5**(1) (1968); Deborah S. Freedman, 'The relation of economic status to fertility', *The American Economic Review*, **53**(3) (1963), pp. 414–426.

[30] Deborah S. Freedman and A. Thornton, 'Income and fertility. The elusive relationship', *Demography*, **17**(3) (1982), pp. 65–78.

[31] E.g. Eva Bernhardt, 'Fertility and economic status. Some recent findings on differentials in Sweden', *Population Studies*, **26** (1972), pp. 175–184; J. L. Simon, 'The mixed effects of income upon successive births may explain the convergence phenomenon', *Population Studies*, **29**(1) (1975), pp. 109–122; M. Hout, 'The determinants of marital fertility in the United States 1968–1970. Inferences from a dynamic model', *Demography*, **15**(2) (1978), pp. 139–159; Wineberg and McCarthy, *loc. cit.* in fn. 10.

[32] Hout, *loc. cit.* in fn. 31; L. J. Waite and R. M. Stolzenberg, 'Intended childbearing and labor force participation of young women. Insights from non-recursive models', *American Sociological Review*, **41** (1976), pp. 235–251; J. C. Cramer, 'Fertility and female employment. Problems of causal direction', *American Sociological Review*, **45**(2) (1980), pp. 167–190; E. Klijzing, J. Singers, N. Keilman and L. Groot, 'Static versus dynamic analysis of the interaction between female labour force participation and fertility', *European Journal of Population*, **4** (1989), pp. 97–116.

[33] Helen Ware, 'Fertility and work-force participation. The experience of Melbourne wives', *Population Studies*, **30** (1976), pp. 413–422; Elise Jones, 'The impact of women's employment on marital fertility in the U.S. 1970–75', *Population Studies*, **35** (1981), pp. 161–173.

[34] Wright *et al.*, *loc. cit.* in fn. 9; Hoem and Hoem, *loc. cit.* in fn. 12.

Table 6. *Parameter estimates in a logistic regression model with interaction included.*[a] *Norwegian women with a second birth 1969 or 1979*

Woman's education (years)	Woman's labour force participation		
	Not employed	100–999 hours	1000+ hours
Second birth 1969			
7–9	*0	0.02	−0.14
10	−0.19	−0.17	−0.15
11–12	0.14	0.16	0.00
13–14	0.34	0.34	0.08
15+	0.43	0.59	0.27
Second birth 1979			
7–9	*0	−0.04	0.12
10	0.06	0.19	0.08
11–12	0.22	0.11	0.26
13–14	0.55	0.60	0.04
15+	0.53	0.34	0.70

[a] Along with main effects of woman's age and birth interval, education of woman's parents, husband's education and income, age difference between the spouses, couple's religion and place of residence.
* Baseline group.

The fact that women of second parity are a select group may have played a crucial role in shaping the positive relationship between mothers' education and third birth. The proportion of childless women is greater among the more educated classes, and thus highly educated women who are exposed to the risk of a third birth might tend to be selected for holding values that strongly emphasize the pleasures of caring for children. Thus, if the number of highly educated childless women had increased relatively sharply, this might be part of the explanation for the positive gross effect of education on third-birth rates during the 1970s.

However, as we showed in Table 2, the rise in the proportion childless among the highly educated was only slightly larger than in the population as a whole. Moreover, the trend in the parity progression ratios from first to second birth was practically the same in the two populations. An excess decline of about three per cent in the population of second-parity women is not likely to be very important in explaining why third-birth probabilities were reduced from about 55 to 40 per cent in the group with the lowest education, but only from 40 to 35 per cent among the well educated.

REPLICATING PART OF THE ANALYSIS WITH AMERICAN DATA

Relationship between Educational Level and Third-Birth Rates in American Birth Cohorts.

The average number of children for women born between 1940 and 1944 shown in the National Survey of Families and Households was 2.52 for women who had been educated for 12 years, compared with 1.93 among those who had had 15 or more years of schooling. Among those born between 1945 and 1949, the figures are 2.43 and 1.73 respectively. As in Norway, the differences are to a large extent due to a higher proportion of low-parity women among the highly educated. In the two quinquennial cohorts, the proportions of childless or with one child only are 16 per cent and 36 per cent in the two groups.

But there are also substantial differences in third-birth rates by mothers' educational level. The relationship is negative, except for women born between 1930 and 1934, few of whom had been at school for more than 12 years (Table 7). However, the differences between college graduates and women who had only graduated from high school has been reduced, and for those born between 1950 and 1954 the difference between the five-year probabilities is not significant. By the time that these women have finished their childbearing, mothers' education may well have a positive effect both as regards five-year and ten-year probabilities.[35]

Table 7. *Proportion of American women who have had a third child within five or ten years after their second, by educational level and birth cohort (per cent)*

Education (years)	Birth cohort									
	1930–34		1935–39		1940–44		1945–49		1950–54	
		N[a]		N		N		N		N
Within 5 years										
0–11	69.5	52	70.8	47	55.9	50	52.4	39	50.5	42
12	55.6	112	64.3	127	47.9	149	39.0	194	32.8	214
13–15	66.6	32	51.8	54	38.1	66	34.4	82	31.5	127
16–20	70.2	17	46.7	39	38.3	50	35.6	82	31.2	73
Within 10 years										
0–11	86.4		78.4		68.7		64.2		57.9	
12	67.2		71.5		55.4		48.2		40.5	
13–15	72.1		60.6		52.0		46.0		37.7	
16–20	79.9		51.8		43.4		38.7		32.4	

[a] Number of women (unweighted).

In another study based on data from the 1985 Current Population Survey, Wineberg and McCarthy[36] found a negative gross effect of educational level on third-birth rates for mothers born during the 1940s. However, the effect was less pronounced for members of the younger cohorts, who had not yet completed their childbearing. The authors also stated that the net effect (after controlling for age and some other variables) was positive for these younger cohorts.

The Relationship for American Second-Parity Cohorts

Generally, the highest third-birth rates were found among those who had received less than 12 years education, but among women who had a second birth in 1955–59 and 1970–79 fertility appeared to be higher among women with more than 15 years schooling than among those who had only graduated from high school. This is true for five-year and for ten-year intervals (Table 8). A positive effect for women who had been educated between 13 and 15 years is found for five-year probabilities in the cohorts of 1975–79, and for ten-year probabilities in the cohorts of 1955–59 and 1965–74. Just as in Norway, the positive effect of mothers' education appears at about the time when overall third-

[35] This is not necessarily less likely than for women of the same cohort in Norway. The observed negative effect of educational level is more pronounced in the American data, but this may to some extent be explained by earlier censoring (1987–88 compared with 1989 in Norway).

[36] *loc. cit.* in fn. 10.

birth rates were stabilized. When these calculations were repeated with data from the 1982 National Survey of Family Growth, a similar positive effect of mothers' education seems to appear.[37] However, no such effect has been explicitly reported in previous

Table 8. *Proportion of American women who have had a third child within five or ten years after their second, by education and year of second birth (second-parity cohort) (per cent)*

Education (years)	Second-parity cohort									
	1955–59		1960–64		1965–69		1970–74		1975–79	
		N[a]		N		N		N		N
Within 5 years										
0–11	75.6	83	61.9	74	47.5	70	46.3	90	47.9	83
12	57.9	133	58.5	133	45.2	119	30.3	178	34.1	178
13–15	56.8	23	52.1	36	36.0	36	30.0	54	39.7	80
16–20	69.5	27	35.0	27	32.3	34	41.7	55	56.0	52
Within 10 years										
0–11	82.7		74.6		58.4		57.1			
12	67.8		66.3		49.3		40.0			
13–15	75.7		58.9		55.2		52.9			
16–20	79.0		45.8		33.7		48.1			

[a] Number of women (unweighted).

American studies. Rindfuss and Parnell, who studied data from the 1980 Current Population Survey, found no effect of mother's education on third-birth rates among married women in the United States during the 1960s and 1970s. A positive effect on parity progression ratios appeared towards the end of the 1970s, but it has not been reported whether this applied to the transition from the second to the third child in particular.

Multivariate Models

As we stated in a previous section, the regression models were estimated for married American women aged between 20 and 34 at the time when they had their second birth. In this section of the population, the pattern of education-level-specific third-birth probabilities is exactly the same as is shown in Table 8. Because the number of mothers with two children in the American data is relatively small, we focus attention on models in which all five-year second-parity cohorts are included, in spite of the fact that the importance of educational level has changed over these cohorts (Table 9).[38]

Contrary to the results of the Norwegian model, we found that there was a strong negative effect of the mother being in employment during the year following her second birth. But inclusion of this variable does not alter the estimated effect of mothers' education, as employment and mothers' education seem to have been virtually unrelated.[39] The difference between the gross and net effect of mothers' education is, as

[37] L. Bumpass, Personal communication.

[38] In general, the patterns of the interactions between second-parity cohort and one of the other covariates are neither very clear, nor easily interpreted. (Not shown here for reasons of space).

[39] This contradicts previous conclusions about the relationship at the level of first births. Cf. e.g. Mott and Shapiro, *loc. cit.* in fn. 24; S. D. McLaughlin, 'Differential patterns of female labor force participation surrounding first birth', *Journal of Marriage and the Family*, **44** (1982), pp. 407–420, Insignificant effects have also been reported, however, for example W. E. Even, 'Career interruptions following childbirth', *Journal of Labor Economics*, **5**(2) (1989).

Table 9. *Parameter estimates with standard errors in logistic regression models for the probability of having a third child within five years after the second. American women who had a second birth at age 20–34 in 1955–1979 and lived in first marriage at that time and five years afterwards.*

	N	Net[a]	Gross
Second-parity cohort			
1955–59	196	1.01 (0.22)	0.88 (0.20)
1960–64	184	0.56 (0.22)	0.65 (0.20)
*1965–69	155	0	0
1970–74	238	−0.32 (0.22)	−0.33 (0.20)
1975–79	218	0.28 (0.22)	0.11 (0.20)
Woman's age			
20–22 yr	307	0.46 (0.17)	0.53 (0.16)
*23–25 yr	310	0	0
26–28 yr	214	−0.36 (0.18)	−0.32 (0.16)
29–31 yr	121	−1.02 (0.24)	−0.88 (0.22)
32–34 yr	39	−1.06 (0.33)	−1.01 (0.31)
Interval between first and second birth			
0–23 mth	339	0.42 (0.15)	0.67 (0.14)
*24–47 mth	455	0	0
48 + mth	197	−0.51 (0.18)	−0.79 (0.17)
Woman's education			
0–11 yr	155	−0.04 (0.20)	0.03 (0.17)
*12 yr	532	0	0
13–15 yr	160	−0.15 (0.19)	−0.08 (0.17)
16–20 yr	144	0.60 (0.22)	0.34 (0.17)
Woman's labour force participation			
*Not employed	710	0	0
Part-time	100	−0.45 (0.23)	−0.62 (0.21)
Full-time	181	−0.58 (0.18)	−0.68 (0.17)

[a] Place of residence (North East, North Central, South, West) and education of woman's parents are included in the model, but have small effects, and could have been excluded without affecting the other estimates.

* Baseline groups.

expected, due to the age variable. Moreover, just as in the case of the Norwegian data, we found that the relationship between employment and fertility turns out to be relatively invariant with mothers' education.[40]

SUMMARY AND CONCLUSION

By the end of the 1970s the decline in the overall third-birth rate in Norway had stopped and had been succeeded by stabilization, or even a slight increase. At the same time, a positive relationship between mothers' education and the third-birth rate was seen. In the second-parity cohorts, probabilities of a third birth for women with more than 12 years' education, an increasingly large group, were higher than for those who only had had compulsory education, even though the former had begun their childbearing later.

[40] This appears very clearly in a cross-tabulation of education, labour force participation, and fertility for women with a second birth between 1970 and 1979 (not shown).

This is true for both five-year and ten-year probabilities and should not be seen as simply a spacing effect. Moreover, given the large sample, the conclusions are fairly solid.

This positive effect of being a graduate runs counter to the traditional idea of education being a factor which inhibits human reproduction, and the prospective increase in higher education makes it no less important. It is particularly interesting that we have found similar results for the U.S., and that there are also signs of a positive effect of education in Sweden.

The positive effect of education on the probability of ever having a third child is not yet seen very clearly in Norwegian or U.S. birth cohorts. However, if the current trend of third-birth rates were to persist, we would expect a positive effect of mothers' education to become apparent in the third-birth progressions among women born during the 1950s. In Norway, this might more than compensate for the moderately increasing difference in the tendency to remain childless, so that the educational gradient in the average number of children may be reduced.

Unfortunately, we have no clear explanation why the social climate during the 1970s and 1980s favoured high third-birth rates among college-educated women. Neither differential selection, income, nor employment appear to have been responsible for this effect. If more suitable data had been available it might have proved possible to detect some ideational changes in a pro-natalist direction among the more highly educated sections of the population, or perhaps a greater degree of scepticism to some of the modern methods of birth control that have been introduced during the last 20 years or so. It is also possible that a data set with more adequate employment variables could have led to a different conclusion about educational differentials in the relationship between employment and fertility. Finally, one may speculate whether a higher level of participation in child care and domestic duties on the part of well-educated fathers, which has been found in some countries,[41] may have promoted a positive effect of education. These issues must be left to future research, and it would probably also prove useful to distinguish not only the level of education, but also the subjects in which women were educated.

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[41] For Norway, see Susan Lingsom and Anne Lise Ellingsaeter, *Arbeid, fritid og samvaer*, SA49 (Central Bureau of Statistics, Oslo, 1983).

Paper IV

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The weak impact of female labour force participation on Norwegian third-birth rates

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Abstract. Individual-level retrospective data from the Family and Occupation Survey of 1988 are used to estimate the effects of various employment variables on the third-birth rates among post-war Norwegian birth cohorts. Women who appear to have a strong work orientation, and may face relatively high opportunity costs of childbearing, do not have particularly low probability of advancing to parity three. This is consistent with previous Swedish and British studies, and lends some support to the view that other factors than stronger employment preferences and increased job opportunities have been largely responsible for the "second demographic transition" in Europe.

Kravdal, Ø, 1992. Le faible impact de la participation féminine au marché du travail sur les troisièmes naissances en Norvège. European Journal of Population / Revue Européenne de Démographie, 8: 247–263.

Résumé. On utilise ici des données rétrospectives individuelles, issues de l'enquête sur la Famille et la Profession de 1988, pour estimer les effets de diverses variables concernant l'emploi sur les taux de fécondité de rang trois de cohortes norvégiennes nées après la guerre. Les femmes qui semblent avoir une forte orientation vers la vie active, et qui peuvent faire face à des coûts relativement élevés pour leurs enfants, n'ont pas une probabilité particulièrement basse d'avoir un troisième enfant. Ce

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résultat est en accord avec des études suédoises et anglaises antérieures, et donne quelque appui à la thèse selon laquelle d'autres facteurs qu'un attrait plus fort vers la vie active et des offres d'emploi croissantes, ont été la cause principale de la "seconde transition démographique" en Europe.

1. Introduction

Understanding the interplay between reproductive behaviour and employment has been one of the major challenges of demographic research. [1]* Whereas small children usually inhibit their mother's work activity, and the long-term effect of family size on the participation rates is also largely found to be negative, [2] a much more blurred picture has emerged from studies where fertility is the dependent variable (see e.g., review by Bernhardt, 1989).

We believe that the most fruitful theoretical approach is to focus on a couple's expected costs of childbearing, in terms of foregone income on the part of the mother and some losses of work-related non-economic satisfaction. A woman who knows that she has to depart from work for some time if she has another child, but who would otherwise have remained in the labour force, suffers certain losses compared to a woman who is a homemaker and intends to remain so regardless of her future reproductive career. [3] The size of these losses, given the length of the spell of non-employment, depends on her wages and her non-economic rewards from work. A woman who resumes employment more quickly after delivery foregoes less income, but has higher child care costs. [4]

In light of this, increased job opportunities for women, higher female wages and, possibly, a changing role orientation with more emphasis on the pleasures derived from employment, may have been important driving-forces behind the reduction to below-replacement level in the contemporary industrialized world. [5] Future trends in a similar direction may be incentives towards further limitations of the family size. Such views are, for instance, referred to by Ryder (1979), who wrote in a review article over ten years ago that "as women gain access to the full range of educational and professional opportunities —and they still have far to go—the alternative opportunity cost of reproduction will rise, and press fertility further down".

* *Superscript numbers refer to notes in the Notes* section before the *References*.

These ideas are not adequately substantiated empirically, however. Several studies point to a negative effect of (previous) labour force experience or employment expectations on fertility desires, for instance among Australian and American two-child mothers (Ware, 1976; Jones, 1981). On the other hand, more recent European investigations suggest that a strong work attachment has no subduing effect on fertility. Hoem and Hoem (1989) and B. Hoem (1990) claim that Swedish women who have been employed during most of the time after first birth have just as high third-birth intensities as women who have been primarily homemakers. [6] This cannot be discarded simply as a peculiarity due to a relatively generous welfare system, which, for instance, provides a fairly long paid maternity (parental) leave (Bernhardt, 1991), since results from a British study carried out along the same lines support the Swedish findings (Wright et al., 1988). Previous Norwegian studies, which have been based on cross-sectional employment data, are consistent with the notion that there is no significant effect of work commitment on the third-birth rates (Brunborg, 1984; Kravdal, 1992).

The objective of the present analysis is to utilize a very rich survey data set, with complete maternity and employment histories collected retrospectively, to find out whether women who appear to be firmly attached to the labour market, and may face the highest costs of childbearing, also display the lowest fertility rates. We focus on the transition from parity two to three, since its diminishing intensity is the key component behind the "second demographic transition" in Norway, [7] and since—at this stage of their life course—observed previous behaviour should be able to provide us with some indications of the women's work commitment.

This investigation resembles closely the studies undertaken in Sweden and Great Britain, but we devote more attention to the *changes* in work activity around the second birth—believing that this will facilitate the distinction between general long-term employment preferences and the immediate responses to childbearing. We also include a control for husband's income, which could not be done in the two other countries.

In order to draw some comparisons between effects of largely economic factors and those that more strongly reflect differentials in an ideational dimension, we have included a measure of religiosity and a regional variable in our models.

2. Data and methods

2.1. Data and methodological framework

In the 1988 Family and Occupation Survey biographies on pregnancies, cohabitation and marriage, educational activity and employment were collected for 4,019 Norwegian women born in 1945, 1950, 1955, 1960, 1965 and 1968 (Central Bureau of Statistics, 1991). Registered annual income and taxes during 1967–1988 for the respondents and their husbands (if they were married at the end of 1987) were obtained from the Directorate for Taxation and linked to the survey data.

We have estimated logistic regression models for the probability of having a third birth within five years after the second for 1,121 women who had their second child prior to 1983. [8] About 75% of all third births occur within a five-year interval (Kravdal, 1991a). [9]

The models including husband's income are only estimated for the 860 women who lived in a first, never-broken, marriage at second birth and at interview, and who had their second birth in 1967 or later. Third-birth rates among women in stable unions are generally higher than among other women, but, fortunately, it seems that the effects of the various sociodemographic characteristics that we estimate in stable unions are closely similar to those in the entire female sample (see Section 3.1).

2.2. Regressors included in the models

Since period effects so clearly show up in the third-birth rates (Kravdal, 1991a, b), time at second birth is included, rather than the woman's birth cohort. Besides, it is important to control for age and interbirth interval, which are recognized to be strong determinants of subsequent fertility, and which also are correlated with the economic variables. [10] We have also included the educational level, which affects the third-birth rates (Kravdal, 1992) as well as the employment behaviour.

Our employment variables refer to the activity during one or more of the following stages: (1) 5–12 months after second birth, (2) 5–12 months after first birth, (3) the interbirth interval (except the first four months), and (4) before first birth. Similar estimates for the employ-

Table 1
Estimates (and standard errors) in logistic regression models for the probability of having a third child within five years after the second

	All women			Continuously married women		
	N	est	(std)	*N*	est	(std)
Year at second birth						
1967–1969 [a]	134	0.65 *	(0.24)	72	0.53	(0.31)
1970–1974 (*B*)	323	0		247	0	
1975–1979	402	0.13	(0.19)	325	0.02	(0.23)
1980–1982	262	0.34	(0.20)	216	0.28	(0.23)
Age at second birth						
–22	245	0.27	(0.20)	141	0.46	(0.24)
23–25 (*B*)	337	0		273	0	
26–28	311	−0.03	(0.20)	251	0.02	(0.23)
29–	228	−0.33	(0.24)	195	−0.32	(0.27)
Interbirth interval						
–24 months	282	0.44 *	(0.19)	211	0.44 *	(0.21)
25–35 months (*B*)	274	0		214	0	
36–48 months	277	−0.23	(0.20)	222	−0.26	(0.23)
49– months	288	−0.68 *	(0.23)	213	−0.78 *	(0.27)
Educational level at second birth						
7–9 years (*B*)	287	0		202	0	
10–12 years	659	−0.28	(0.17)	505	−0.35	(0.21)
13– years	175	0.04	(0.26)	153	0.02	(0.30)
Place of residence at interview						
Eastern Norway (*B*)	545	0		405	0	
Southern & Western Norway	360	0.53 *	(0.16)	297	0.67 *	(0.18)
Middle & Northern Norway	216	0.10	(0.19)	158	0.13	(0.16)
Religiosity (church attendance during year before interview)						
0–2 (*B*)	802	0		584	0	
3–	391	0.86 *	(0.15)	276	0.90 *	(0.18)
Employment 5–12 months after second birth						
No (*B*)	757	0		570	0	
Some	364	0.04	(0.16)	290	0.13	(0.19)
Average income for the husband during the 5 years before second birth						
Low				294	0.61 *	(0.20)
Medium (*B*)				291	0	
High				275	0.32	(0.22)

N Number of women.
B Arbitrarily chosen baseline group.
[a] 36 women with second birth 1963–1966 included when the model is estimated for all women regardless of marital status.
* Significant at 0.05 level.

ment effects appear if we condition on the labour market behaviour during 5–18 months, when more women have resumed employment. The four months immediately after delivery are excluded because most women stay at home during that period, and a large proportion of them have a maternity leave with full wage compensation. [11] Reported unpaid maternity leave after the first four months is not reckoned as employment in our analysis.

We have chosen husband's average income during the five years preceding second birth as an indicator of his earning capacity and the economic well-being of the family, but very similar parameter estimates for the income effects, as well as for all other effects, are obtained with "income the year of second birth" and "income during the five years before and after second birth". [12] The attention is centered on the income component on which pension contributions are based, converted to 1990 prices by using the consumer price index. Income after taxation gives exactly the same results. We have chosen to divide into three income categories, each comprising roughly one-third of the sample.

The woman's own income is not included in the models, since we have only had access to registered annual earnings, along with relatively broad categories of working hours. [13]

Unfortunately, both religiosity and place of residence refer to the time at interview, but religious attitudes are probably fairly stable, and —even though family size plays a role in migration decisions—our estimates of the regional effect certainly provide some interpretable information.

3. Results

3.1. A brief inspection of the determinants of third births

Model estimates for all two-child women and for those who were living in first, never-broken marriage at second birth and at interview are displayed in Table 1. Our focus is on the latter group, and it is reassuring that the estimates are so closely similar.

As expected from previous studies (Kravdal, 1992), there is a decline and upturn in the third-birth probabilities, and a pronounced negative effect of age and interbirth interval. Presumably, these fac-

tors signal such as fecundity and contraceptive use, and, above all, the childbearing intentions (see e.g., B. Hoem, 1990).

There appears to be a U-shaped relation between education and third-birth rates, but none of the differences between the three educational groups are significant at a 0.05 level. This result runs counter to previous investigations based on a large data set derived from the Population Censuses and the Central Population Register, which clearly point to the existence of a positive effect of education (Kravdal, 1992). We see no reasonable explanation of this discrepancy.

Husband's income is inversely related to the third-birth rates. A positive effect of being married to men with low earnings, albeit much weaker, was also found in the register- and census-based studies. [14] In the survey data we have estimated a positive parameter also for high income, but it is not significant at a 0.05 level. [15] As judged by the period-income interaction (not shown), the relation between income and fertility appears to have remained constant during the two decades our study covers.

A strong effect of religiosity is seen in these data. Women who have been to church or attended religious meetings at least three [16] times during the year preceding the interview (excluding christening ceremonies, weddings and funerals), display much higher third-birth rates than do their less religious counterparts. [17]

Finally, our models confirm that it is more common to progress to parity three in Southern and Western Norway than in other parts of the country. [18]

3.2. The employment-fertility relation

In our exploration into the fertility–employment relation we first turn our attention to employment variables that refer to only one stage of the life course. As may be seen from Table 2, none of these variables, which are closely linked to each other, [19] have a strong bearing on the third-birth probabilities. None of the parameter estimates are significantly different from 0.

A special comment is in order with respect to the work experience prior to entry into motherhood. On average, the women in our sample have worked 4.0 years when they deliver their first child, but there is a large variation in the pre-birth work activity, depending on educational level, time spent in school, and age. With age and educational

Table 2
Effect of various labour force variables on the third-birth probabilities, when year at second birth, age at second birth, interbirth interval, education, place of residence and income of husband are controlled

	N	est	(std)
Model 1			
Employment 5–12 months after second birth			
No (*B*)	570	0	
Some	290	0.13	(0.19)
Model 2			
Employment 5–12 months after first birth			
No (*B*)	523	0	
Some	337	−0.01	(0.18)
Model 3			
Employment between first and second birth [a]			
−0.25 (*B*)	467	0	
0.25–0.75	248	−0.10	(0.20)
0.75–	145	0.03	(0.25)
Model 4			
Employment before first birth			
0	49	0.16	(0.37)
−2.5 years (*B*)	243	0	
2.5–5.0 years	310	0.02	(0.21)
5.0– years	258	−0.10	(0.28)
Model 5			
Employment before first birth, relative to that expected from age and education [b]			
-0.90	276	0.20	(0.21)
0.90–1.10 (*B*)	284	0	
1.10–	295	0.19	(0.20)

N Number of women.
B Arbitrarily chosen baseline group.
[a] Woman-years employed from 4 months after first birth to second birth, divided by length of the interbirth interval (in years) minus 4 months.
[b] Prediction based on parameters obtained from a regression of pre-birth work experience, with age and education as regressors.

level controlled, a long work experience before first birth may imply that part of the education is taken after first birth, or that the woman has worked while attending school. It may also signal that she has taken her degree fairly quickly, with no sidesteps in the educational system or failed exams.

Without plunging into further discussions of the complex causal relations between education, employment and reproductive behaviour,

we merely point out that both the actual pre-birth employment and the pre-birth employment relative to that expected from age and education [20] may be relevant indicators of the general work commitment. With the former variable, we obtain a negative trend (Model 4), but no significant parameters. With the latter, a U-shaped non-significant relation appears (Model 5).

We believe that a labour force variable spanning a longer part of the life course, and which captures changes in the employment around the time of delivery, may improve our insight into the employment-fertility relation. It has been pointed out by Ní Bhrolcháin (1986) and Mott and Shapiro (1983) that employment shortly after birth is a good indicator of future work activity. It is likely, however, that women who are homemakers the year after second birth are a mixed group with widely different long-term preferences and opportunity costs of childbearing, and that a pooling of these subgroups may dilute a possibly true negative effect of labour force commitment.

Some of these women who are non-employed shortly after second birth, remain homemakers regardless of their fertility, and having an additional child does therefore *not* entail an income loss. If this advantage is not entirely offset by a lower family income (with husband's income controlled), a fairly high fertility might be expected. However, the majority are likely to enter (or re-enter) the labour market at some time in the future. [21] The highest opportunity costs are suffered by those who have accumulated considerable human capital through previous work experience, and who have a very strong need or desire to continue working, but who have had inadequate access to jobs or acceptable child care. If these problems are likely to show up also after the arrival of the next child, they face large costs of childbearing, which is likely to reduce their probability of advancing to a higher parity. A third sub-group, which might be expected to display a fertility intermediate to the two sub-groups mentioned above, are the women who have no or very little previous work experience, but who plan to work when the children have reached a much higher age. Another child will contribute to postpone their entry into paid work. However, the corresponding loss of income may be relatively small due to the lower human capital these women have accumulated compared to those with more labour market experience. Besides, the loss will be suffered in a more distant future, and, therefore, presumably be less important in the decision-making.

The data do not allow us to distinguish properly between these groups. Indeed, it would be exceedingly difficult with any data source, since it requires a knowledge about previous occupational goals. We nevertheless believe that our compound employment variables provide some new insight, and it is interesting to note that *all* parameters shown in Table 3 are very small. As judged by the interaction between the employment variables and the year at second birth, there is no temporal change in the employment effect (not shown). A fairly large positive parameter associated with a strong home-attachment was estimated for women with a second birth during 1967–1969, but it was not significant. We also mention that there are neither educational nor income differentials in the relation between employment and third-birth rates (interactions not shown). [22]

As expected, a negative parameter shows up in Models 6 and 7 (Table 3) for homemakers whose previous behaviour signals a relatively strong work commitment. However, their third-birth rates are not significantly lower than for the other groups. Moreover, the table reveals that the less employment-devoted homemakers have no higher fertility than the women who have resumed their gainful activity already during the first year after they have had their second child.

An even more "extreme" group of home-attached women is constructed in Model 8. These women have had a low employment profile both before first birth and during the interbirth interval. However, their third-birth rate does not exceed that of the mothers who were employed shortly after second birth.

One interpretation might be that their advantage of having low costs of childbearing is offset by their lower family income compared to the dual-earner couples. It seems, however, that family income—or at least the component stemming from the husband—is not positively related to fertility. In fact, husband's income was very weakly related to fertility according to previous Norwegian studies, which have more credibility because of the large sample size. A more appealing explanation might therefore be that neither income nor cost considerations play a crucial role when deciding whether to proceed to parity three in Norway.

Moreover, we repeat that even this fairly small group of apparently devoted homemakers may be somewhat mixed, with a considerable proportion having occupational goals to be pursued at a later stage. If

Table 3
Effect of changes in labour force participation on the third-birth probabilities, when year at second birth, age at second birth, interbirth interval, education, place of residence and income of husband are controlled.

	N	est	(std)
Model 6			
Employment before first birth and after second			
Homemaker after 2. birth			
Rel. emp. before 1. birth [a]:			
< 1 (*B*)	277	0	
> 1	293	−0.11	(0.20)
Some emp. after 2. birth			
Rel. emp. before 1. birth:			
< 1	126	0.13	(0.27)
> 1	164	0.03	(0.24)
Model 7			
Employment between first and second birth and after the second			
Homemaker after 2. birth			
Interbirth employment [b]:			
< 0.25 (*B*)	420	0	
> 0.25	150	−0.15	(0.24)
Some emp. after 2. birth			
Interbirth employment:			
< 0.25	47	0.18	(0.35)
> 0.25	243	0.06	(0.21)
Model 8			
Employment before first birth, between first and second, and after second			
Homemaker after 2. birth			
Pre- and interbirth emp. [c]			
< 0.90 and < 0.25 (*B*)	156	0	
medium employment	300	−0.24	(0.23)
> 0.90 and > 0.25	114	−0.13	(0.31)
Some emp. after 2. birth	290	−0.02	(0.24)

N Number of women.
B Arbitrarily chosen baseline group.
[a] Defined as in Model 5, Table 2.
[b] Defined as in Model 3, Table 2.
[c] Prebirth employment defined as in Model 6, interbirth employment as in Model 7.
* Significant at 0.05 level.

these women could, somehow, be excluded, a high fertility might have shown up for the remaining group.

The highest probabilities of having a third child, albeit not significantly higher than for other groups, are found for women who are

employed shortly after second birth, but have relatively little work experience before that (the third group in Model 6 and 7). Similar results were found in Sweden (Hoem and Hoem, 1989). [23] An interpretation may be that the initiative to enter the work force at this stage of their life, with little previous experience, may have been preceded by a decision to terminate their childbearing.

4. Summary and conclusion

In this analysis we have piled up further evidence for a weak impact of labour force participation among two-child mothers on their subsequent fertility. Women with little work experience before second birth do not have significantly higher third-birth rates than women who have previously been more strongly committed to occupational tasks. This holds whether the more employment-prone drop out of the labour market for some time after second birth, and thus suffer a loss of income and non-economic rewards from work, or whether they somehow manage to remain gainfully employed. We note, however, that a negative parameter is estimated for the former group, which confirms our theoretical expectations.

All in all, the costs of childbearing incurred by the employment-prone women appear to be of little importance in their reproductive decision-making, or it may be that these disadvantages are outweighed by the higher total income among the dual-earner families. However, the latter does not seem very likely, since the present study as well as previous register- and census-based examinations suggest that there is a non-positive, presumably small, effect of husband's income.

Our results do not fit with the notion that increased employment opportunities and a generally stronger preference for work activity are crucial determinants of fertility. Given also the large effects of religious activity and place of residence, our analysis lends some support to the idea that one should assign a more central role to ideational forces, [24] primarily the dimensions not involving employment attitudes (see e.g. Lesthaeghe and Meekers, 1986).

We hesitate, however, to draw very firm conclusions. One reason is that our concern has been *third* births, with controls for age, and that only *post-war* cohorts were included in the data. It way well be that an increased need for or desire for a foothold in the labour market in the

early adulthood may have contributed to the postponement of first birth, which is a major component of the declining period fertility rates. Neither do we rule out the possibility that the lower third-birth rates in the 1945 than in the 1935 cohort may be explained partly by the less pronounced work orientation among the latter.

Moreover, it is possible that the continuously home-attached woman, who never returns to work after entry into motherhood, hardly exists in our data. Even a large proportion of the women who have little work experience prior to second birth and no entry into the labour force during the first year afterwards, may intend to take up gainful employment at a later stage. Another child would contribute to postpone this, and if such long-term costs are taken into consideration, it might explain that their fertility deviates little from the average.

The results from Sweden, Great Britain and Norway are strikingly similar. With due respect to the limitations these studies share when it comes to inferring the respondents' employment plans, they all point to a modest impact on fertility of a strong work attachment or high opportunity costs of childbearing. This may have some implications for economic-demographic theory and for our general insight into past and future reproductive behaviour. It might, therefore, be worthwhile to estimate such models also for other countries—preferably with data that bring us closer to an understanding of the woman's long- and short-term occupational goals, her child care costs, and other employment-induced burdens of childbearing. Such comparative analysis may arise from the wave of fertility surveys now being planned in Europe and, possibly, some register-based follow-ups.

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Notes

[1] Probably, there is a very complex causal structure, where these two spheres of life affect each other mutually, and also may be regarded as jointly determined by a number of structural factors

and individual characteristics. Some attempts are made to model simultaneously the effect of labour force participation on fertility and the opposite effect (see e.g., Cramer, 1980; Klijzing et al., 1988), and complex models that handle the employment-fertility relation in a joint-decision framework are also developed (see e.g., Willis, 1973). However, most of the scholarly attention has been devoted to models with a uni-directional causality.

[2] For an exception, see e.g. Jones (1981).

[3] This higher price of childbearing among the employment-prone would be set off against a higher total family income over the life course (with husband's income fixed). A higher income is often thought to promote fertility (e.g. Becker, 1960), at least with a given level of child "quality" requirements, but this has failed to materialize very clearly empirically (e.g., Freedman and Thornton, 1982).

[4] She may also be burdened with a more heavy double work-load. In a dual-earner family the household work has to be done after regular working hours, whereas the homemakers would often be able to carry out part of these duties while supervising the children—even though child care is often an extremely exhaustive task which precludes any other activity.

[5] For instance, the costs associated with a third child are higher when employment is a alternative to homemaking for mothers with children who have passed the pre-school age, than in a phase of development where it is usual to drop out of the labour force permanently at marriage or first birth. When it becomes progressively more common to work when the children are small, childbearing will become less expensive in terms of lost employment ("time costs"), but a given length of non-employment may be regarded as more and more discomforting, if this development is accompanied by changes in perceived utility from work activities.

[6] Other variables that are likely to capture the general labour force attachment, for instance the extent of gainful employment between first and second birth, lead to similar conclusions.

[7] The third-birth rates fell sharply from the mid-1960s to the mid-1970s, and afterwards there has been an upsurge (Kravdal, 1991a, b). In a cohort perspective, this has materialized as a progressively lower proportion who proceed to parity three across the cohorts 1935–1950.

[8] We have excluded the few women who had their second child within 12 months after the first birth, and those who had their third child within 12 months after the second. This was done in order to ensure that a quick parity progression did not inhibit employment during the 5–12 months after delivery, which is the interval much of our attention is focused on.

[9] This analytical framework does not allow us to assess the impact of factors that change their value during the time the woman is exposed to the risk of having a third child. However, we believe that the information on current employment or current cumulated employment, which could have been included in a hazard regression model, would not add much to our knowledge. We have therefore preferred a model that is technically easier to estimate.

[10] Preliminary test runs have revealed that we control sufficiently well for these purely demographic factors by grouping into four categories.

[11] Norwegian women who have had gainful employment during a certain number of months prior to childbirth, are entitled to a maternity leave with full wage compensation for some months. During the period covered by our investigation, this maternity leave interval has been 12–18 weeks. It is currently 32 weeks.

[12] According to economic-demographic theory, income is likely to affect the demand for child "quality" and "quantity", and may be related to contraceptive use as well (see e.g., Becker, 1960). There seems to be no general agreement as to which income concept should be preferred. Obviously, the potential income during the time when a third child places the most heavy demands on the family economy is a relevant income variable. However, the economic strength of the family during that period is determined also by loans and savings, which, in turn, are influenced by previous consumption and earnings. Morover, both the "quality" requirements and the ideas about desired child "quantity", along with the general materialistic aspirations of

the family, may have developed gradually, and, thus, reflect the economic status in earlier stages.

[13] Some preliminary models were estimated for a sub-sample of women who had reported full-time employment during one of the calendar years prior to second birth. The wages at that time, corrected for number of years before second birth, had no effect (net of age, period, and education) on the third-birth rates.

[14] The inverse relation found in Norway may suggest that the theoretically expected positive effect of income on the demand for "child quantity" is swamped by differential "quality requirements" or other confounding factors not adequately controled in our models. Socio-economic differentials in contraceptive use, net of educational level, are not likely to be very large, but it may well be that certain life values tend to be associated with both a strong orientation towards income-generating activities and a low preference for childbearing. Also results from other countries demonstrate that negative income effects may appear—in particular for transitions beyond parity two (e.g. Simon, 1975; Bernhardt, 1972; Wineberg and McCarthy, 1989). Heckman and Walker (1990) claim, however, that male earnings have a positive impact on all parity progression rates in Sweden.

[15] Similar results were obtained also with respect to the income during the five years before and after second birth (the effects are 0.53, 0, 0.10 for three equally large groups with low, medium and high income). Note that the positive parameter associated with high income may partly reflect the suggested response to childbearing in the direction of more over-time working for the fathers (Ellingsæter, 1991). As regards the income during the year at second birth, the relation is U-shaped (the effects are 0.52, 0, 0.42, with the latter barely significant at a 0.05 level). All in all, there are indications of a positive effect of high earnings, compared to a medium level. It seems that this only holds for women married to men who had low earnings more than five years before second birth. Controls for age and education of the husband, and more detailed controls for time at second birth, did not change these results, but since we only had access to a fairly crude education variable, it may well be that this positive effect of a rising male income works through a higher male education, which in other studies is found to exert a positive effect on the third-birth rates (Kravdal, 1992).

[16] This limit is rather arbitrarily chosen. Our intention was to identify a fairly large group with a relatively strong commitment to the Christian ideas. We might have included also those who attended church once or twice (e.g. those who go to church on Christmas Eve only). That would have given a smaller parameter estimate.

[17] This effect may be due to a negative attitude among the Christians towards induced abortions, less egalitarian sex roles, and more scepticism towards consumerism and individualism.

[18] Previous studies have shown that this regional pattern also holds when we control for fertility differentials between urban and rural communities. The traditionally higher fertility in the South and West compared to the East—along with the lower prevalence of divorce and consensual unions—is usually thought to reflect, above all, a regional heterogeneity in the ideational climate. In the South and West Christian beliefs and attitudes probably have a much stronger hold of the population.

[19] For instance, 77% of the women who had no employment during 5–12 months after second birth, also had no employment during 5–12 months after first birth, and 76% had worked less than 25% of the interbirth interval. On the other hand, 70% of those who had some employment during 5–12 months after second birth, were also employed during 5–12 months after first birth. Moreover, according to a multivariate logistic regression model the pre-birth labour market experience has a considerable net impact on the work activity after first and second birth.

[20] We have estimated a linear regression model for pre-birth employment, with age at first birth, number of years in education before first birth, and the educational level at second birth as regressors. These estimates are used to predict the expected work experience.

[21] For instance, only 27% of the women who were born in 1945 and who neither worked during the year after second birth nor between first and second birth, were coded as non-employed at interview (31% among those who had had a third child). Of course, a large fraction of these women, who may have fairly young children at interview, are likely to enter the labour market at a later stage.

[22] It also seems that the employment effect is invariant with the interbirth interval.

[23] They used a time-varying employment variable and compared current employment status with an average since first birth.

[24] We recognize, of course, that the various fertility determinants are not easily classified as economic or non-economic, and that socio-economic factors not captured by our model may have contributed to the regional fertility differentials.

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Paper V

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Forgone Labor Participation and Earning Due to Childbearing Among Norwegian Women*

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Individual-level retrospective data from the Family and Occupation Survey of 1988 are used to assess the time diverted from gainful employment because of the presence of children in two Norwegian birth cohorts. We find that a two-child mother born in 1950, whose births occurred in her early twenties, lost 6.6 woman-years up to age 37, compared to a childless woman. By matching information on registered income with the survey data, we estimate that her lost income amounts to $151,000 at 1990 prices. After taxation the loss is $98,000. Women with fewer than 12 years of schooling seem to forgo more labor market activity by reason of childbearing than do their better-educated counterparts. The pattern is less clear with respect to the loss of income.

The birth of a child usually leads to less labor market activity for the mother than she would have had otherwise. This frequently is referred to as the *time cost* of childbearing. In contrast, the cash *opportunity cost* is the income forgone during a withdrawal from the labor force or during a period with reduced working hours, along with some long-term negative effects on the wage rate and the pension rights. Because of the social and emotional rewards derived from work, noneconomic losses also are associated with a withdrawal from the labor force. These may be included in the opportunity cost. In addition, parenthood entails so-called direct expenditures for clothes, food and other items.

One of the cornerstones of economic-demographic theory is that a rational couple would take into account their expected direct and opportunity costs of childbearing, along with a broad array of various noneconomic sacrifices, when deciding whether to proceed to a higher parity level. Accordingly, political authorities in some countries consider a reduction of the costs a crucial element of a policy intended to promote fertility (e.g., Klinger 1987). It is also a widely accepted notion that the increase in the expenses of childbearing following in the wake of improved job opportunities for women may have played an important role in reducing fertility to below-replacement level in the contemporary industrialized world (see, for example, the review by Ryder 1979).[1]

Opportunity expenditures recently have been estimated for the United States in a

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life-table approach with data from National Longitudinal Surveys covering the late 1960s, the 1970s, and the early 1980s (Calhoun and Espenshade 1988). It was predicted that a two-child mother forgoes only about two years of labor market activity. Earlier American studies indicate a higher time cost of childbearing. For instance, Reed and McIntosh have argued, on the basis of employment data from the 1960 census, that a first child leads to a four-year employment loss (quoted in Espenshade 1977). A recent British analysis, in which employment profiles were simulated on the basis of participation rates from 1980, concluded that the time diverted from market work by a two-child mother was more than six years (Joshi 1990).

It should be of general interest to carry out similar studies for other countries, not least because of the wide differences between the estimates from the United States and Britain. This article reports an attempt to estimate forgone woman-years and earnings in Norway, where the overall participation rates for women are not much higher than those in the United States and Britain. We make use of a very rich data set that includes complete maternity and employment histories collected retrospectively in a recent survey. This approach permits us to model cumulated labor force experience for real birth cohorts, and thus to obtain an estimate of the time expenditures of childbearing. To our knowledge, previous explorations into this subject have been based largely on synthetic cohorts. Similar models for female earnings before and after taxation (denoted here as gross and net income) are estimated by linking the survey data with individual income and tax histories. The close correspondence between our income and employment figures, and between the employment figures in this survey and those from previous cross-sectional surveys, show that the data source is well suited for our purpose.

The social differences in labor market behavior after childbirth have attracted considerable scholarly interest, not least because of the implications for welfare distribution and for our understanding of the apparently universal inverse relationship between education and lifetime fertility (e.g., Kasarda, Billy, and West 1986). The bulk of the empirical evidence suggests that well-educated women return relatively quickly to work after birth (e.g., Bernhardt 1986; Desai and Waite 1991). In accordance with this pattern, Calhoun and Espenshade (1988) found a lower time cost of childbearing in this group. Other studies, however, show that education exerts a nonpositive effect on employment during the first years after delivery (e.g., Cramer 1979). One of the objectives of this Norwegian analysis is to estimate forgone employment and income for various educational groups, and to discuss briefly the similarities between these differentials and those which are reported with respect to reproductive behavior.

Our attention is focused on women born in 1945 and 1950, which are the two oldest cohorts in the available data set. One out of four of these women has completed some postsecondary education, and they entered adulthood during a period with escalating female employment rates and rapidly changing sex role attitudes. We do not estimate the temporal trends in the employment and income losses due to childbearing, because the remaining cohorts in our data set were younger than age 33 at interview. There appear to be only minor changes between the 1945 and the 1950 cohorts. Nor do we address the issue of husbands' possible compensation for wives' forgone earnings, through working longer hours when the children are small (see, for example, Ellingsæter 1991) and through the tax benefits a husband enjoys if he is the sole breadwinner in the family.

A BRIEF COMPARATIVE DESCRIPTION OF THE NORWEGIAN SETTING

Female participation rates in Norway have increased sharply during the last few decades, particularly among women with preschool children. In 1989, 79% of all

Norwegian women aged 25–54 were employed (when employment is defined as at least one hour of gainful work during a one-week reference period, as seeking work, or as temporarily absent from work, including maternity leave). Among married women with a youngest child aged 0–2, the employment rate was 68%, whereas 75% of those with a child aged 3–6 and 83% of those with a child aged 7-15 were employed (Central Bureau of Statistics 1990). The corresponding figures for 1975, when the two cohorts in our study were in their prime childbearing years, were 35%, 46% and 59% respectively. A considerable market for part-time jobs exists in Norway, and in many sectors parents with responsibility for small children have been allowed to reduce their working hours. In fact, this reduction even has become a statutory right, albeit with substantial limitations. During the last two decades, more than half of the employed married women with children have worked part-time (Ellingsaeter 1989).

In female work activity, Norway has lagged behind the other Nordic countries (OECD 1988). In Sweden, for instance, the participation rate among women aged 25–54 is currently more than 90%; even in the early 1970s it was almost 70%. About 90% of Swedish women with preschool children are employed, a large proportion part-time (Statistics Sweden 1992).

On the other hand, the female participation rate in Norway in 1989 was slightly higher than that in the United States (74%) and in Britain (73%), and far surpassed that in some of the Central European countries (e.g., The Federal Republic of Germany, where the figure was 60%) (OECD 1991). The levels in Norway, Britain, and the United States also were fairly close to one another in the early 1970s. Part-time employment has been less common in the United States than in Norway (OECD 1988), so the total number of hours worked by women in the two countries differs less than do the employment rates. Britain also contains a relatively large fraction who have worked part-time. According to the employment rates published in the official labor market statistics, work activity after childbirth has been no higher in the United States than in Norway. In 1989, 55% of married American white women with a child aged 0–2 were employed, and 64% and 74% respectively among those with a child aged 3–5 and 6–17. The corresponding proportions in 1975 were 33%, 42% and 53% respectively (U.S. Bureau of the Census 1991). British women with preschool children display somewhat lower participation rates than their American or Norwegian counterparts (Ermisch 1991).

Work activity among mothers is determined by a variety of factors, such as the labor demand in the various sectors, the human capital of women relative to men, gender pay differentials, the taxation system, the families' economic needs, sex role attitudes, and the provision of child care. Without trying naively to attribute the cross-national employment differentials to one specific factor, we point out that there is a substantial variation in child care and public policies aimed at facilitating the combination of gainful work with family obligations. Equal opportunity and gender equality ideologies seem to be rooted deeply in the Norwegian people; through a number of laws and agreements, efforts are made to recruite women into male-dominated sectors, to prevent unequal pay between men and women, and to support female employment in general (OECD 1988). Nevertheless, the provision of public child care, or private child care with public subsidies, is very limited compared to that in Sweden (Nordic Statistical Secretariat 1991).[2] This situation probably contributes to the lower participation rates in Norway. In the United States and Britain day care institutions seem to be even more scarce (OECD 1990), but, as in Norway, a variety of private, largely home-based arrangements have been set up to meet the needs of working parents.[3] Part of the expenses associated with the various private child care alternatives are deductible for American taxpayers.

Nordic women also benefit from a relatively generous maternity leave program, but it is not altogether evident how this program affects employment among mothers with small

children. In Norway, those who have been gainfully employed during a certain number of months before childbirth are entitled to a maternity leave with full wage compensation for some weeks. During the period covered by our investigation, the leave was as short as 12–18 weeks; currently it is 32 weeks. After this period, however, women may have an unpaid maternity leave up to a total of 12 months, and even more in the public sector (Hansen 1991). This has been a statutory right since the mid-1970s. In Sweden, the paid maternity leave is much longer (Sundström and Stafford 1991), and the parents may even extend their income compensation beyond the next birth if the birth interval is short enough (Hoem 1990). By contrast, there is no provision for maternity leave at a national level in the United States, and in Britain there is only a relatively short leave with 90% wage compensation (OECD 1990). Thus an American mother who decides to stay at home during the first year after birth generally would not be counted as employed in the labor statistics, as she would be (at least according to instructions) in Norway and Sweden. Moreover, she would not have the same right to return to her job. Recognition of this fact might induce American women to tolerate a higher cost or greater inconvenience of child care in order to resume gainful employment very quickly after delivery. On the other hand, those who remain homemakers for a considerable number of months after birth may tend more strongly to drop out of the labor force permanently.

We also mention that employed mothers in Norway and other Nordic countries have certain rights which are likely to ease the everyday burdens of the combined mother-worker role without necessarily influencing the employment decision appreciably. For instance, employed parents are entitled to stay at home with a sick child for a certain number of days per year, and the mother may return home to breast-feed her baby during working hours.

Finally, the availability of part-time jobs in Norway and Sweden, many of them even rewarding and secure, may have tended to raise female participation rates. It is less evident, though, how this availability has affected the total number of hours supplied by females, because a large fraction of the part-time workers undoubtedly would have preferred full-time work to nonemployment in spite of the inconveniences that would result.

DATA

Our analysis is based on interview data from the Norwegian Family and Occupation Survey of 1988, which are linked with income and tax information from the Directorate for Taxation. In the survey, individual biographies of pregnancies (childbirths for male respondents), cohabitation, educational activity, and employment were collected for 4,019 women born in 1945, 1950, 1955, 1960, 1965, and 1968, and for 1,543 men born in 1945 and 1960 (Central Bureau of Statistics 1991). The nonresponse rate for the females was 19%. In the present analysis we focus on the two oldest cohorts, who had largely finished childbearing and had incurred the major part of their opportunity expenditures at the time of interview.

Registered annual income and taxes were available for each of the years 1967 through 1988, and are included for all respondents. Thus we know almost the entire lifetime income history up to the time of interview for female respondents born in 1950 and the history after age 22 for those born in 1945.

We have focused on the income component on which contributions to the public pension system are based. This is the taxable return from labor market activity. The income and tax figures have been converted to 1990 prices in U.S. dollars by using the Norwegian consumer price index and the average 1990 exhange rate.

Generally, the data appear to be of very high quality. For instance, we have calculated the proportion of women in our sample who reported themselves as employed in December

1972, 1977, 1982, and 1987; these figures agree very well with those obtained by the Labor Force Sample Surveys, which have been conducted quarterly since 1972.[4] Moreover, we find a high correlation between reported employment and registered income.[5]

The interviewers were instructed to consider women on maternity leave as employed; this classification is consistent with international conventions. In addition, they were instructed to register a special code for maternity leave, without distinguishing between a leave with or without wage compensation. We suspect, however, that maternity leave was underreported. During the first three or four months after childbirth, when a large fraction of the women must have had a maternity leave, a considerable proportion of the respondents in the survey reported no activity.[6] Moreover, some women have reported a maternity leave, which is necessarily unpaid, during the following year.[7] Some also may have had a maternity leave during that period, but registered it as usual employment. It seems likely, however, that the majority of the mothers on leave at this stage reported neither employment nor a special code for maternity leave.

Our decision was to consider all women as nonemployed during the first four months after delivery, when almost every woman is a homemaker and when many women receive a full wage compensation. This step entails a modest overestimation of the income-producing activity forgone because of childbearing. On the other hand, we include all of those who reported themselves as employed after five months, a step that would tend to bias the estimates in the opposite direction. The former contribution probably dominates, so that we overestimate slightly the loss of income-generating activity.

We also mention that work not exceeding 10 hours per week was not recorded in collecting the employment histories. Nor was employment lasting less than three months. We imposed these restrictions in order to simplify the data collection procedures, which certainly were ambitious enough even without such a detailed mapping of the past. As judged by the income histories, however, the work activity that is left out would have contributed very little to the cumulated labor force experience, and it would not have affected appreciably the estimates of forgone employment.[8]

In regard to the income data, the most obvious limitation is that some "black market activity" (such as home-based paid childcare) is not included. We know little about the extent of this activity.

METHODS

Methodological Framework

Certainly, employment and fertility affect one another, and the behavior in these two arenas of life is determined jointly to some extent. For instance, previous labor market experience and expectations about future gainful activity may affect the birth rates, which, in turn, have a profound impact on the employment rates. The simultaneous nature of the employment-fertility decision poses great methodological challenges, and much of the demographic research on this subject has had to be based on models with a unidirectional causality.

In the present analysis we model the total labor force participation for a real birth cohort up to a certain age as a function of reproductive factors, education and some other variables. We assume that previous employment has no impact on fertility. This means, for instance, that a mother with (say) two children and a childless woman who otherwise is entirely equal to the mother, have had the same work experience up to the age when the mother delivers her first child. Thus the estimated differences in total labor force participation between parity levels may be taken as answers to questions such as "How much more work experience would a two-child mother have had if she had remained

childless instead?". One must of course control as much as possible for factors affecting both fertility and labor market behavior.[9]

The assumption that employment differences show up after childbirth seems reasonably realistic to us, except that the employment patterns probably differ somewhat during the few months before delivery (see, for example, McLaughlin 1982), which, of course, is a response to an impending birth. For instance, we found no significant differences (net of education) in employment up to age 25 when we compared childless women and one-, two-, and three-child mothers with their first birth at age 25 or later. A similar result showed up for women at ages 20 and 30. Moreover, investigations based on other data point in the same direction. Indeed, there is no general agreement about the effect of employment on the birth rates (see, for example, the review by Bernhardt 1989), but recent studies both from Norway (Kravdal forthcoming a), Sweden (Hoem and Hoem 1989), and Britain (Wright et al. 1988), which address the issue of differential third-birth rates, suggest that past employment is unrelated to fertility.

The individuals in our sample are followed up to the end of the year when they are 37 years old, which is 1987 for the 1950 cohort. It would be possible to extrapolate beyond this age, but the simplicity of the real-cohort approach appeals to us, and we leave more sophisticated techniques to future investigations.

Specifying the Model

We have estimated the following models for Y, which is the woman's cumulated labor force participation in full-time equivalents,[10] and for I, which is her total income:

$$Y = a + b(N) + N_{123}c(A) + N_{23}d(L) + e(E) + g(X) + \epsilon \quad (1)$$

$$I = a' + b'(N) + N_{123}c'(A) + N_{23}d'(L) + e'(E) + g'(X) + \epsilon'. \quad (2)$$

As usual, ϵ is an error term. N is the number of live births. (We do not adjust for infant or child mortality, which is very low.) The net effect of parity, b(N), is defined as

$$b(N) = b_1N_1 + b_2N_2 + b_3N_3 \quad (3)$$

where N_1 is 1 if the woman has one child ($N = 1$), otherwise 0. N_2 and N_3 are defined similarly. Thus b_1, b_2, and b_3 are the effects of having 1, 2, or 3 children relative to the childless, whom we chose arbitrarily as a baseline group. The c, d, and e functions, which are the main effects of age at first birth, interbirth interval, and educational level, are defined analogously to b, and a is a constant. When we address the issue of educational differentials in the time and opportunity expenditures, we include f(N,E), which is the effect of a cross-classification by education and parity, instead of b(N) and e(E). The term g represents the effects of all other variables X that we included during our preliminary experimentation, but which we dropped from the final model. The ′ is used to symbolize that the effects on employment and on income are different.

We do not include other first-order interaction terms, because they either have no meaningful structure or interpretation, or because they do not improve the model fit significantly.

We used the REG routine in SAS to estimate the models by OLS regression. Inspection of the residuals shows that the usual model assumptions are reasonably well satisfied. The REG routine allows the investigator to impose some restrictions on the parameters and to test whether the model fit is reduced significantly under these restrictions. Unless stated otherwise, we used a 0.05 significance level.

Variables

Number of children (N) is 0, 1, 2, or 3. Women with four or more children are excluded from the analysis because they are a fairly small group and because the fourth child often is born so late that the women have experienced far from the entire loss of income and employment at interview.

Mother's age at first birth (A) is a particularly important factor. It may have an independent effect on the employment rates after childbirth, partly because it captures differences in previous work experience and human capital. In addition, and presumably even more important, our cut-off at age 37 corresponds to a shorter duration since last previous childbirth among those who delivered their child at a relatively late age. In other words, the women with a late birth experienced a smaller share of their total opportunity costs at the cut-off than the women who had an earlier delivery. Because age at first birth is a relevant variable only for women who have at least one child, we include the dummy N_{123}, which is 0 unless parity is 1 or higher.

For similar reasons the *mean birth interval length* (L) must be included in the model, together with the N_{23} dummy. For two-child mothers, L is defined as the difference between dates of first and of second birth (given in month and year); for three-child mothers it is half of the difference between the dates of first and of third birth.

Education (E) refers to the highest level attained by age 37. Nine years of education are compulsory (seven years before 1974). Beyond that minimum, there are six possible levels. In our analysis these levels are denoted by the number of years required for attainment with "normal" progression (10, 11–12, 13–14, 15–16, 17–18, and 19–20 years of schooling). For instance, those who graduate from the highest level of secondary school usually have had 12 years of schooling. One is expected to receive a master's degree five or six years after that, for a total of 17–18 years.

A considerable fraction of the women in our sample were enrolled in school for more years than would be required to reach the level in question. The reason may be that they took a sequence of courses on the same level, that they failed examinations, or that they were part-time students. A control for these "extra years," however, did not lead to more than minor alterations in the effect estimates. Nor did it seem warranted to include a measure of the educational activity after a woman first reached the level that was recorded as the highest by age 37. Although such additional schooling affects the employment profile in the same direction as does a higher formal level, we found no interesting changes in our most important effect estimates when this variable was included.

In some preliminary models we also included place of residence and husband's education, because these factors may partly capture the woman's need for work and the availability and nature of jobs and child care. They had little impact, however, on the other estimates.

RESULTS

Forgone Employment Due to Childbearing in the 1945 and 1950 Cohorts

In Table 1 we show a main effects model for cumulated labor force participation up to age 37 among women born in 1945 or 1950.[11] As expected, we found a large difference between childless women and those who had three children by age 37. When we consider all women in the two cohorts, regardless of their cohabitational history, a three-child mother who had her first child at age 23–24, with a mean interval of 31–48 months before each of the next children, worked 7.14 years less than a childless woman (with control for

Table 1. OLS Regression Estimates (with Standard Errors) for Total Labor Force Experience (in Years) up to Age 37 for Women Born in 1945 and 1950, Main Effects Model

	All Women			Women Still Married and in First Union at Age 37		
	Number of Women	Estimate	(SE)	Number of Women	Estimate	(SE)
Intercept		15.63	(0.51)		15.43	(0.74)
Number of Children						
0[a]	103	0		38	0	
1	171	−2.54*	(0.63)	98	−2.86*	(0.87)
2	531	−5.61*	(0.58)	423	−5.34*	(0.80)
3	271	−7.14*	(0.60)	220	−6.84*	(0.81)
Age at First Birth						
1 or more children						
≤20 years	205	−0.21	(0.45)	134	−0.42	(0.51)
21–22 years	219	−0.93*	(0.44)	164	−0.61	(0.47)
23–24 years[a]	176	0		152	0	
25–27 years	208	0.94*	(0.45)	172	1.12*	(0.47)
≥28 years	165	1.75*	(0.49)	119	2.03*	(0.53)
Else	103	0		38	0	
Mean Interbirth Interval						
2 or more children						
≤30 months	203	0.35	(0.39)	158	0.24	(0.43)
31–48 months[a]	309	0		251	0	
≥49 months	290	0.94*	(0.35)	234	0.97*	(0.38)
Else	274	0		136	0	
Education, Highest Level Attained (Number of years to which the degree corresponds)						
7– 9 years[a]	214	0		153	0	
10 years	441	0.49	(0.36)	323	0.13	(0.42)
11–12 years	150	−0.27	(0.46)	112	−0.67	(0.53)
13–14 years	163	−1.18*	(0.47)	126	−1.39*	(0.54)
15–18 years	108	−2.23*	(0.55)	65	−1.90*	(0.65)
R^2		0.23			0.18	

[a] Baseline group.
* Significant at $p < .05$.

education). This difference is likely to be somewhat larger at a higher age of observation because the youngest child typically is only about age 7 when the mother reaches age 37.

The difference between childless women and one-child mothers (assuming 23–24 years at first birth) is 2.54 years, whereas the difference between one- and two-child mothers (assuming an interbirth interval of 31–48 months) is 3.07, and that between two- and three-child mothers is 1.53. All of these differences are significantly different from 0 at a 0.05 level. Apparently, the costs associated with the third child are relatively small. This

finding may be explained in part by the use of age 37 as the cut-off, which tends to understate the time diverted from paid work due to a third child more than that due to lower-order children.

A similar artificial cut-off effect also tends to exaggerate the importance of age at first birth on the labor force experience lost up to age 37. For instance, we estimated that if the three-child mother mentioned above had her first child at age 25–27, her work experience would have been only 6.20 years (7.14–0.94) lower than that of the childless. She would have some time to lose after age 37, however. On the other hand, a woman who had her first child at age 21–22, loses as much as 8.07 years. A longer interbirth interval, which goes hand in hand with a higher age at last birth, affects the costs of childbearing in the same direction as does a higher age at first birth.

The main effects model displayed in Table 1 shows that a higher level of education is accompanied by a lower cumulated labor market experience. For instance, women with a college or university degree (15 or more years of schooling) have worked 2.23 years less than those with only the nine years of compulsory education, net of differences in reproductive behavior, because they spent a longer time in school. Beginning in their late twenties, the well-educated generally have the highest participation rates.

For the sake of comparison, we also estimated the model for women who were married by the end of 1987 and who never had broken a marriage or consensual union previously. The estimates for this group are broadly similar to those for the entire sample (Table 1).

As judged by a homogeneity test, significant variations occur in the employment losses across educational groups: the tests clearly rejected the hypothesis that differences in total employment between women with n and with $n+1$ children are equal across educational groups for all values of n. When the forgone labor market experience is predicted from a model that includes a cross-classification of education and parity rather than the main effects of these two variables, we see clearly that the time expenditures of childbearing are lower among women with some postsecondary education than among their less educated counterparts (Figure 1). Separate tests for each parity transition, however, show that the educational differential in the forgone work experience is nonsignificant for first births ($p=0.61$) and also for third births ($p=0.14$), although less markedly so. When we compare childless women with three-child mothers, we find that the difference in labor market experience is 8.2 years among those with less than 13 years of education, as opposed to 4.3 years among those with some postsecondary education. Among those with more than 15 years of schooling, the corresponding difference is less than four years. The largest sacrifice in labor market experience, about 8.8 years, is made by the women with 10 years of education.

Opportunity Expenditures

When using the income data to estimate opportunity expenditures, we devote our attention largely to women born in 1950, for whom we have an almost complete income history.

Table 2 shows the main effects of the number of children on total income. A two-child mother with a first birth at age 23–24 and an interbirth interval of 31–48 months has earned $127,000 less than the childless woman (controlling for education). If the first child had been born two years earlier, the income sacrificed would have been $151,000 (this figure is calculated by using estimated age effects not shown in the table). Her loss of cumulated labor market experience would have been 6.6 years, as it also would have been among women in the 1945 cohort.

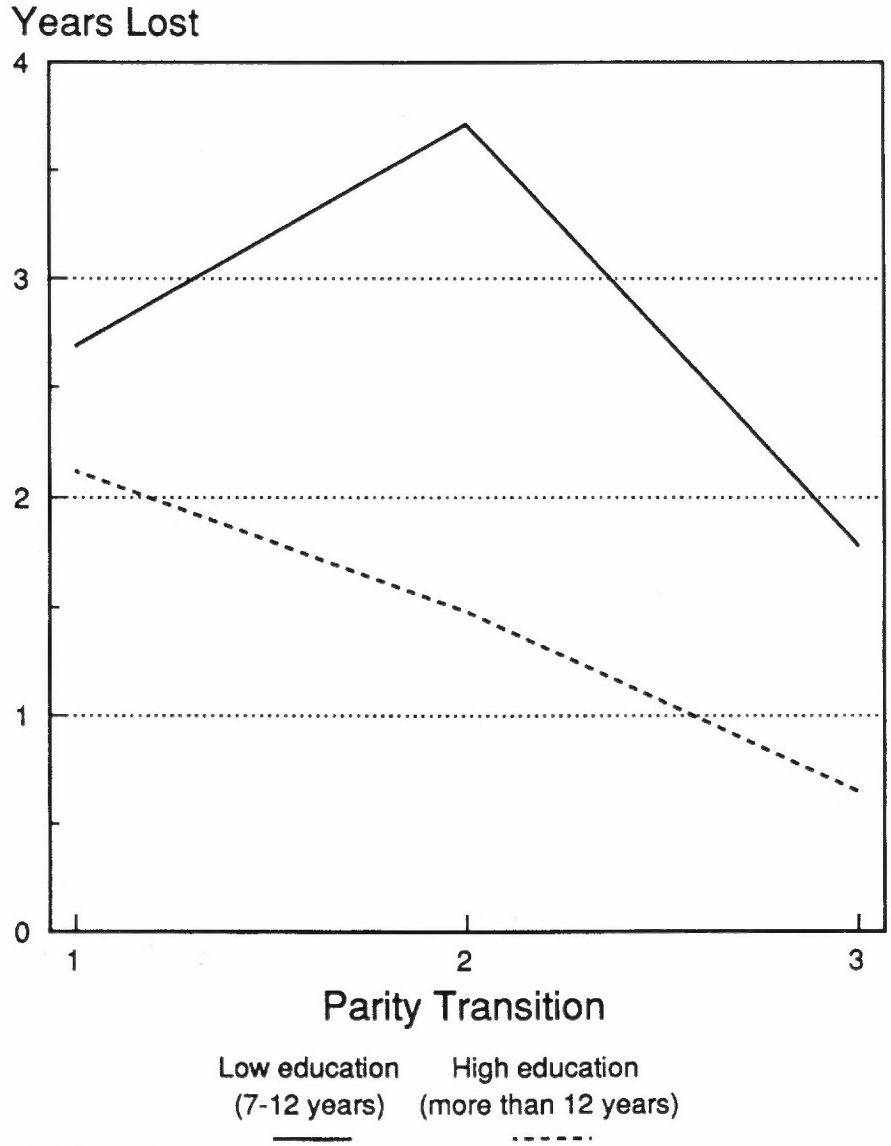

Figure 1. Estimated Reduction in Total Labor Force Participation Up to Age 37 Due to Each Parity Transition, by Mother's Educational Level.[a] Women Born in 1945 and 1950

[a] Predicted from estimates in an OLS regression model with main effects of age at first birth, length of birth interval, and a cross-classification of educational level and number of children. All women, regardless of marital status, are included. The time diverted from the labor market due to the *first child* is predicted here as total labor force participation for a childless woman, minus total labor force participation for a woman who bore her only child at age 23–24, but who is otherwise equal. According to our model, this employment loss depends on the age at first birth and on the educational level. The *educational differences* in the loss, however, do *not* depend on age at first birth. In regard to the transitions to *second and third child*, we assume that the mean interbirth interval is 31–48 months. The interval length affects the predicted loss of employment experience for each educational group, but *not* the *differences* between these groups.

Table 2. OLS Regression Estimates (with Standard Errors) for the Effect of Parity on Total Income up to Age 37 (in Thousands of Dollars at 1990 Prices) among Women Born in 1950, Main Effects Model[a]

	Income		Income after Tax	
	Estimate	(SE)	Estimate	(SE)
All Women				
Number of Children				
0[b]	0		0	
1	82.4	(21.9)	49.3	(15.7)
2	127.4	(20.0)	81.3	(14.4)
3	153.4	(20.8)	100.3	(14.9)
Still Married and in First Union at Age 37				
Number of Children				
0[b]	0		0	
1	54.6	(30.4)	31.0	(21.9)
2	91.2	(28.3)	55.2	(20.5)
3	114.9	(29.0)	73.1	(20.8)

[a] Controlled for age at first birth, interbirth interval, and educational level, as in Table 1. There are 579 women in the sample.

[b] Baseline group.

If we consider instead the income after taxation, the loss is \$81,000 for a two-child mother if she had her first child at age 23–24 and \$98,000 if she had her first child at age 21-22.

Note that the third child appears to be less costly than the first and the second: the gross income loss is \$26,000, as opposed to \$82,000 and \$45,000 respectively. Again, this finding should be interpreted partly as a result of setting the cut-off at age 37.

Let us now return to the loss of \$151,000 and 6.6 years of work activity for a woman in the 1950 cohort who had her first child at age 21–22. If we assume that the 6.6 years were diverted from gainful employment around 1975 and that her hourly wages would have been equal to those in the manufacturing industries (\$10.19 at 1990 prices), an income loss of about \$140,000 would be expected. These two estimates of income loss differ by only 8%. Considering the crude assumptions made here, the fairly large standard errors, and the limitations of the data, we hesitate to place much emphasis on the higher figure obtained for the loss of registered income. Nevertheless we point out that a difference in this direction is consistent with the idea that income may be reduced even when a gap no longer exists in the employment profiles; the reason is the lower *previous* labor market experience. In the British investigation mentioned above, it is shown that such a pay penalty constitutes a considerable part of the total cash opportunity costs suffered up to age 60 (Joshi 1990).

We also estimated the opportunity expenditures for women who had had only one partner and still were married by age 37 (Table 2). The income losses are considerably smaller for these women, in spite of broadly similar employment losses. For instance, a two-child mother with her first delivery at age 23–24 has lost only \$91,000. It turns out that the opportunity expenditures of childbearing among the married are particularly low for first births, whereas there are fairly small differences by marital status in the expenditures associated with later stages of family building. This finding, however, may be no more than

an artifact of stochastic variation. In fact, a very small group of the continuously married are childless, and the 0.05 confidence interval for the difference between their labor market experience and that of the one-child mothers extends far beyond the corresponding difference estimated for the entire female sample.

In Table 3 we show the predicted loss of gross and net income due to the first, second, and third child for various educational groups. As in Figure 1, these losses, but not the educational differences in the losses, depend on the age at first birth and on the interbirth interval.

The pattern differs from that for the time expenditures. Whereas the second and the third child are less expensive for the better-educated than for women with no postsecondary education, education tends to increase the cost of the first child. Childless women with more than 12 years of schooling seem to have a high income in relation to their work activity. None of the educational differentials are significant at a 0.05 level, but the p-values are fairly small. Because of Norway's progressive taxation system, the positive effect of education on the opportunity expenditures of the first child is slightly less pronounced when we consider the net income.

These results tend to support the notion that trends and variations in opportunity costs are key determinants of reproductive behavior. In Norway, as in most other countries, a

Table 3. Estimated Reduction in Income (in Thousands of Dollars at 1990 Prices) Due to Each Parity Transition, by Mother's Educational Level[a]

	Income			Income after Tax		
	Parity Transition			Parity Transition		
	1	2	3	1	2	3
Women Born in 1950: Reduction in income up to age 37						
Education						
7–12 years	71.8	65.9	36.5	45.6	46.6	26.6
13 or more years	114.1	15.5	2.7	65.3	12.3	3.4
p-value[b]	0.27	0.08	0.22	0.47	0.10	0.25
Women Born in 1945 and 1950[c]: Reduction in income during ages 23–37						
Education						
7–12 years	89.6	70.6	18.6	61.4	47.5	12.0
13 or more years	105.9	45.4	5.6	62.2	33.9	1.9
p-value[b]	0.74	0.43	0.60	0.96	0.43	0.55

[a] Predicted from estimates in an OLS regression model with main effects of age at first birth, length of birth interval, and a cross-classification of educational level and number of children. All women, regardless of marital status, are included. The income loss due to the *first child* is predicted here as total income for a childless woman, minus total income for a woman who bore her only child at age 23–24, but who is otherwise equal. According to our model, this income loss depends on the age at first birth and on the educational level. However, the *educational differences* in the loss do not depend on age at first birth. In regard to the transitions to *second and third child*, we assume that the mean interbirth interval is 31–48 months. The interval length affects the predicted loss of income for each educational group, but *not* the *differences* between these groups.

[b] For the hypothesis that there is no difference between the educational groups at the parity transition in focus.

[c] Women with a first child before age 23 are excluded.

strong inverse relationship exists between education and lifetime fertility. The well-educated have their first child at a later age, and a relatively large proportion remain childless. Thus it is somewhat interesting that our data indicate a particularly strong economic disincentive among the better-educated to enter motherhood. In regard to the timing issues, the findings suggest no ready explanations related to considerations of opportunity costs. In fact, we observed that the relatively high expenditures of having a first child among the college- or university-educated are most pronounced at later ages (results not shown), a finding that does not fit with an idea that it is beneficial for them to postpone the first birth.

Moreover, it is an interesting characteristic of Norwegian reproduction that among women who had their first child at the same age, educational level has no subduing effect on subsequent fertility. In fact, there has been a gradually increasing *positive* effect across the postwar cohorts. It even outweighs the counteracting influence of a higher age at first birth among the well-educated, and thus produces a positive *zero order* effect of education on third-birth rates among recent second-parity cohorts (Kravdal forthcoming b). It is thought-provoking that this stimulating effect of education on birth rates beyond parity 1 goes hand in hand with lower opportunity costs of childbearing among the higher social strata.

All in all, one cannot claim that these conclusions regarding the social variations in opportunity expenditures rest on a very solid foundation. When we pool the 1945 and the 1950 cohorts, further doubts arise as to whether such variations really exist. In order to include the 1945 cohort, we had to exclude women with a first birth before age 23 and take into account only the earnings during ages 23–37. A similar trend appears in the estimates when this approach is used, but the p-values are large (Table 3).

CONTRASTS BETWEEN NORWEGIAN AND AMERICAN ESTIMATES OF FORGONE EMPLOYMENT

Our estimates of forgone employment are much higher than those reported by Calhoun and Espenshade (1988). Other American authors have estimated a time expenditure that deviates less from ours, but these estimations are based on much older and somewhat less relevant data (see review by Espenshade 1977).

In the Calhoun-Espenshade study a loss of 2.1 full-time equivalent years is predicted for continuously married white women in the 1960 cohort whose two births were at ages 25 and 27. Losses of 2.5 and 2.9 years are predicted for women in the 1950 and the 1940 cohorts respectively. According to the Norwegian estimates, continuously married women in the 1945 and the 1950 cohorts with their first birth around age 25 and their second birth about three years afterwards would divert about 4.8 full-time equivalent years from paid work up to the age of 37 (Table 1), and the time expenditures beyond that age would not be negligible.

We do not understand fully whether the real differences in time expenditures between the two countries are quite as large as suggested by our own estimates and by those of Calhoun and Espenshade, or whether the gap also could be ascribed in part to data or methods. In spite of a public welfare system that generally is less generous in its support of working parents, a somewhat lower level of forgone hours in the United States does not seem entirely unreasonable. Certainly, the richer supply of subsidized child care institutions in Norway may induce a higher participation rate among women with preschool children. As discussed in a previous section, however, the Norwegian maternity leave program actually may serve as a disincentive to gainful employment when the children are very small. Moreover, we do not rule out the possibility that fuller access to part-time jobs in

Norway may tend to result in a lower level of total working hours among certain groups of mothers. Only a thorough comparative investigation could reveal whether these factors are likely to produce such a profound difference in the time expenditures, or whether there are other social or economic forces that would tend to make childbearing less of an obstacle to market work in the United States than in Norway, or would contribute to moving more American mothers into gainful activity.

When we compare the official labor force statistics for the two countries, the similarities indeed are conspicuous, but the figures do not mean that time expenditure due to the presence of children cannot be somewhat higher in Norway than in the United States. As mentioned earlier, the proportions employed in the two countries among women aged 25–54 were very close during the 1970s and 1980s. When we compare the married parous women, the participation rates are lower in the United States, but the impact of the youngest child's age seems to differ very little between the two countries. This finding suggests that the forgone hours of formally defined employment, at least those associated with transitions beyond parity 1, do not differ widely. Yet a lower time expenditure may result if, for some reason, the *number of children*, net of the age of the youngest, has a less inhibiting effect in the United States than in Norway. Moreover, during the period under investigation, a progressively larger fraction of the Norwegian women who reported themselves employed in the official statistics and who had a child aged 0–2 were actually on unpaid maternity leave. In principle, this fact is consistent with a higher loss of income-generating activity among the Norwegian women. In our judgment, however, a correction for maternity leave would not lead to very marked changes in the employment rates, especially not for the 1960s and 1970s.

All in all, neither our brief review of the public policies nor the comparison of the official statistics provides convincing evidence that the time expenditures due to two childbirths in the United States are less than half of those in Norway. Yet we also fail to see any obvious reason why data or methodology would produce such a wide gap. The Norwegian data seem to be of a very high quality, although we have pointed out that they may involve certain limitations, and that our approach when coping with these limitations entails a modest overestimation of the loss of income-generating activity. With respect to the regression methodology, we are fairly confident that it gives reasonable results. In fact, similar opportunity expenditures show up when we simply calculate the average cumulated work experience for women with various reproductive careers (not shown). Our estimates also agree reasonably well with some rough calculations based on official labor market statistics from the mid-1970s, where the employment rates are cross-classified by number of children and age of the youngest child. For instance, if we compare the employment rates of women who proceed to parity 2 three years after entry into motherhood with those of married childless women in their twenties, we find a time expenditure of more than five years.[12] This figure is based on the assumption that everyone works full-time; it would have been higher if we had taken into account the unpaid maternity leave and the differential use of part-time work. Moreover, it is reassuring that our results are so close to those reported in the British study (Joshi 1990). Certainly, employment rates among mothers with preschool children are lower in Britain than in the United States or Norway, but a time cost of (typically) six years was estimated on the basis of data from 1980, and a higher level presumably would have been found for women born in the late 1940s.

The Calhoun-Espenshade study makes use of a sophisticated methodology, which provides the opportunity to predict complete employment profiles even for birth cohorts for whom the data represent only a very small portion of the life course. It is difficult to realize the implications of all the assumptions that are made. In particular, it is not clear to us how the temporal trend in the time expenditures is affected by the fact that the regression model for the employment transitions does not allow explicitly for a differential response to

childbearing across cohorts. We do not claim, however, that a model without an interaction between cohort and reproductive behavior necessarily leads to seriously biased estimates for some of the cohorts. The temporal trend in the employment pattern subsequent to childbirth may be captured more indirectly, and an interaction term actually may have proved to be superfluous.

An advantage of the American study is that it provides predictions of work activity by age for the 1960 cohort. It would be interesting to see similar figures for the 1940 and 1950 cohorts, and to compare them, using simple calculations, with the employment profiles for various groups of women in the Norwegian survey. This procedure could reveal whether the differences in the expenditure estimates from the two countries are due largely to differences among the childless, among women with infants, or among those with older children. It also might be worthwhile, as a part of future research, to predict the extent of gainful activity by age for younger Norwegian cohorts or to employ the Norwegian approach on a set of American data with more complete employment histories, such as the 1988 National Survey of Families and Households.

SUMMARY AND CONCLUSION

We have used a very rich survey data set with complete individual life histories up to interview to estimate the loss of income and the time diverted from gainful employment due to childbearing among Norwegian women born in 1945 and 1950. Consistency appears to exist between employment and income figures, which are based respectively on self-reported biographies and register information.

We have shown that a woman born in 1950 who had two children, the first at age 21-22 and the second about three years later worked 6.6 (full-time equivalent) fewer years up to the age of 37 than a childless woman with the same education. Her loss of income amounts to $151,000 at 1990 prices, or to $98,000 after taxation. A British investigation suggests that she is not likely to lose more than about one woman-year after age 37, but that her loss of income may be more substantial (Joshi 1990).

The loss of $151,000 up to age 37 might be considered large compared to the total earnings of about $300,000 up to that age which we estimated (not shown) for a childless woman with no postsecondary education. One should take into consideration, however, that the women typically are likely to earn three quarters of a million dollars in subsequent years if they have full-time employment up to the age of 65.

Our estimates suggest that women with more than 12 years of schooling lose less cumulated labor market experience because of childbearing than the less well educated, but these differentials are significant only at the 0.05 level for second births. This subduing effect of education on the time diverted from gainful activity is consistent with the study carried out in the United States by Calhoun and Espenshade (1988) and with several other investigations of the reentry into the labor force after childbirth. We have found less clear educational differentials in income loss, however. In the American study the higher hourly earnings among the better-educated more than outweighed the smaller time expenditures, so that a higher income loss showed up.

Generally our estimates of foregone employment are much higher than those presented by Calhoun and Espenshade (1988), but are fairly close to those reported from Britain by Joshi (1990). It does not seem altogether unlikely that the time expenditures due to the presence of children are lower in the United States than in Norway. Yet in view of the parenthood policies in the two countries, and the female employment rates published in the official labor market statistics, the very large gap in the estimates is somewhat surprising. Further investigations would be required to learn whether a considerable part of the

differences between the Norwegian and the American results should be ascribed to data or to methodology, and to identify other social or economic forces in the two countries that would tend to produce widely different time expenditures.

The Norwegian estimates are for women who have largely terminated their childbearing and who have experienced most of their time and opportunity expenditures. As a result of the sharp rise in participation rates among women with small children during the last few decades, less time is diverted from gainful employment among younger cohorts. This fact is set against higher child care expenditures and possibly a more stressful domestic workload.[13] Future policies concerning the labor market, earnings, and child care facilities, as well as general economic development, are crucial determinants of the future opportunity costs of childbearing.

In addition to forgone earnings and child care expenditures, parents incur direct costs of clothes, food, and various other items that may well be of the same magnitude.[14] The role of opportunity costs and direct costs in reproductive decision making is a matter of persistent scholarly dispute. Undoubtedly, parenthood entails a wide range of pleasures and sacrifices in addition to the purely economic costs. For many couples, having one or two children is such an essential element of a "meaningful life" that even much higher opportunity expenditures than those estimated here would not be prohibitive. On the other hand, one can imagine easily that economic cost considerations may enter strongly into the decision making in some segments of the population at certain stages of their reproductive careers. In particular, it is not unlikely that the expenses following in the wake of a third child have a bearing on fertility, although they may well be lower than those associated with the first two children.

NOTES

[1] For instance, the arrival of a second or third child would be more expensive in forgone income in a phase of development where gainful employment is an alternative to homemaking than in a situation where the prevailing behavior is to drop out of the labor force at first birth. On the other hand, the sharp rise in the female employment rates during the last few decades also reflects the fact that it has become progressively more common to work even when the children are small. This practice tends to *reduce* the forgone income.

[2] For instance, whereas 8% of the children aged 0-2 and 28% of those aged 3-6 were enrolled in full-time day care institutions in Norway in 1989, the corresponding figures for Sweden were 18% and 44% respectively (part-time enrollment in the age group 3-6 was 26% in Norway and 17% in Sweden). In Sweden there are also many municipally employed childminders. All in all, the variety of child care alternatives, with suitable opening hours, that are offered to Swedish parents serve to establish a high degree of compatibility between family obligations and (part-time) work (see, for example, Bernhardt 1991). Moreover, the child care system itself represents a demand for female workers. The favorable position of Sweden relative to Norway may reflect a larger public commitment in general, a somewhat more flourishing economy during much of the postwar era, and a more pronounced erosion of and antagonism towards traditional family values.

[3] In 1986, about 70% of the preschool children of employed American mothers were cared for in their own homes or in another home (U.S. Bureau of the Census 1991). Only 15%, which corresponds to less than 10% of all children aged 0-5, were enrolled in day care centers. Some also attended nursery schools. For further discussion of child care in the United States see Presser (1989).

[4] According to the 1988 Family and Occupation Survey, the employment rates at ages 22 and 27 in 1972 were 52% and 47% respectively. Corresponding figures for age groups 20-24 and 25-29 in the Labor Force Sample Survey were 52% and 48%. In 1987, 65, 72, 75 , 81, and 84% were employed at ages 22, 27, 32, 37, and 42, according to the Family and Occupation Survey. According to the Labor Force Sample Surveys, 67, 75, 79, 81, and 83% were employed in the corresponding five-year age intervals. The proportions reporting part-time work in these surveys also seem to agree.

[5] As will be discussed in a later section, figures on total employment loss and income loss due to childbearing are remarkably consistent. In addition, among those who reported that they had been employed in 1987, about 98% had a registered taxable income during that year. In 1970 more than 80% of those who were 20 or 25 years old and who reported employment were registered with an income. The corresponding figure for those who claimed to have had full- time employment during that year was about 90%. Their income was as expected, according to statistics on female wages in the manufacturing industry.

[6] For instance, 57% of the women who had their first child reported no activity (i.e., neither employment nor a special code for maternity leave) during the four months after delivery, even though many of them obviously must have been entitled to a leave with wage compensation. In fact, more than half of this 57% worked more than six months during the year preceding the first birth. Twenty-seven percent of the women with at least one child reported a full maternity leave during the three- to four-month interval after first birth. Eight percent reported employment during the entire interval, but no code for maternity leave. Probably this discrepancy is due largely to misreporting. Very few were registered with a special code for maternity leave without also having reported employment, as they were asked to do.

[7] For instance, the maternity leave during 5-12 months after first birth amounts to 0.04 woman-years when all mothers in the survey are pooled (whereas the reported employment is 0.26 woman-years). The corresponding figure for the 13-24 month interval is 0.02 woman-years. We also mention that a few women reported taking a maternity leave before childbirth.

[8] A check among 769 women (largely recruited from the 1960, 1965, and 1968 cohorts) who reported no employment during 1987, and who were not entitled to a paid maternity leave during that period, revealed that as many as two-thirds had received some income. The amount, however, corresponded to only about two months of labor market activity. Moreover, such occasional work seemed to be confined largely to students, and was much less common among women who had become mothers. In 1970, one in four 20- or 25-year-old women who reported no employment was registered with an income. Again, the highest figures were recorded for students.

[9] In principle, these factors should be exogenous. For instance, if a higher education is partly a response to childlessness, it would not be entirely correct to interpret differences in work experience between childless women and two-child mothers with the same education as the cost of having two children. Moreover, we point out that some sources of heterogeneity are difficult to control. For instance, health-related factors or a basic preference for income-generating activities may affect the probability of remaining childless, as well as labor market behavior and income. We also mention that even if (say) a two-child and a three-child mother are assumed to have had equal work experience before second birth, the anticipated responses to a third childbirth may differ. For some reasons, the two-child mother may expect or know that she will be out of the labor force for a very long time if she has another child, and this may be one reason why she never proceeds to parity 3.

[10] The following categories of weekly working hours were defined in the survey: 10-24, 25-34, 35-45, and 45 or more hours. In the estimation of full-time equivalents these categories are given the weights 0.43, 0.75, 1.00, and 1.25 respectively.

[11] It has been our strategy to pool these two cohorts whenever possible. There is no significant effect of cohort on the cumulated labor force experience, and the interaction between cohort and number of children is not significant. There appears, however, to have been a significant downward trend in the time expenditures of the third child when we compare the 1945 and the 1950 cohorts. The educational differentials in the time expenditures are broadly similar in the two cohorts.

[12] We emphasize, however, that computations based on such period figures for broad age groups, with no adequate control for the sociodemographic composition of the various categories, are not necessarily very close to the time expenditures observed for specific groups of women within real birth cohorts.

[13] We have in mind that in a dual-earner family, the household work must be done after regular working hours. In contrast, homemakers often can carry out some of these duties while supervising the children, even though child care often may be an extremely exhausting task that precludes any other activity.

[14] In fact, it has been estimated in Norway that a "typical" couple would need about $75,000 to provide two children with food, clothes, equipment for "normal" leisure pursuits, and so on (Borgeraas 1990; Statens Institutt for Forbruksforskning 1990). This figure is meant to cover expenses

up to age 18. Per-child direct expenditures of about $80,000 are reported from the United States (Espenshade 1984), and £30,000 from Britain (quoted in Joshi 1990).

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Paper VI

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THE IMPACT OF FIRST-BIRTH TIMING ON DIVORCE: NEW EVIDENCE FROM A LONGITUDINAL ANALYSIS BASED ON THE CENTRAL POPULATION REGISTER OF NORWAY *

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Abstract. The association between divorce risks in first marriage and the timing of the first birth is inspected in a life-table analysis of registered birth and marriage histories from Norway. One of the main conclusions is that the high propensity to divorce among women who have had a premarital birth is not confined to those who marry someone other than the father of their child. Also, women who have had a premarital child with their husband, run a much higher risk of marital breakup than do those who had their first baby in wedlock. The relative difference between these two groups, which appears to be particularly large at the beginning of marriage, has decreased during the last two decades. It is argued that couples who postpone childbearing beyond two years of marriage may have particularly low divorce rates.

Résumé. ***L'effet de la première naissance sur le divorce : Nouveaux résultats d'une analyse logitudinale basée sur le registre central de population de Norvège***
Les liens entre les risques de divorce d'un premier mariage et la venue du premier enfant sont observés à l'aide d'une analyse longitudinale des biographies familiales (mariages et naissances enregistrées) en Norvège. Une des principales conclusions est que la forte propension à divorcer des femmes qui ont eu un enfant avant le mariage n'est pas restreinte à celles qui n'épousent pas le père de leur enfant. Egalement, les femmes qui ont eu un enfant légitimé de leur futur mari, ont un risque plus élevé de divorcer que celles qui ont eu leur premier enfant légitime. La différence relative entre ces deux groupes, qui est particulièrement forte au début du mariage, a décru au cours des deux dernières décennies. On montre également que les couples qui reportent leurs naissances au-delà de deux ans de mariage peuvent avoir des taux de divortialité particulièrement bas.

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1. Introduction

This article reports some results from a recent study of marital instability in Norway, where the focus is on judicial divorce in first marriage. We confine ourselves to two aspects of the association between first-birth timing and divorce. Firstly, we intend to assess the impact of having a child out of wedlock and subsequently marrying the father of the child. To our knowledge, the divorce propensity of this subgroup of unmarried mothers has not so far been thoroughly explored. A part of this analysis will compare divorce risk for those who have a premarital birth and marry the father with the risk for those who marry another man. Our second target is to gauge the effect of postponing the first birth beyond two years of marriage. Not much research has been carried out on this subject, and we believe that our results, based on a very large data set and a multivariate life table analysis, may be of some interest.

There is extensive evidence from other countries of a strong correlation between first-birth timing and marital breakdown. After Christensen's pioneering studies in the 1950s and the 1960s (e.g., Christensen and Meissner (1953)) several researchers have focused their attention on the effects of premarital births on subsequent divorce risks. It is generally agreed that having a child before marriage is associated with a high risk of marital instability (Bumpass and Sweet (1972), Menken et al. (1981), Teachman (1983), Morgan and Rindfuss (1985), Billy et al. (1986)).

One should keep in mind, however, that the group of unmarried mothers is rather heterogenous: While most women marry the biological father of their child, a small group marry a different man. It has been demonstrated that women in the latter subgroup run a higher risk of separation than do those in the former subgroup (e.g., Furstenberg (1979)). Several investigators have used the high degree of marital breakup among those who marry someone other than the biological father as one of the explanations for the divorce level of the total group of women with a premarital birth (e.g., Morgan and Rindfuss (1985), McLaughlin et al. (1986), Billy et al. (1986)). It is one of the main objectives of our study to split up this heterogenous group, and to see whether those who eventually marry the father of the child also have a much higher divorce rate than do women with a more traditional marriage–birth sequence. Owing to lack of data, few demographers have had the opportunity to answer this question.

Several explanations are advanced to account for the high divorce propensity of women who have a child when they marry. One of the theories that has attracted a good deal of attention, contends that the marriages contracted subsequent to childbearing or conception are arranged quickly in order to 'legitimize' the baby. According to Furstenberg (1979), for instance, such haste may produce less compatible matches.

It has also been argued that there is a connection between first-birth timing and some socioeconomic characteristics at the beginning of marriage or later in life. O'Connell and Rogers (1984) have found that – controlling for age at marriage – couples who have a child before marriage or who were pregnant at marriage, are more economically disadvantaged than others. They believe that this also affects their divorce rates.

The lower social class status of this group may have been an effect of an unplanned pregnancy and a resulting disruption of the educational career. An alternative explanation – based on a reversed causation – could be that lower class couples are more likely than others to have babies out of wedlock. If this is the case, we are faced with a spurious correlation of first-birth timing and divorce. People who have a child before marriage may simply be different from the others – and not only with respect to economic and social characteristics. The couple's attitudes, in particular their family values, may affect both their tendency to have a baby out of wedlock and their tendency to experience a marital breakdown. This explanation has received some attention in the literature (e.g., Furstenberg (1979)), but perhaps less than it deserves.

The effect on the divorce risk of postponing the first birth has attracted the interest of only a few demographers, and the results are somewhat contradictory. The results obtained by Morgan and Rindfuss (1985) did not confirm their hypothesis that a delay of the first birth causes a 'cementation' of the marriage and provides the family with a better economic platform. Births delayed until two or more years after marriage did not 'provide more protection against separation than do earlier marital births'. Three other authors, however, have found that the length of the first-birth interval has a significant, positive effect on marital stability (Murphy (1985), Kiernan (1986), Ermisch (1986)).

Several interactions will be taken into account when we study the effect of first-birth timing. One of the main objectives will be to find out whether having a child with the husband before marriage has a constant impact on marital stability throughout the entire life course.

Another goal is to throw some light on variation over calendar time. Since the birth timing pattern has changed very much in contemporary Norway (see next section), the effect on marital stability may also have changed. In particular, premarital fertility has apparently gained more and more acceptance in the population, and we believe that as a result, the impact of a premarital birth may have changed over successive marriage cohorts – not only if we consider the entire group of women who have a child when they marry, but also if we concentrate on those who marry the father of their child. Another aspect worth consideration is whether the impact of first-birth timing on the divorce rate also depends on age at marriage.

These interactions have been under scrutiny by other demographers, who have not had the opportunity to focus on, for instance, women who have a child out of wedlock and subsequently marry the father of the child. Billy et al. (1986) and McLaughlin et al. (1986) argue that the birth–marriage sequence has a long-term effect in the United States, whereas Morgan and Rindfuss (1985) found that a 'premarital birth affects the likelihood of marital disruption only at early marital durations'. According to some American researchers, the effect of first-birth timing has not been constant across the marriage cohorts. Billy et al. (1986), McLaughlin et al. (1986) and O'Connell and Rogers (1984) have observed that the effect is somewhat smaller for recent cohorts than it was some year ago. On the other hand, Castro and Bumpass (1987) observed an increasing influence of a premarital birth over the last ten years. Morgan and Rindfuss (1985), however, found no change in the effect of the marriage-birth sequence.

2. Norwegian divorce trends and pattern of first-birth timing

Compared to other Scandinavian countries Norway has had rather low divorce rates, and the increase has been remarkably smooth during the last two decades. Divorce legislation has not been revised in this period, and that is probably the reason why there have been no sudden changes in the rates like those observed, for instance, in Sweden in the mid-1970s.

Given current duration-specific rates, about one third of marriages will be terminated by divorce. This proportion has more than doubled

since 1970. As in other countries, increased female economic independence and changes in family values are considered as two important driving forces behind this development. Drifting attitudes may in turn be a *result* of the emergence of 'modern' demographic behaviour.

An increasing proportion of first marriages in Norway take place after the birth of the woman's first child. This development goes hand in hand with a general weakening of the link between fertility and marriage and an increasing acceptance of informal cohabitation. For

Table 1
First-birth timing for selected cohorts and ages, per cent distribution.

Birth cohort	Age at marriage	First-birth timing					
		Before marriage with		Within		Childless at 24 months	Total
		Another man [a]	The husband	0–6 months	7–24 months		
1945–1949	17–19 years	1.0	5.2	70.9	15.0	7.9	100.0
1950–1954	17–19 years	1.3	7.7	67.5	13.5	10.0	100.0
1955–1959	17–19 years	2.2	12.0	58.2	15.4	13.2	100.0
1960–1964	17–19 years	0.9	16.2	49.4	17.8	15.7	100.0
1940–1944	20–22 years	1.7	3.9	41.8	30.4	22.2	100.0
1945–1949	20–22 years	1.8	4.4	44.6	27.5	21.6	100.0
1950–1954	20–22 years	2.4	8.6	36.1	24.6	28.3	100.0
1955–1959	20–22 years	2.3	12.2	28.0	24.4	33.1	100.0
1960–1964	20–22 years	1.7	15.4	27.6	23.6	31.7	100.0
1940–1944	23–25 years	2.2	4.3	29.0	34.8	29.7	100.0
1945–1949	23–25 years	3.3	4.9	26.3	32.1	33.3	100.0
1950–1954	23–25 years	4.6	8.6	21.3	28.6	36.9	100.0
1955–1959	23–25 years	3.6	11.7	19.2	27.6	37.9	100.0
1935–1939	26–29 years	4.6	6.7	24.2	35.6	28.9	100.0
1940–1944	26–29 years	5.0	5.4	23.6	34.3	31.7	100.0
1945–1949	26–29 years	7.4	7.5	21.1	32.0	31.9	100.0
1950–1954	26–29 years	7.7	10.9	20.2	32.2	31.1	100.0
1955–1959	26–29 years	6.2	12.5	21.4	28.2	31.7	100.0
1935–1939	30–34 years	6.7	7.4	21.1	31.6	33.3	100.0
1940–1944	30–34 years	10.8	7.2	19.6	29.4	33.0	100.0
1945–1949	30–34 years	11.9	10.1	19.6	27.7	30.7	100.0
1950–1954	30–34 years	12.6	12.6	21.8	24.7	28.3	100.0

[a] The proportion of women who have married someone other than the father of their child may be slightly overestimated. The reason for this is that the identification number of the father is missing for a few women. In these cases the father and the husband are assumed to be different persons.

instance, during the last 25 years out-of-wedlock fertility has escalated in Norway. In 1986 about 28 per cent of all newborn children had a mother who was not married, whereas the corresponding proportion around 1960 was less than four per cent. This sharp rise in the illegitimacy ratio is mainly caused by increasing premarital fertility.

In Norway during the last two decades there has not been much change in the proportion of brides who bring a child they conceived with another man into their marriage. As shown in table 1, the proportion has been about 2–4 per cent in the age groups where most marriages are contracted. For those who married in their thirties, however, there has been an increase from 7 to 13 per cent over the two decades.

On the other hand, it is becoming more and more common for a couple to start childbearing as unmarried and 'legalize' the union at a later stage. Among those who married when they were 20–22 years old in the mid-1960s, about four per cent had a child with their husband before marriage. Some 15–20 years later this figure was as high as 15 per cent. A similar development has occurred for all age groups. Fewer women are pregnant when they marry, however. In some age groups this has offset the increase in the premarital fertility, so that the proportion of brides who had a child before seven months had elapsed remained constant from the mid-1960s to the mid-1980s. In the age group 20–22, for instance, this proportion stayed at about 35 per cent. For the diminishing group of teenage brides, however, there has been a decrease from 77 to 67 percent, and for those marrying in their early thirties, there has been an increase from 35 to 47 per cent.

At the other end of the spectrum, it is interesting to note that about one third of the women who were not teenage brides were still childless after two years of marriage. The proportion of 'postponers' has increased for the youngest age groups over the last 20 years.

3. Data

Our analysis is based on individual marriage and birth histories for complete cohorts of Norwegian women born after 1935. The life histories are derived from the Central Population Register. This data source provides us with an excellent opportunity for detailed studies of a few purely demographic determinants of divorce.

The Central Population Register was established in October 1964. Everyone who has lived in Norway for some period after 1960 – however short – has been assigned an identification number and is included in the register. No one is ever removed from the register, but there are codes showing whether a person is a resident, has emigrated or is dead. Each individual is represented by a data record containing purely demographic information such as marital status, mother's and father's identification number etc. The register is continuously updated, but the history of codes, reflecting changes of status, is kept for analytical purposes. It has therefore been possible to construct individual histories – dating back to 1964 – of changes in marital status.

For those born after the register was established, the parents' identification numbers are included on the birth certificates and entered into the register when the newborn are entered. For older birth cohorts the parents' identification numbers were included for children who were living with their parents when the Population Census 1970 took place. This implies that the records contain indentification numbers of mothers and fathers for most children born after 1953.

Reorganizing this material, we have been able to create a file with birth and marriage histories for all Norwegian women born after 1935. These histories have been updated to 1984. The file also contains the identification number of women's husbands as well as the father of their children.

Since few women born after 1935 had a child before 1953, we have almost complete birth histories up to 1984 for the women in our data file. The marriage histories are complete from 1964. We have information about year of marriage for a large proportion of the women who married earlier, but to study the effects of first-birth timing we need the exact date. Consequently, we have focused on marriages contracted after 1964. Only first marriages are included in our analysis.

4. Method

We believe that the most suitable framework for this kind of demographic divorce analysis is the life course perspective. Accordingly, we have chosen hazard models as our main analytical tool. Such models will conveniently handle the problem of censored durations of

exposure, and they also serve to estimate the effects of covariates on the attrition process under investigation.

We have estimated divorce intensities for first marriages contracted after 1964 by women who were born 1935–1964 and who married when they were 17–34 years old. The intensities are assumed to be constant within duration segments of one or two years, and are estimated from the third year to the 20th year. (The first segment, called duration 3 in the tables, is from the second to the third wedding anniversary.) The reason why we start at two years duration is that we want to study the effect of being childless at that duration but having a child later on. Very few divorces are left out when we start at two years duration – partly because the divorcing spouses are required to have a separation period of no less than one year. Even among teenage brides in the 1980s, only a half per cent had divorced within two years.

We will not dwell on the technical details in this article, but we think it is appropriate to emphasize that the women contribute to the population at risk until they die, emigrate, or divorce, or until the end of the observation period is reached (31 December 1984).

We are going to show one example of divorce intensities calculated for separate groups of women, but in general the estimation is based on log-linear regression models. The parameters representing the effects of the different covariates are estimated with a computer program called LOGLIN (Olivier and Neff (1976)). Using these regression models, the intensities are presented as relative risks between categorical variables (relative to an arbitrarily chosen baseline group).

The following variables were selected for the analysis: birth cohort of the woman, her age at marriage, timing of her first birth, parity (her number of children and the age of the youngest child) and duration of marriage. These variables describe different aspects of the demographic situation at marriage as well as the demographic changes afterwards.

Factors related to the first-birth timing and current parity are seldom included simultaneously in divorce models. We think such an approach should be taken when the required data exist. We have observed that the effects of each of these variables change when the other is included – not the general pattern, but the size of the differences between the categories.

The women who have not had any children after, say, two years of marriage, form a heterogeneous group at a later duration (for which divorce rates are to be estimated): Some will progress to parenthood,

Table 2
Number of women still married after two years, by birth cohort and age at marriage.

Birth cohort	Age at marriage				
	17–19 years	20–22 years	23–25 years	26–29 years	30–34 years
1935–1939			259	5108	3574
1940–1944		11952	22914	11821	3842
1945–1949	18637	56192	34641	14037	4764
1950–1954	24650	50318	28858	13183	1266
1955–1959	19894	40692	20405	2211	
1960–1964	8794	9142			

while others will remain childless. Since it is well documented that childless couples have a very high divorce risk, we think it is important to treat them as a separate group. Using hazard models with covariates for both parity and first-birth timing, the childless are singled out.

We now turn to a short description of the selected categories. Table 2 shows the number of women included in our analysis and the cohort and age groups we have used.

As the observation period is from October 1964 to December 1984, there is a certain selection with respect to age and cohort. For instance, the 259 women in the 1935–39 cohort and age group 23–25 must have been born in 1939 and married at the age of 25 in order to be included among those who married after October 1964. Correspondingly, no women born in 1964 and marrying at the age of 22 are included among the 9142 in the 1960–64 cohort and 20–22 age group. This will influence some of the estimated parameters, primarily the main effects of cohort and age and the interaction effects with these two variables. However the bias is likely to be very small, and of little concern for us as our focus is on the timing effects.

Table 1, presented earlier, shows the categories we have used for first-birth timing, as well as the distribution over these categories.

We have also included a time-varying covariate in our models, namely the woman's parity. Since we have access to a complete birth history, we know the number of children and the ages of the children at the marital duration we study. We have chosen ten categories for this parity variable: three groups for the number of children (one child, two children, three or more children); three groups for the age of the youngest or the only child (0–6 years, 7–13 years, 14 years or older); and the childless as a separate group.

Table 3
Significance level of interactions.

Interaction [a]	Difference in log-likelihood [b]	Degrees of freedom [c]	Significance level [d]
First-birth timing * Duration	1485.4	44	10^{-281}
First-birth timing * Parity	1234.9	31	10^{-239}
Parity * Duration	1333.8	85	10^{-222}
Parity * Cohort	397.3	36	10^{-61}
Parity * Age	275.8	35	10^{-38}
First-birth timing * Cohort	149.3	20	10^{-21}
First-birth timing * Age	110.9	16	10^{-15}
Age * Duration	153.8	44	10^{-13}
Cohort * Duration	132.3	45	10^{-9}
Cohort * Age	37.8	13	10^{-3}

[a] The model includes five main effects and the indicated interaction.
[b] Log-likelihood (minus two times the logarithm of the likelihood, to be exact) of the interaction model being tested minus the log-likelihood of the main effects model.
[c] Number of parameters to be estimated in the interaction model minus the number of parameters to be estimated in the main effects model.
[d] Approximate figures when we use a χ^2-distribution with the degrees of freedom shown in the table.

We have estimated a variety of models – some comprising all individuals and all durations, and some estimated separately for each duration. In the main effects model in table 4 – which is of the former class – we have included all five factors we want to study. The structure of this simple model will be described briefly in the next section.

It turns out that some interactions should be taken into account in addition to the main effects. With five factors it is possible to construct ten first-order interactions (interactions between two factors). To test the significance of these interactions, we compared the main effects model with the model containing the main effects plus each of these interactions, and employed the likelihood ratio test. Table 3 shows the resulting significance levels for the interactions.

Because we have a large number of observations, the significance levels are very low compared to those conventionally used (0.05 or 0.01). If we confine ourselves to first-order interactions and search for a better and better fit by experimenting with different selections of interactions, we end up with a very complex model, and one that is almost impossible to interpret. In fact, if we use a significance level of, say, 0.05, all the models with nine interactions would be rejected in favour of a model with ten interactions.

We believe that the best procedure under such circumstances is to present several models – each of them including only a few interactions. In general the total selection of interactions when the data set is large should be made partly on the basis of significance tests (like those referred to in table 3), and partly on the basis of the a priori hypotheses or a judgement of the substantial importance of the interactions. In our analysis all the interactions with first-birth timing are – in one way or another – taken into account. However, we start with a simple picture based on a main effects model and intensities estimated separately for different groups of women.

5. Results from some simple estimations

As an elementary illustration (see fig. 1) of the effect of a premarital birth, we have calculated divorce intensities for women who were born 1940–1944, who married at age 26–29 and who were still married after two years (i.e., a small proportion of the marriages are left out because of divorce, death or emigration during the first two years of marriage). The total size of this group is 11821, but in fig. 1 we have picked out two subgroups: 638 women (5.4 per cent) who had a premarital child with their husband, and 4056 women (34.3 per cent) who had their first child within 7–24 months of marriage. The intensity is obviously higher in the first group. In fact, the partial probabilities of divorcing within 18 years are 15 per cent and seven per cent, respectively.

We now turn to the main effects model, where we included birth cohort, age at marriage, first-birth timing, parity and duration (see table 4). It appears that there is a considerable independent effect of first-birth timing. Women who had their first child 7–24 months after they married were chosen as the baseline group. The divorce risk for those who were pregnant at mariage was 1.63 times higher, and the risk for those who had a premarital child with the husband was 2.44 times higher. Having a child with another man before marriage is associated with a particularly high divorce risk – 6.11 times higher than for the baseline group. It also appears that the divorce risk is 0.70 times lower for women who wait more than two years to have their first child than it is in the baseline group.

As our aim is to study the impact of first-birth timing on divorce risks, we will refrain from commenting in detail on the other estimated

Table 4
Relative divorce intensities. [a]

Cohort	1935–1939		0.65
	1940–1944		0.84
	1945–1949 B		1.00
	1950–1954		1.17
	1955–1959		1.35
	1960–1964		1.77
Age at marriage	17–19 years		1.97
	20–22 years		1.28
	23–25 years B		1.00
	26–29 years		0.85
	30–34 years		0.73
Number of children	0		11.94
	1, 0–6 years		3.74
	7–13 years		3.56
	14+ years		2.25
	2, youngest	0–6 years B	1.00
		7–13 years	1.58
		14+ years	1.63
	3+, youngest	0–6 years	0.63
		7–13 years	1.20
		14+ years	1.72
First-birth timing	Before marriage		
	with another man		6.11
	with the husband		2.44
	Within 0–6 months		1.63
	Within 7–24 months B		1.00
	Childless at 24 months		0.70
Duration	3 years		0.36
	4 years		0.72
	5 years B		1.00
	6 years		1.20
	7 years		1.32
	8 years		1.42
	9–10 years		1.45
	11–12 years		1.38
	13–14 years		1.31
	15–16 years		1.35
	17–18 years		1.36
	19–20 years		1.36

[a] B = Baseline group.

parameters, which largely confirm results previously reported in the literature. A more thorough discussion of divorce determinants in Norway is given by Kravdal and Noack (1988) and Kravdal (1987).

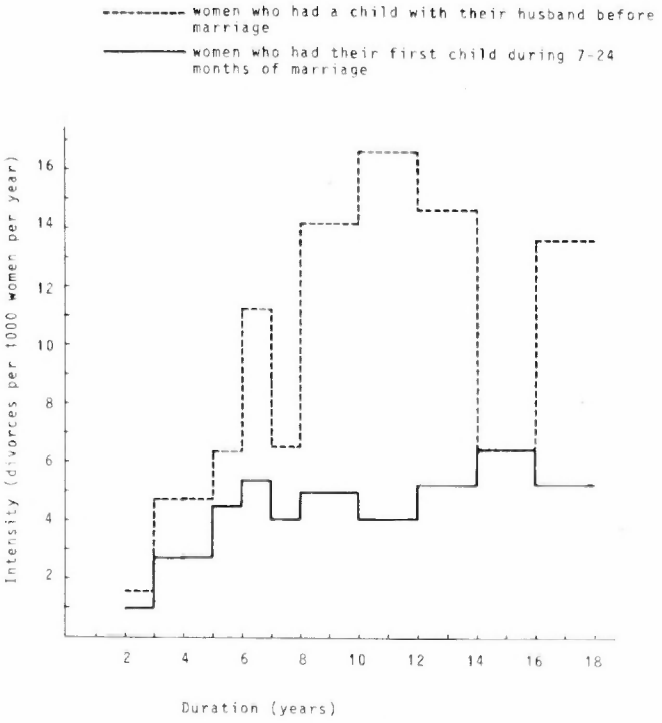

Fig. 1. Divorce intensities for two groups of women who were born 1940–1944 and married when they were 26–29 years old.

The most surprising result is perhaps that the divorce risks estimated in the multivariate models, as well as for the two separate groups in fig. 1, show no clear sign of decline over marital duration, which is often observed in other studies. Actually, when we calculated the intensities separately by age and cohort, we observed a marked turning point at about 5–7 years of marriage for women who were born after 1950 and who married before they reached the age of 23. After this 'marital cirsis' there is a decline. For the other age and cohort groups, divorce rates rise steeply during the first 5–7 years and are then virtually constant. A further elaboration of this finding is not within the scope of the article.

6. Variation of the timing effect by birth cohort and age at marriage

In the previous section we presented the main trends in the effects of first-birth timing, assuming that these effects were independent of the value of other covariates. As stated earlier, we also intend to study some interactions, and we start with a short description of how the birth–marriage sequence has affected the divorce risks in different cohorts.

The simple procedure that we have used is to estimate a model with all the main effects included, in addition to the interaction between first-birth timing and cohort. The likelihood ratio test showed that this interaction gave a quite large improvement of the model fit. Five interactions had a lower significance level than this interaction and four had a higher level (table 3).

According to this model with one interaction, the divorce risk for the birth cohort 1935–1939 was 3.74 times higher for women who already had a child with the husband when they married, than it was for those who had their child within 7–24 months of marriage. This factor fell to 2.16 for the 1950–1954 cohort and then increased to 3.25 for the 1960–1964 cohort.

A different picture was revealed when we estimated a more complex model in which all the five interactions with lower significance levels were included in addition to the interaction between first-birth timing and cohort. With such a model it is not possible to give a single figure for the relative divorce risk of the mothers with a premarital birth. The relative risk will depend on parity and duration. However, the relative risk in the 1935–39 cohort divided by the relative risk in the 1950–54 cohort is independent of the values of the other covariates, and is easily calculated from the estimated parameters in the interaction between cohort and first-birth timing. This quotient is 1.97, as opposed to 1.73 in the simple interaction model (3.74/2.16).

The corresponding quotient between the 1950–54 cohort and the younger cohorts is close to one. This implies that the relative risk of those who have a child with the husband before marriage decreases between the 1935–39 cohort and the 1950–54 cohort and subsequently remains almost constant. The relative risk in the oldest cohort is double of what it is in the 1950–54 cohort. We take this as our conclusion – believing that the most complex model with several important interactions serves as the best guide. We will also mention that a model

with all ten first-order interactions gives approximately the same results as the model with six interactions.

A similar discussion could be presented for the effect of postponing the first birth more than two years. Here we will only refer to the conclusion: that no changes in the effect could be detected across cohorts.

When we studied the interaction between age and first-birth timing in the same way, we found that a birth before marriage had a smaller effect on the divorce rate for teenage brides than for other women. No other interesting features were revealed.

7. Duration dependence of the timing effect

We now turn to a description of duration dependence, i.e., how the effects of first-birth timing on divorce risk vary across marriage duration. This is a more elaborate analysis than the one we have presented for the intercohort variation. In order to simplify our discussion of duration dependence, we have not included interactions between first-birth timing and cohort or age at marriage in the models. Whenever we write 'first birth before marriage' or similar expressions in this or the next sections, we refer to women who have a premarital child *with their husband*.

A first screening model, including all the main effects plus the interaction between first-birth timing and duration, indicated that the relative risk of divorce of women who have a premarital child with their husband decreases with increasing duration of marriage. However, in order to be on safer ground when we draw conclusions about duration dependence, we have based our arguments on more complex models. Since the significance tests in table 3 show that the interactions between parity and first-birth timing, parity and duration, and first-birth timing and duration all give a considerable improvement of the model fit, we decided to estimate duration-specific models including an interaction term between first-birth timing and parity. These models give results that differ somewhat from those obtained in the screening model – a fact which tends to justify the complexity.

Two of the duration-specific models are shown in table 5 as examples. These are for women married six years and 11–12 years. When the couples have been married for six years and have two children – the

Table 5
Relative intensities. Model estimated separately at various durations. [a]

Cohort		Age at marriage		Number of children		First-birth timing				
						Before marriage with		Within		Childless at 24 months
						Another man	The husband	0–6 months	7–24 months	
Duration six years										
1935–1939	0.68	17–19 yrs	1.92	0						13.74
1940–1944	0.79	20–22 yrs	1.32	1,	0–6 yrs	36.23 [b]	15.80	12.68	8.41	2.86
1945–1949 B	1.00	23–25 yrs B	1.00		7–13 yrs	29.96	9.39			
1950–1954	1.28	26–29 yrs	0.94		14+ yrs	23.57 [b]	– [d]			
1955–1959	1.42	30–34 yrs	0.76	2,	youngest 0–6 yrs	15.49	4.62	2.08	1.00 B	0.44
	2.25				7–13 yrs	11.59 [b]	10.49 [b]			
					14+ yrs	–	–			
				3+,	youngest 0–6 yrs	6.17	2.59	1.49	0.57	–
					7–13 yrs	–	–			
					14+ yrs	–	–			
Duration 11–12 years										
1935–1939	0.78	17–19 yrs	1.77	0						4.10
1940–1944	0.84	20–22 yrs	1.22	1,	0–6 yrs					2.14
1945–1949 B	1.00	23–25 yrs B	1.00		7–13 yrs	6.89 [b]	3.67	3.53	3.25	3.46
1950–1954	1.15	26–29 yrs	0.81		14+ yrs	8.58 [b]	4.66 [b]			
1955–1959	1.42	30–34 yrs	0.60	2,	youngest 0–6 yrs	3.67 [b]	1.60	1.32	1.00 B	0.84
					7–13 yrs	4.48	2.23	1.75	1.36	1.55
					14+ yrs	6.49 [c]	–			
				3+,	youngest 0–6 yrs	2.05	1.30	0.81	0.51	0.46
					7–13 yrs	3.39	2.16	1.54	1.12	–
					14+ yrs	–	16.12 [c]			

[a] B = Baseline group.
[b] Exposure time less than 500 woman years.
[c] Exposure time less than 100 woman years.
[d] – = Exposure time greater than 0, but no divorces.

youngest child being less than seven years of age – the divorce intensity is 4.62 times higher for women who had their first child prior to marriage than for those who waited till they had been married 7–24 months (the baseline group). The risk of those who waited more than two years (in the 'childless at 24 months' category) is even lower, only 0.44 of the baseline risk.

At a duration of six years, those who were married when they had the first child, could not possibly have a child older than seven years. At duration 11–12 years, however, some women with two children have a youngest child who is less than seven years, and some have a child aged 7–13 years. In both of these groups the divorce intensities are about 1.6 times higher for those who started childbearing before marriage than for those who had their first child within 7–24 months ($1.60/1.00 = 1.60$ and $2.23/1.36 = 1.64$). This factor, 1.6, is considerably lower than the factor 4.62 calculated above.

Waiting more than two years before having a child has no 'protective power' apparently, as the risk relative to those who had a child within 7–24 months was slightly less than one in one of the age groups ($0.84/1.00 = 0.84$), and slightly higher in another ($1.55/1.36 = 1.14$).

In fig. 2, which is derived from similar calculations, we show how the importance of first-birth timing changes over the marital life course. The parity is fixed at two. Groups with less than 500 woman years of exposure or fewer than ten divorces are not plotted. It appears that the high risk of the 'early starters' relative to the other group declines steadily across duration. In the duration interval 8–16, the women who had a premarital birth have about twice as high a divorce risk as women who had a child within 7–24 months of marriage. For the first seven years of the marriage, the risk of divorce is more than three times higher.

Some methodological comments on this approach are in order. The underlying assumption of the duration-specific models is that the timing effect at a certain duration is equal for all cohorts and age groups. However, different cohorts are involved at different durations, as is easily seen in table 5. Obviously, at long durations the estimates of the timing effect are based on the oldest cohorts only. From the cohort interaction we have inspected before, we know that the timing effect is *greater* for older cohorts. Therefore the fact that different cohorts are involved does *not* explain why the timing effect decreases with duration.

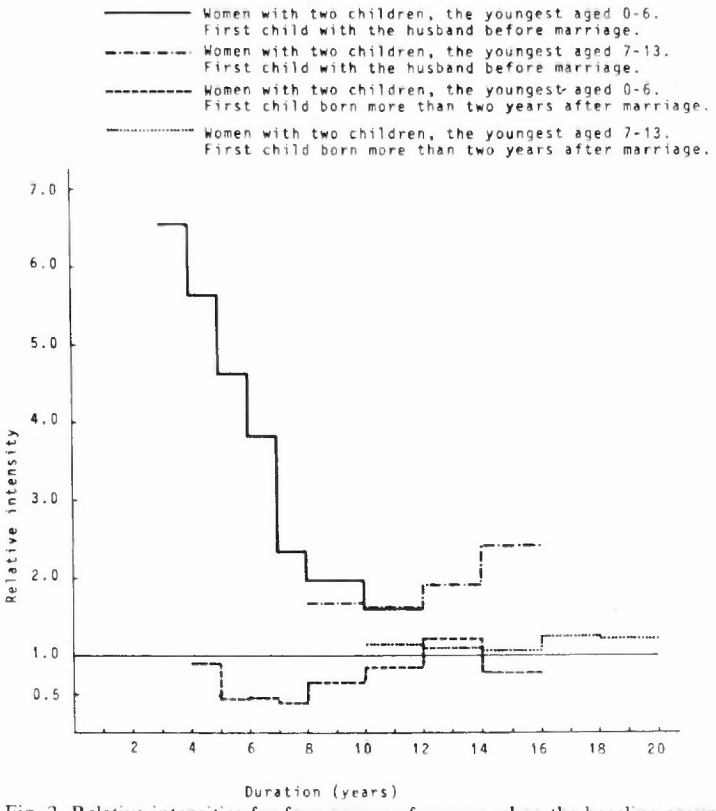

Fig. 2. Relative intensities for four groups of women when the baseline group consists of women with the same number of children and the same age of the youngest child, but who got the first child during 7–24 months of marriage.

At duration 6–10 years, divorce intensities are particularly low for women who had their first child more than two years after they married, compared to those who had their first child within 7–24 months of marriage. At longer durations these groups of women experience approximately the same level of divorce.

We have taken women with two children as our example. For women with one child and for those who have three or more children, the same main trends are revealed, but there are also a few differences. Here we will only point out that the divorce intensities of women who have had a premarital child, relative to women who had a child within 7–24 months, are generally smaller for women with one child.

8. Some interpretation problems

When divorce rates are estimated for groups of women according to their fertility status at marriage, it is usually taken for granted that the divorce differentials reflect the influence of the birth–marriage sequence itself or of some characteristics of those who have experienced a particular sequence. An alternative interpretation, which we have not seen discussed in the literature yet, is that the higher divorce intensities of those who had a child before marriage are partly caused by the fact that women in that category have older children than do women who were married when they had their first birth. It is documented in the literature that the divorce risks tend to increase with the age of the child (e.g., Becker et al. (1977)), and this is also confirmed by our results shown in table 4.

At a given duration of marriage, the age of the oldest child is given by the timing of the first birth. Consequently, it is impossible to estimate independent effects of both the oldest child's age and the timing. Let us take one-child mothers as an example of the interdependence of these variables: In the sixth year of marriage the divorce intensity among those who had a child before marriage is 1.88 times higher than among those who had a child within 7–24 months (15.80/8.41 = 1.88). However, in these two cases there is a difference in the age of the child as well. In the former case the child is over five years of age and in the latter case it is 3–4 years. The 'postponers' have an even younger child.

We can present similar arguments for women with two children. At a certain duration we know the age of the *oldest* child when the first-birth timing is given. In the sixth year of the marriage, for instance, those who had a first child within 7–24 months have an oldest child who is 3–4 years old, whereas those who gave birth prior to marriage, have an oldest child who is over five years. On average, the *youngest* child will probably also be younger in the first group. We control for the age of the youngest child with our parity variable, but that does not solve the problem as we have used rather wide age groups. A typical age of the youngest child in the first group would be two years, while it would be four years in the second – both within the age group category 0–6 years.

Our results are consistent with the view that these differences in the children's age can explain *part* of, but not the *entire* variation in the

divorce intensities. There is also room for a more traditional interpretation, for instance that the birth–marriage sequence has an effect in itself. At long marriage durations it is evident that the age effect cannot be the only explanation of the divorce differentials we observe. The reason for this is that there is still an impact of an early first birth, but no impact of a postponement. If factors other than the age of the youngest child have an impact at long durations, it is reasonable to assume that they should also have an impact at shorter durations.

It is not easy to estimate just how much the age effect contributes to the total variation of the divorce risks. We offer the following short argument in support of the view that the age effect can be of considerable magnitude.

Let us take the intensities at duration 11–12 years into consideration and concentrate on mothers with two children who have the first one within 0–6 months of marriage. (Using such a narrow group, the age differences of the oldest children are very small.) Some of these women have a youngest child who is younger than seven, and some have a youngest child who is older than seven. Assuming the most usual birth spacing, the average age in the first group will be close to seven years, and in the second group few children will be older than ten years. In table 5 we see that the divorce intensity in the second group is about 1.3 times higher than that of the first group (1.75/1.32 = 1.33). At durations 9–18 years, the corresponding differentials are between 1.0 and 1.5 (without a clear variation pattern). The conclusion of this inspection is that the age of the youngest child has a substantial impact. (In principle, this might of course be interpreted as a spacing effect rather than an age effect, but since we see no obvious reason why a long birth interval should tend to increase the divorce intensity, we will not speculate any further in this direction). As mentioned earlier, the divorce risk at marriage duration 11–12 years for women who had a premarital birth with their current husband, relative to the intensity of women who had the first child within 7–24 months, is about 1.6 (but somewhat larger for other durations after nine years). In the comparison between these two categories, the age difference between the oldest children is typically about two years, and it could be the same for the youngest children. Considering the results referred to above, an age difference of two years may account for a substantial proportion of a relative intensity that is about 1.6.

Our calculations, which are based on the three age groups 0–6, 7–13

and 14 or more, give only a rough impression of the independent effect of a child's age. We do not know, for instance, whether an age difference of a couple of years has more impact when the child is young than when it is older. To our knowledge, no answer to this question is reported in the literature. We are inclined to assume that, at least when the children are very young, a few years of age difference must affect the divorce risk to a particularly large extent. The argument for this is that the divorce process takes time, and it is not very likely that the couple would have a child after they had separated or decided to separate. Thus there are probably only a few couples who divorce when the child is only one year, while divorces are likely to be more common when the child is, say, three.

The fact that the relative risk associated with premarital births is particularly high at short durations, and higher for mothers with two children than for one-child mothers, is consistent with the assumption that the child's age plays a larger role the younger the child. It is also reasonable to expect a large contribution from the age effect when we compare the divorce rates of the 'postponers' with those of the women who have their child within 7–24 months of marriage. The former group is an open one, in the sense that the child is born two years after the marriage or later. Consequently the women in this group may have an almost newborn child at the duration studied.

9. Summary

In our opinion the most interesting result of this analysis is that couples who have a child out of wedlock and marry afterwards run a much higher risk of divorce than do those who have their first baby after seven months of marriage. In other words, the high propensity to divorce among women who already have a child when they marry is not confined to those who marry someone other than the biological father of their child. Premarital conceptions also increase the divorce risk, but not to the same extent as premarital births.

The timing of the first birth does not have as large an impact nowadays as it had 20 years ago. Women who have had a premarital child with their current husband have a divorce risk which has become increasingly like that of women who were childless at marriage. This probably indicates that the pressure to marry is weakening, or that the

group of unmarried (and usually cohabiting) mothers is less selective with respect to different individual characteristics. Norwegian couples who plan to marry and have children may be more and more indifferent to the timing of the birth relative to the marriage.

Another finding of our analysis is that the effect of a premarital birth on the divorce risk is slightly less pronounced for teenage brides than for women who are older when they marry.

We have also found that the effect of an early first birth decreases over the marital life cource, though it is still apparent after ten years of marriage. On the other hand, postponing the first birth is observed to have an effect within ten years of marriage only.

We have argued that the observed divorce differentials can be partly explained by an age effect: Those who have an early first birth have older children, and those who have a late birth have younger children. In particular, the high divorce rate at short durations for women with a premarital birth and the low rate for the 'postponers' can to a certain extent be explained by age effects.

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Paper VII

UNOBSERVED HETEROGENEITY IN MODELS OF MARRIAGE DISSOLUTION

By

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ABSTRACT

The goal of this paper is to examine the impact of unobserved heterogeneity when analysing the determinants of marriage dissolution. In the present analysis the parameter estimates of the explanatory variables appear to be insensitive to the omission of unobservables. The parameter estimates of the baseline hazard, however, are sensitive. When the unobserved heterogeneity is taken into consideration, the divorce risks increase steadily with duration. This supports the view that the declining hazard found in most studies of marital instability is due to a selection mechanism. Our analysis also demonstrates that the unobservables account for a considerable amount of the population variation in divorce propensity compared to the amount accounted for by the observed covariates.

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1. INTRODUCTION

During the last three decades, when the lifelong marital commitment has gradually lost some of its attraction in a large part of the world, several scholars have devoted their attention to studies of sociodemographic divorce differentials. A variety of factors have proved to be closely correlated with the propensity of marriage dissolution: age at marriage, number of children, the children's age, timing of first birth relative to marriage, age difference between the spouses, education of husband and wife, place of residence, occupation, income and employment status of both spouses, religious denomination, church attendance and other socioeconomic or family background characteristics (see e.g., Becker et al., 1977; Bumpass and Sweet, 1972; Castro and Bumpass, 1987; Cherlin, 1977; Hoem and Hoem, 1988; Menken et al., 1981; Teachman, 1983; Trussell et al., 1988)

To our knowledge all these variables have never been analysed simultaneously. A subset of the observed demographic and socioeconomic characteristics are usually included in the analysis, and it is implicitly assumed that these observed covariates include all systematic sources of variation in divorce propensity. Even if all the variables referred to had been included, however, it would not be possible to capture all heterogenity in the population. Human decision-making and behaviour is, of course, far too complex to be completely explained by a set of standard socioeconomic and demographic factors. A considerable amount of variation in marital instability is likely to be caused by variables that are not observed or can hardly be observed. It is, for instance, difficult to obtain sufficient measurements of factors like social environment, normative barriers associated with a marital break-up, or the thoroughness of the search for a suitable mate. In most analyses of divorce, it is therefore reason to believe that important explanatory factors are omitted. As is well known, failure to adequately control for unobservables can produce severe bias in the parameter estimates of the included covariates, as well as create a misleading impression of duration dependence. The last problem may arise because of a dynamic selection process. The idea is that married couples have different divorce intensities, and that those with high intensities are selected out of the marriage cohort over time, leaving those with low intensities behind. In this way one gets a selection of married couples that are more robust against divorce than the rest. Consequently, failure to control for heterogeneity may lead the researcher to misinterpret the observed duration dependence as true duration dependence at the individual level.

Our approach is to estimate hazard models based on data for complete marriage cohorts of Norwegian women born after 1935. The standard procedure of controlling for unobserved heterogeneity in hazard models is to assume a functional form for the duration distribution given observed and unobserved covariates and a parametric functional form for the distribution of unobservables (see, e.g. Heckman and Willis (1977) and Harris (1982)). In this paper we apply a

more flexible strategy proposed by Heckman and Singer (1982, 1984), where the distribution of unobservables is approximated by a multinomial distribution. Then the estimation problem consists of fitting mixing densities to data. This strategy has formerly been employed by Heckman and Singer (1984) for analysing durations of unemployment, by Trussel and Richards (1985) in a study of child mortality and second births, and by Montgomery (1987), who studied marriage formation and home ownership.

The primary goal of the present study is to examine the importance of a number of measured covariates of marriage dissolution in Norway compared to the importance of unobservables. Our focus is on judicial divorce in first marriage. To our knowledge, neither divorce nor separation has been analysed in the light of unobserved heterogeneity yet.

Secondly, we want to find out whether the duration dependence at the individual marriage level - controlling for unobservables - differs from that found on the basis of standard methods.

Our third goal is to test the sensitivity of the covariate effects estimates to the omission of unobservables.

Finally, we include a discussion of the importance of first birth timing, which is a divorce determinant we have previously paid particular attention to (Kravdal, 1988). Our intention is to see whether we can gain improved insight into the correlation between first birth timing and divorce when the unobserved heterogeneity is accounted for by the Heckman-Singer procedure.

2. SPECIFICATION OF THE STATISTICAL MODEL

Our basic framework is the standard proportional hazard model for single spell data assuming time invariant covariates. More precisely, the hazard function h is assumed to be of the form

$$\ln h(t|x,v) = \ln\psi(t) + \beta x + v \qquad (1)$$

where ψ is the baseline hazard, x is a vector of observed covariates and v is a variable that summarizes the effect of the omitted covariates. Then the distribution function of t given x and v, $F(t|x,v)$, satisfies

$$F(t|x,v) = 1 - \exp(-e^{\beta x+v} \int_0^t \psi(u)du) \qquad (2)$$

For reasons that will be explained in the next section, we have defined the duration observations to be from the beginning of the third year of marriage (t=0) and until divorce or the censoring time. Censoring may be due to death, emigration, widowhood, or having reached the end of the maximum observation time in our data set, which is 31 December 1984.

There are two distinct sources of variation in divorce propensity. The first is due to the fact that the spouses are making decisions under uncertainty. This is the reason why we have chosen a

stochastic framework and have modelled instantaneous divorce probabilities.

The second source of variation is due to individual differences in attitudes or preferences and in the environment the spouses face. This variation is partly caught by the included observed covariates and the remainder by unobserved covariates. This fact represents the motivation for including the heterogeneity component v into the model.

In our analysis we assumed that v either was equal to zero or multinomial distributed. Then the distribution $F(t|x)$ takes the following form

$$F(t|x) = \sum_{j=1}^{s} q_j[1-\exp(-e^{\theta_j+\beta x}\int_0^t \psi_j(u)du)] \qquad (3)$$

where $\sum_{j=1}^{s} q_j = 1$, and v is assumed multinomial with s cells and support points at locations $\theta_1,\theta_2\ldots,\theta_s$. The standard model without unobservables (v=0) is included in (3) and emerges for s=1.

Model (3) specifies that a randomly selected married couple has the probability q_j of belonging to group j where the marriage duration distribution is given by

$$F(t|x) = 1 - \exp(-e^{\theta_j+\beta x}\int_0^t \psi_j(u)du) \qquad (4)$$

In all but one of the model alternatives we have assumed that ψ_j is independent on j. This means that the intensity in one group($j=j_1$) is a constant multiple of the intensity in another group ($j=j_2$).

We have confined our study to situations where s is fixed equal to 2 or 3.

In the present analysis the baseline hazard ψ is assumed to be on the two following forms,

$$\psi(t) = c\lambda^c t^{c-1}(1+\lambda^c t^c)^{-1} \qquad (5)$$

or

$\psi(t)$ is a step function with 8 steps.

The step function parameters a_1 - a_8 correspond to intervals 0-1 year, 1-2 years, 2-3 years, 3-4 years, 4-5 years, 5-9 years, 9-11 years, 11-14 years. (By mistake step number 6 has been too wide, but this does not affect the main empirical conclusions that we draw in this paper.)

The specification in (5) means that the duration distribution is

log logistic. The hazard function is monotone decreasing from infinity if $c < 1$ and is monotone decreasing from λ if $c = 1$. If $c > 1$ the hazard increases from 0 to a maximum at $t = \lambda^{-1}(c-1)^{1/c}$ and decreases thereafter.

As λ becomes very small, the log-logistic can be approximated by $\psi=kct^{c-1}$ where k is a constant. The function ct^{c-1} is known as the Weibull hazard. In some of the estimated models the log-logistic hazard degenerates to a Weibull hazard.

The models are estimated by a maximum likelihood procedure. Let us assume that we have N women in our sample. Furthermore, it is assumed that the individuals are independent and that they have the probabilities F(t) of becoming divorced before time t. If N1 women divorce at time t_i, i=1,2,....,N1,respectively, and N-N1 women are censored (as married) at time z_i, i=N1+1,....,N, respectively, the likelihood L is given by

$$L = \prod_{i=1}^{i=N1} f(t_i) \cdot \prod_{i=N-N1}^{i=N} (1-F(z_i)) \qquad (6)$$

where f(t) is the derivative of F(t) with respect to t.

The maximum likelihood is found by applying an optimization routine in the NAG-library. This routine is based on a modified Newton-Rapson algoritm. Several initial values were tried, and they all gave the same parameter estimates. This is no guarantee, of course, that the global (and not only a local) maximum is reached. Standard deviations of the parameters are estimated by inverting the Hessian matrix (consisting of partial derivatives of the likelihood with respect to the parameters).

3. DATA

3.1 Individual life histories

Our analysis is based on individual marriage and birth histories for complete cohorts of Norwegian women born after 1935. The life histories are derived from the Central Population Register. Data from the three censuses in 1960, 1970 and 1980 are added. This gives information on the socioeconomic characteristics of the women, their husbands and their parents as well as place of residence and religious denomination. This data source provides us with an excellent opportunity for detailed studies of some divorce determinants that are supposed to be important.

The Central Population Register was established in October 1964. Everyone who has lived in Norway for some period after 1960 has been assigned an identification number and is included in the register. No one is ever removed from the register, but there are codes showing whether a person is a resident, emigrated or dead. Each individual is represented by a data record containing purely demographic information like marital status, mother's and father's

identification number etc. The register is continuously updated, but the history of codes, reflecting changes of status, is kept for analytical purposes. Therefore, it has been possible to construct individual histories - dating back to 1964 - of changes in marital status.

For those born after the register was established, the parents' identification numbers are included on the birth certificates and entered into the register when the newborn are entered. For older birth cohorts the parents' identification numbers were included for children who lived with their parents when the Population Census 1970 took place. This implies that the records contain identification numbers of mothers and fathers for most children born after 1953.

Reorganizing this material, we have been able to create a file with birth and marriage histories for all Norwegian women born after 1935. These histories are updated to 1984. The file also contains the identification number of the spouses as well as the fathers of the children.

Since very few women born after 1935 had a child before 1953, we have almost complete birth histories up to 1984 for the women in our data file. The marriage histories are complete from 1964. We have information about year of marriage for a large proportion of the women who married earlier, but to study the effects of a factor like first birth timing we need the exact date. Consequently, we have confined ourselves to marriages after 1964.

In the analysis presented in this paper we examine first marriages that were recently contracted when the 1970 census took place. Therefore, we have based this study on data for the 1968-1970 marriage cohorts. After some further limitations (to be described below) a population of 51000 women remained. 12 per cent cent of these marriages were dissolved by divorce before 31 December 1984.

3.2 Covariates included in the models

All covariates included in our models are constant during the observation period. In principle it would be possible, though much more complicated, to have time-varying covariates as well. It is well known from Norway (Kravdal, 1988) and other countries that the number of children and the age of the children have a considerable impact on divorce risks. Particularly the couples who are childless at a given duration of marriage, have a high propensity of subsequent divorce. Therefore, the childless are excluded in our calculations. We have focused on couples who are still married after two years, and who at that time have at least one child. It is not distinguished between those who at two years duration or at a later stage in the marital life course have one child and those who have more children. This will probably not affect the shape of the estimated hazard. By including the age of the child, however, the hazard might be depressed with increasing duration. Kravdal and Noack (1988) found that there was a sharper reduction of the intensity after 10 years of marriage if this variable was included than if it was left out. Stated otherwise: when the intensity does not show a more clear decline than we have observed

in simple estimates of intensity by duration, it is because the children are getting older.

A covariate that is of particular interest for us, is the timing of the first birth. There are four important categories for this variable:

1: Women who have got a child before marriage, and who have married another man than the father of the child.
2: Women who have got a child before marriage, and who have subsequently married the father of the child.
3: Women who have got their first child during 0-6 months of marriage.
4: Women who have got their first child during 7-24 months of marriage.

The distinction between the first two groups is based on the personal identification numbers of husbands and fathers in the life histories. In our analysis group 1, which is quite small and has a very high divorce rate, is left out.

Two other important variables are the age at marriage and the time at marriage. The inclusion of the latter variable needs some explanation:

The census data contains variables describing the situation as of 1 November 1970. For women married 1968-1970 we know , for instance, the education and the place of residence as of 1 November 1970. At that time some women in the actual marriage cohorts have been married for 22 months, others for only a day, and those marrying in November or December 1970 are still spinsters. We have information about the woman as well as her parents and her husband. However, if she is separated at the time of the census or (of course) if she is not yet married, the characteristics of the husband are missing. For that reason we have left out couples not registered as married at the time of the census. Consequently the population under study consists of women who have married January 1968 - October 1970, and who are not separated 1 November 1970. Because we want to assess the effect of first birth timing and exclude the currently childless, it is most convenient to observe the women (those who are still married by then) from their second marriage anniversary, i.e., January 1970 - October 1972. (This corresponds to t=0.) For those married in the beginning of 1968, there will be very few divorces in the fourth year of marriage (from the beginning of 1971), as those separated 1 November 1970 are excluded. For those marrying in, 1970 there will be more divorces during the fourth year (1973), as the few couples removed due to separation 1 November 1970 have already divorced. This selection problem is only relevant in the first years of the marriage, when divorce rates are very small. It is not likely that the parameter estimates, being based on observations up to as late as 1984, will be affected. Nevertheless, time at marriage (in months since January 1970) is included as a covariate. This is also because we cannot rule out from the outset that there is real effect of even such a small span in historical time, as divorce risks have escalated during the

last decades. It appears, however, that this variable has a small effect on the divorce rates. The difference in divorce intensity between January 1968 and October 1970 is not more than 20 per cent in any of the models estimated in the paper. Furthermore, the parameter estimates of the other covariates are not perceptibly changed when the time-at-marriage variable is excluded.

We will briefly describe the other variables that we have used and the categories. With one exception, which is clearly pointed out, they all refer to the situation as of 1 November 1970.

Place of residence: group 1: Non-rural parts of Eastern Norway
group 2: Rural parts of Eastern Norway, non-rural parts of Southern, Western, Middle and Northern Norway
group 3: Rural parts of Southern, Western, Middle and Northern Norway
(Norway consists of 5 main regions: Eastern, Southern, Western, Middle and Northern Norway.)

Woman's education and
husband's education : number of years at school (minimum 9, maximum 18)

Woman's educational activity and
husband's educational activity : student/not student

Her parents education (1 November 1960): group 1: missing, or not living with parents 1960
group 2: low
group 3: medium
group 4: high

Woman's taxable income per year and
husband's taxable income per year : 0-272000 (average: 7000 for women and 27000 for husbands)

Woman's occupation: group 1: no occupation
group 2: pedagogical, medical work
group 3: clerical work, sale, commerce
group 4: agriculture, forestry, fishing
group 5: industry, craft
group 6: hotel and restaurant work, charwork
group 7: technical work
group 8: post, telecommunication
group 9: other occupations

Husband's occupation: group 1: no occupation
group 2: pedagogical, medical work
group 3: clerical work, sale, commerce
group 4: agriculture, forestry, fishing
group 5: industry, craft

group 6: hotel and restaurant work, charwork
group 7: technical work
group 8: post, telecommunication
group 9: sea transport
group 10: other transport
group 11: military work
group 12: other occupations

"Other occupations" includes fairly small groups with widely different divorce rates: different kinds of service work, (buisiness) administration, police, firemen, religious work, juridical work, artists etc.

Woman's and husband's religious denomination:

group 1: both spouses members of the Norwegian Church
group 2: both spouses members of another religious society
group 3: none of them member of a religious society
group 4: other combinations

Age at marriage, time at marriage, education and income are treated as continuous covariates. These variables enter the model measured on the log scale and the log scale squared level. All other covariates are dummy variables.

4. EMPIRICAL RESULTS

The answers to the questions posed in the introduction are known to be quite sensitive to the functional form imposed on the hazard (Trussell and Richards, 1985). Accordingly, we believe that we will be on safest ground with a rather flexible structure. As stated in the methods section our primary choice has been the log-logistic function, which in our situation is either monotonically increasing within the relevant duration interval or rises to a maximum and then decreases. This functional form is also applied by Trussell and Richards (1985) and Montgomery (1987).

An increasing intensity during the first years of the marriage seems reasonable, as it, according to Norwegian law, takes at least one year between separation and judicial divorce. Besides, it takes time to build up a marital conflict and to make the final decision to split up. It is found in Norway, as well as in several other countries, that the divorce intensities (disregarding the possible effects of unobserved heterogeneity) level out or decline after 5-10 years. The log-logistic hazard will be able to fit such a pattern. There exists, however, very little theoretical guidance in specification of functional forms, but most authors emphasize that, in

general, investment in marital specific capital (e.g., a common social network) should make the intensity decrease with duration.

We have also estimated models based on a semiparametric hazard where the baseline hazard takes the form of a step function. As our data set contains as much as 51000 observations, there is no need to economize very much with the parameters, so we have chosen 8 parameters in this second baseline hazard.

Since our data material comprises a very large number of individuals we have had the opportunity to include several covariates in our models and divide into a fairly large number of levels within each covariate. The estimated effects of the covariates may therefore be of some interest for those engaged in studies of divorce differentials. We will, however, refrain from commenting on these differentials, as our main concern in the current paper is the insight gained by controlling for unmeasured heterogeneity.

4.1 Estimated models

In the remaining part of this paper we refer to the following 5 models:

Equal baseline models:

1. Log-logistic function, standard model without unobserved heterogeneity
   a. 3 covariates
   b. 5 covariates
   c. 14 covariates
2. Log-logistic function (in one case degenerating to a Weibull), Heckman-Singer model with unobserved heterogeneity
   a. 3 covariates
   b. 5 covariates
   c. 14 covariates
3. Step function, standard model without unobserved heterogeneity
4. Step function, Heckman-Singer model with unobserved heterogeneity

Unequal baseline models:

5. Log-logistic and Weibull function, Heckman-Singer model with unobserved heterogeneity
   14 covariates

4.2 The Heckman-Singer approach with log-logistic baseline hazard

The estimates for models with a log-logistic baseline hazard are given in tables 1, 2 and 3. In model 1a, which is a standard model, only a few important demographic variables (age and time at

marriage and first birth timing) are included as covariates. It appears that when we estimate a Heckman-Singer model with two support points (model 2a), -2 log L (L is the likelihood) is reduced by 37. This is a fairly large improvement of the model fit with only two additional parameters. The relative importance of the other covariates and the ranking of the categories does not differ very much from one model to the other, but the shapes of the hazards differ markedly. While there is a maximum at about 6 years duration in the standard model, the hazard is monotonically increasing for each of the two sub-populations according to the Heckman-Singer model. One sub-population, the high-risk group, comprises 10 per cent of the women, and the intensity in this group is 27 times higher than in the low-risk group (exp (3.3) = 27.1).

==> tab 1

When more covariates are added to the standard model, -2 log L is reduced by 554 (compare model 1c in table 2 and model 1a in table 1). This might seem to be a very large number, but one should keep in mind that as much as 37 parameters are added. We will not comment on the estimated covariate effects, but merely point out that the effect of first birth timing, in which we have taken a particular interest, actually is slightly increased when the other covariates are included. The high divorce risk among women with a birth prior to marriage is not explained by their socioeconomic characteristics.

==> tab 2

A Heckman-Singer model with two support points (model 2c) gives a further reduction of -2 log L (55 with 2 parameters). This means that although we have improved the model fit considerably by including several covariates, there is still room for further improvement. In terms of reduction of -2 log L the improvement is even better than the one obtained with a smaller number of covariates. Stated otherwise, the inclusion of more observables have not diminished the importance of taking the unobserved heterogeneity into account.

As noticed when we compared model 1a and model 2a, there are no important discrepancies between the corresponding parameter estimates of the two models. The variables have the same relative importance in models 1c and 2c, but the differences in divorce intensity between the different levels of the variables have increased. For example, the divorce intensity at age 18 is 3.3 times higher than at age 30 in model 1c and 5.0 times higher in model 2c. The divorce risk increases slightly with the woman's educational attainment, the difference being 7 per cent between elementary education and a master level, according to model 1c. Model 2c yields 8 per cent as a difference. There is a negative relationship between husband's education and the propensity of marital break-up. By comparing the same educational levels as above, we find that the divorce intensity is reduced by 40 per cent according to model 1c and

Table 1. Parameter estimates with standard errors in models based on log-logistic hazards

		Model 1a Standard model		Model 2a Heckman-Singer model (two support points)	
AGE AT MARRIAGE (years)	log	-31.737	(3.235)	-48.476	(4.673)
	$\log^2$	4.673	(0.527)	7.176	(0.754)
TIMING OF FIRST BIRTH	Before marriage	0		0	
	Within 0-6 months	-0.326	(0.044)	-0.446	(0.065)
	Within 7-24 months	-0.658	(0.047)	-0.912	(0.072)
TIME AT MARRIAGE (months/12)	log	842.290	(998.638)	1279.590	(1091.917)
	$\log^2$	-98.627	(117.738)	- 149.757	(128.735)
c		1.776	(0.046)	1.750	(0.041)
$\lambda \cdot 10^3$		11.669	(n.c.)	4.421	(0.912)
$\lambda^c \cdot 10^3$		0.369	(0.042)		
constant		-1746.909	(2117.632)	-2563.650	(2315.349)
q_1		-		0.099	(0.012)
Θ_1		-		3.303	(0.133)
-2 log L		50 273		50 236	

n.c.= not calculated

Table 2. Parameter estimates with standard errors in models based on log-logistic hazards

		Model 1c Standard model		Model 2c Heckman-Singer model (two support points)	
AGE AT MARRIAGE (years)	log	-29.529	(3.359)	-45.845	(4.574)
	$\log^2$	4.323	(0.547)	6.778	(0.738)
TIMING OF FIRST BIRTH	Before marriage	0		0	
	Within 0-6 months	-0.407	(0.045)	-0.542	(0.064)
	Within 7-24 months	-0.712	(0.049)	-0.953	(0.071)
TIME AT MARRIAGE (months/12)	log	1748.312	(1010.787)	2513.563	(1071.117)
	$\log^2$	-205.899	(119.179)	-295.914	(126.293)
PLACE OF RESIDENCE	Eastern Norway non-rural	0		0	
	Eastern Norway rural, remaining non-rural ..	-0.447	(0.027)	-0.614	(0.039)
	Remaining rural	-0.897	(0.045)	-1.207	(0.064)
LENGTH OF EDUCATION (years-10)	log	1.941	(6.709)	3.629	(8.505)
	$\log^2$	-0.190	(0.717)	-0.361	(0.907)
EDUCATIONAL ACTIVITY	not studying	0		0	
	studying	0.286	(0.073)	0.392	(0.100)
LENGTH OF EDUCATION FOR HUSBAND (years-10)	log	-1.872	(4.322)	-4.444	(5.473)
	$\log^2$	0.123	(0.458)	0.369	(0.578)
EDUCATIONAL ACTIVITY FOR HUSBAND	not studying	0		0	
	studying	-0.080	(0.053)	-0.128	(0.071)
INCOME (/1000+1)	log	0.087	(0.046)	0.095	(0.061)
	$\log^2$	-0.017	(0.015)	-0.015	(0.020)
INCOME FOR HUSBAND (/1000+1)	log	0.223	(0.056)	0.280	(0.076)
	$\log^2$	-0.087	(0.013)	-0.115	(0.017)
OCCUPATION	no occupation, unknown .	0		0	
	pedagogical work, medical work	-0.174	(0.064)	-0.214	(0.083)
	clerical work, sales work	-0.028	(0.047)	-0.045	(0.063)
	agriculture etc.	-0.361	(0.180)	-0.380	(0.206)
	industry, craft etc. ...	0.097	(0.061)	0.152	(0.084)
	hotel, restaurant work, charwork	0.188	(0.060)	0.250	(0.084)
	technical work	0.021	(0.155)	0.069	(0.200)
	post, telecommunication	-0.015	(0.098)	-0.065	(0.132)
	other occupations	0.186	(0.091)	0.259	(0.128)

(cont.)

Table 2 cont.

OCCUPATION FOR HUSBAND	no occupation, unknown	0		0	
	pedagogical work, medical work	-0.054	(0.111)	-0.026	(0.147)
	clerical work, sales work	-0.131	(0.091)	-0.154	(0.124)
	agriculture etc.	-0.509	(0.113)	-0.648	(0.148)
	industry, craft etc.	-0.137	(0.086)	-0.162	(0.119)
	hotel, restaurant work, charwork	0.369	(0.107)	0.531	(0.151)
	sea transport	0.449	(0.105)	0.659	(0.149)
	other transport	-0.037	(0.093)	-0.042	(0.128)
	technical work	-0.228	(0.108)	-0.263	(0.144)
	military work	-0.190	(0.094)	-0.235	(0.130)
	post, telecommunication	-0.022	(0.143)	0.031	(0.192)
	other occupations	0.144	(0.099)	0.207	(0.136)
PARENTS' EDUCATION	unknown, not living with parents	0		0	
	low	-0.176	(0.065)	-0.231	(0.088)
	medium	-0.102	(0.080)	-0.161	(0.109)
	high	0.342	(0.100)	0.441	(0.137)
COUPLE'S RELIGION	both Norwegian Church	0		0	
	both other rel. society	-0.685	(0.159)	-0.872	(0.187)
	none of them member of rel. society	0.665	(0.127)	0.888	(0.182)
	other combinations	0.236	(0.049)	0.341	(0.069)
c		1.773	(0.046)	1.750	(0.040)
$\lambda \cdot 10^3$		11.376	(n.c.)	4.931	(0.839)
$\lambda^c \cdot 10^3$		0.357	(0.040)		
constant		-3661.484	(2143.094)	-5258.126	(2270.672)
q_1		-		0.137	(0.016)
Θ_1		-		3.087	(0.120)
-2 log L		49 719		49 664	

n.c.= not calculated

45 per cent according to model 2c. The same structure is revealed for the categorical covariates, as is more clearly seen directly from the table. For instance, the divorce risk for women with a premarital birth relative to women who get their first child as married, is increased from 2.0 in model 1c to 2.6 in model 2c. Likewise, the risk in non-rural parts of Eastern Norway relative to the rural parts of Southern, Western, Middle and Northern Norway is increased from 2.5 to 3.4. Such a magnification of the covariate effects is also found by Trussell and Richards (1985) in their study of second births, where they used a log-logistic hazard and two support points.

In figure 1 we have plotted the predicted intensities for a particular group of women in order to illustrate the different shapes of the hazards, as well as the difference in intensity between the high-risk group and the low-risk group. The intensities for other categories of women have the same profile, but are generally smaller or larger.

==> fig 1

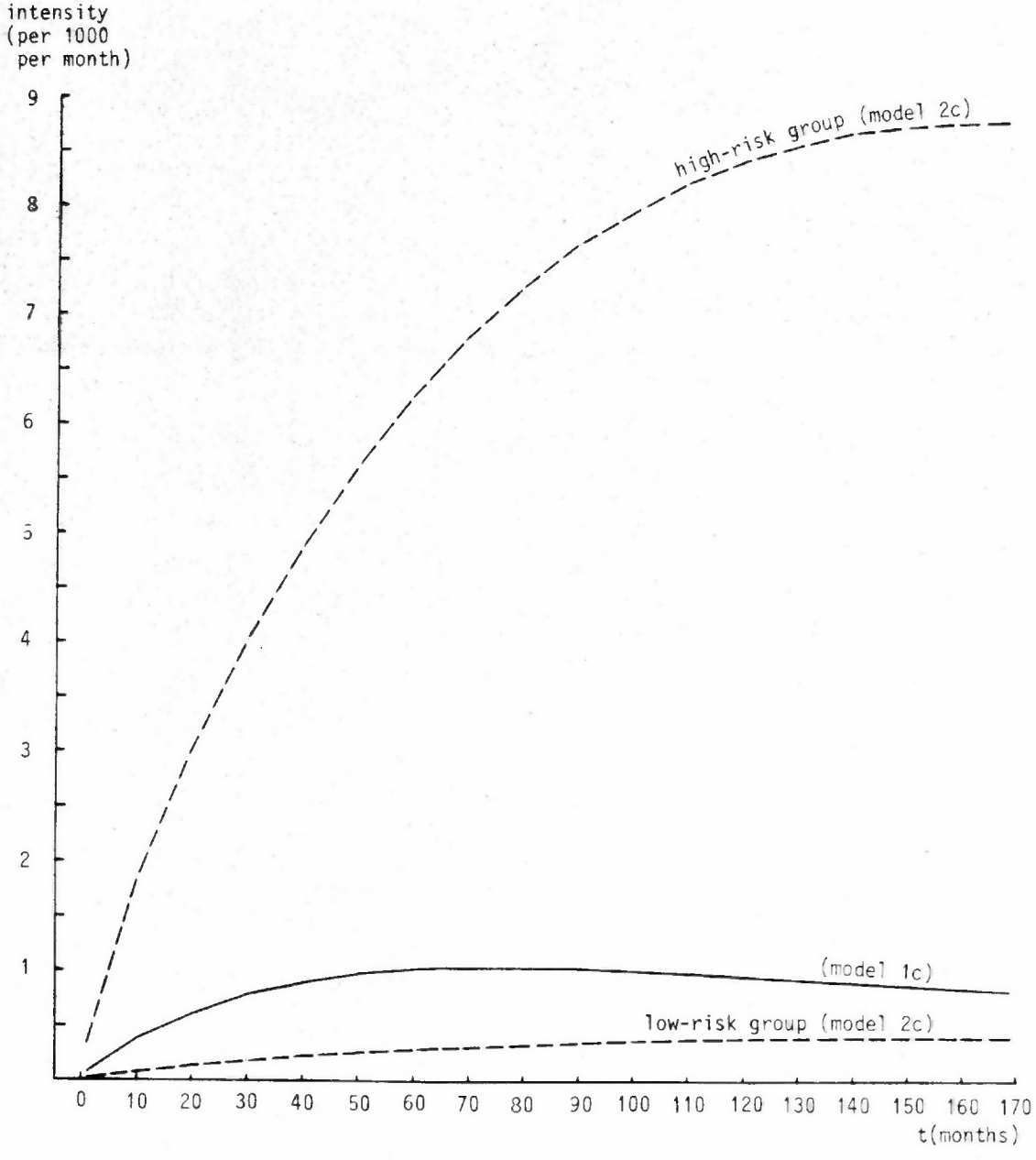
It is clearly seen that the baseline hazard has a different shape when the Heckman-Singer procedure is used (model 2c) than when we use a standard model (model 1c). The profiles resemble those found in model 1a and 2a. When we use a Heckman-Singer model, we get a hazard that rises with increasing duration, though with a gradually smaller steepness. According to the standard model, however, the hazard has a maximum at about 6 years duration. The shape of this hazard is illustrated more clearly in figure 2.

==> fig 2

It also turns out that the proportions of women in the high- and low-risk groups in model 2c and the difference between the intensities of these two groups are quite close to that found for model 2a. About 14 per cent of the women are in the group with a very high divorce risk. Actually, the risk is 22 times higher than for the remaining 86 per cent of the marriage cohort. In other words, we are fairly close to a socalled "mover-stayer" situation. A small group experience that a very large proportion divorce, while the majority have quite few marital breakdowns. Among the female population selected when drawing figure 1, the proportion of divorce predicted according to model 1c is 13.7 per cent, while model 2c gives 67.1 per cent in the high-risk group and 5.0 per cent in the low-risk group. (These proportions are the contributions to F(t) in equation (3) from the two sub-populations.)

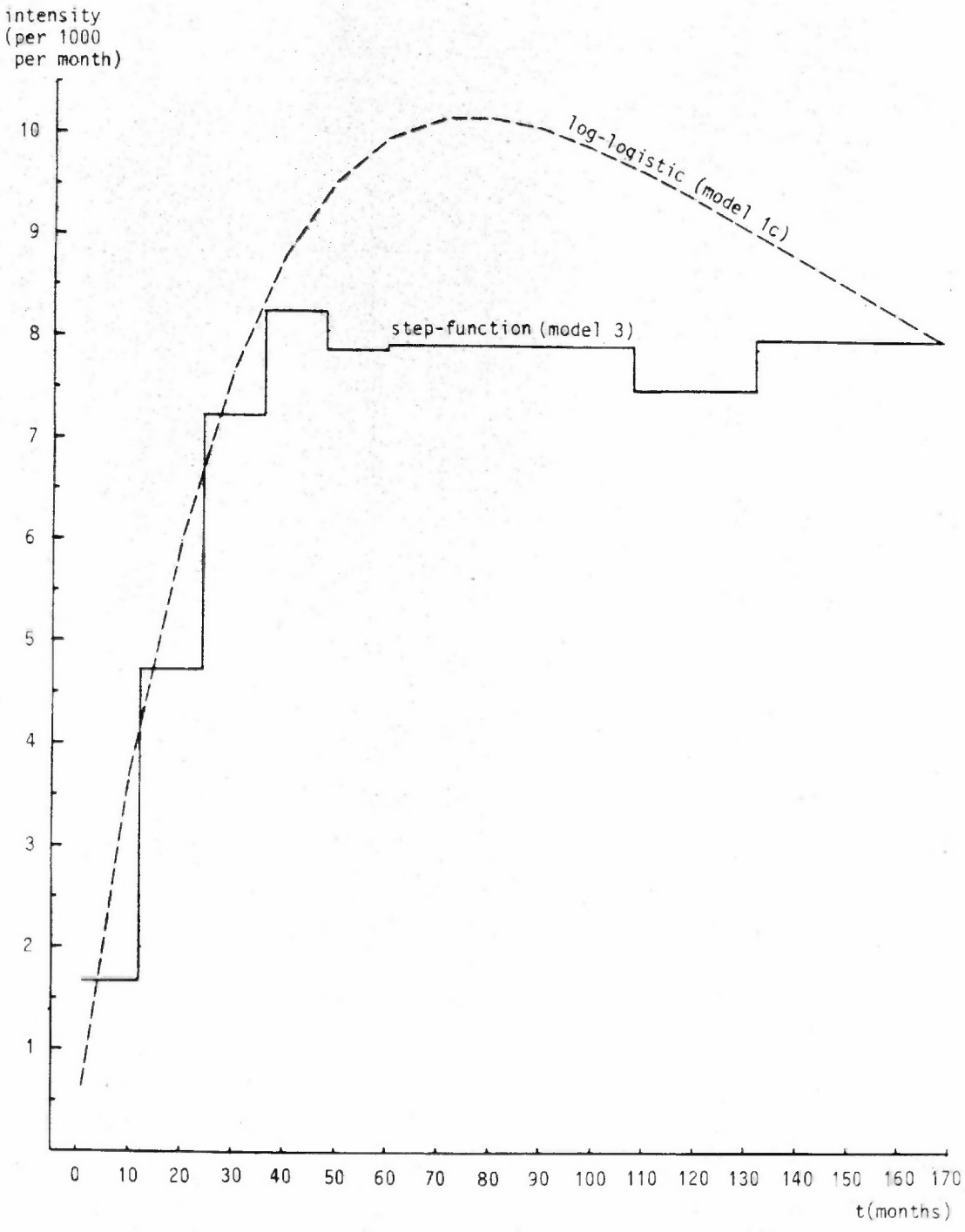
Employing a more flexible model (model 5) with different c and λ for each of the two subgroups (i.e. c_1, λ_2 for j=1 and c_2, λ_2 for j=2 in equation (3)) we obtain a further increase in goodness of fit by a reduction of 10 measured by -2 log L. The estimates are given in table 3, and predicted intensities are plottet in figure 3. We get a much larger high-risk group than in the equal baseline intensity model; 29 per cent of the women are in the high-risk group.

Figure 1. Predicted intensities[1] based on model 1c and model 2c



1) For women who marry at age 22 in the middle of 1968, who have their first child more than 7 months after marriage, who have income 5000, who have a husband with income 40000, who have 9 years of schooling, and who have husbands with 9 years of schooling. With respect to the other covariates the women are assumed to belong to the baseline categories.

Figure 2. Shape of hazard[1] according to model 1c and 3



1) Adjusted with a multiplicative factor so that both curves end in the same point.

Furthermore, the intensity profile for this group shows a clear maximum. For the low-risk group, however, the intensity increases with duration. With a log-logistic function for the low-risk group it was difficult to find a maximum of the likelihood. However, it was obvious that λ would be very small for the low-risk group, so we substituted with a Weibull function: $\psi(t) = k \cdot c \cdot t^{c-1}$, which is a good approximatiation to the log-logistic as λ becomes small. The constant k was considered as a part of the constant term in the β-vector. The resulting maximum likelihood turned out to be virtually identical to the one we obtained with a log-logistic hazard when we terminated the non-converging search process.

==> tab 3

==> fig 3

According to model 5 the intensity for the high-risk group relative to the low-risk group depends on duration. The relative intensity is very high in the first stage of marriage, but is only 17 at 10 years and 6 at 14 years. The average value (obtained by comparing integrals under the intensity curves) is 22, which is equal to the result we found with the equal baseline intensity model (model 2c). The corresponding divorce probabilities, which are 67 and 5 per cent according to model 2c, are 39 and 2 per cent according to model 5. In other words, we are even closer to a "mover-stayer" situation.

We have also estimated equal baseline models with three support points (see model 2c, table 3). The reduction of -2 log L is not negligible: 13 with 2 additional parameters. According to the estimated model, a small group of married couples (about 6 per cent) are found to have a very high intensity, a larger group (about 23 per cent) a medium intensity, and the remaining women have very stable marriages. We cannot rule out the possibility that a further increase to four support points would have given even greater improvement of the model fit, but due to the very long CPU-times required to estimate our most complex models, we have not given priority to an eleboration of this matter.

4.3 The Heckman-Singer approach with semiparametric baseline hazard

It is interesting to note that we obtain almost the same results when we employ a semiparametric baseline hazard. Particularly the parameter effects for the covariates and the size and relative intensities of the high-risk and low-risk groups (see table 4) are very close to those estimated in models where we assumed a log-logistic baseline hazard (see table 2). The shape of the hazards do not differ much either. In figure 2 we have shown the shapes according to the standard models 1c and 3. (As we are interested in the shape rather than the absolute size, the scale is not important. For convenience the curves are ajusted with a multiplicative factor so that they end in the same point.) It appears that the semiparametric

Table 3. Parameter estimates with standard errors in models based on log-logistic and Weibull hazards

		Model 2c Heckman-Singer model[1] (three support points)		Model 5 Heckman-Singer model with unequal baselines[2] (two support points)	
AGE AT MARRIAGE (years)	log	-53.253	(5.342)	-44.504	(4.317)
	$\log^2$	7.884	(0.859)	6.616	(0.695)
TIMING OF FIRST BIRTH	Before marriage	0		0	
	Within 0-6 months	-0.621	(0.074)	-0.527	(0.061)
	Within 7-24 months	-1.092	(0.083)	-0.905	(0.067)
TIME AT MARRIAGE (months/12)	log	2091.983	(1201.016)	1933.770	(1132.484)
	$\log^2$	-246.108	(141.610)	-227.477	(133.533)
PLACE OF RESIDENCE	Eastern Norway non-rural	0		0	
	Eastern Norway rural, remaining non-rural	-0.697	(0.047)	-0.575	(0.037)
	Remaining rural	-1.367	(0.076)	-1.113	(0.059)
LENGTH OF EDUCATION (years·10)	log	3.653	(9.392)	2.456	(7.896)
	$\log^2$	-0.365	(1.001)	-0.243	(0.842)
EDUCATIONAL ACTIVITY	not studying	0		0	
	studying	0.469	(0.121)	0.416	(0.099)
LENGTH OF EDUCATION FOR HUSBAND (years·10)	log	-6.097	(6.231)	-2.729	(5.086)
	$\log^2$	0.531	(0.658)	0.200	(0.538)
EDUCATIONAL ACTIVITY FOR HUSBAND	not studying	0		0	
	studying	-0.167	(0.081)	-0.101	(0.066)
INCOME (/1000+1)	log	0.133	(0.070)	0.091	(0.056)
	$\log^2$	-0.025	(0.022)	-0.016	(0.018)
INCOME FOR HUSBAND (/1000+1)	log	0.307	(0.086)	0.270	(0.071)
	$\log^2$	-0.130	(0.020)	-0.108	(0.016)

(cont.)

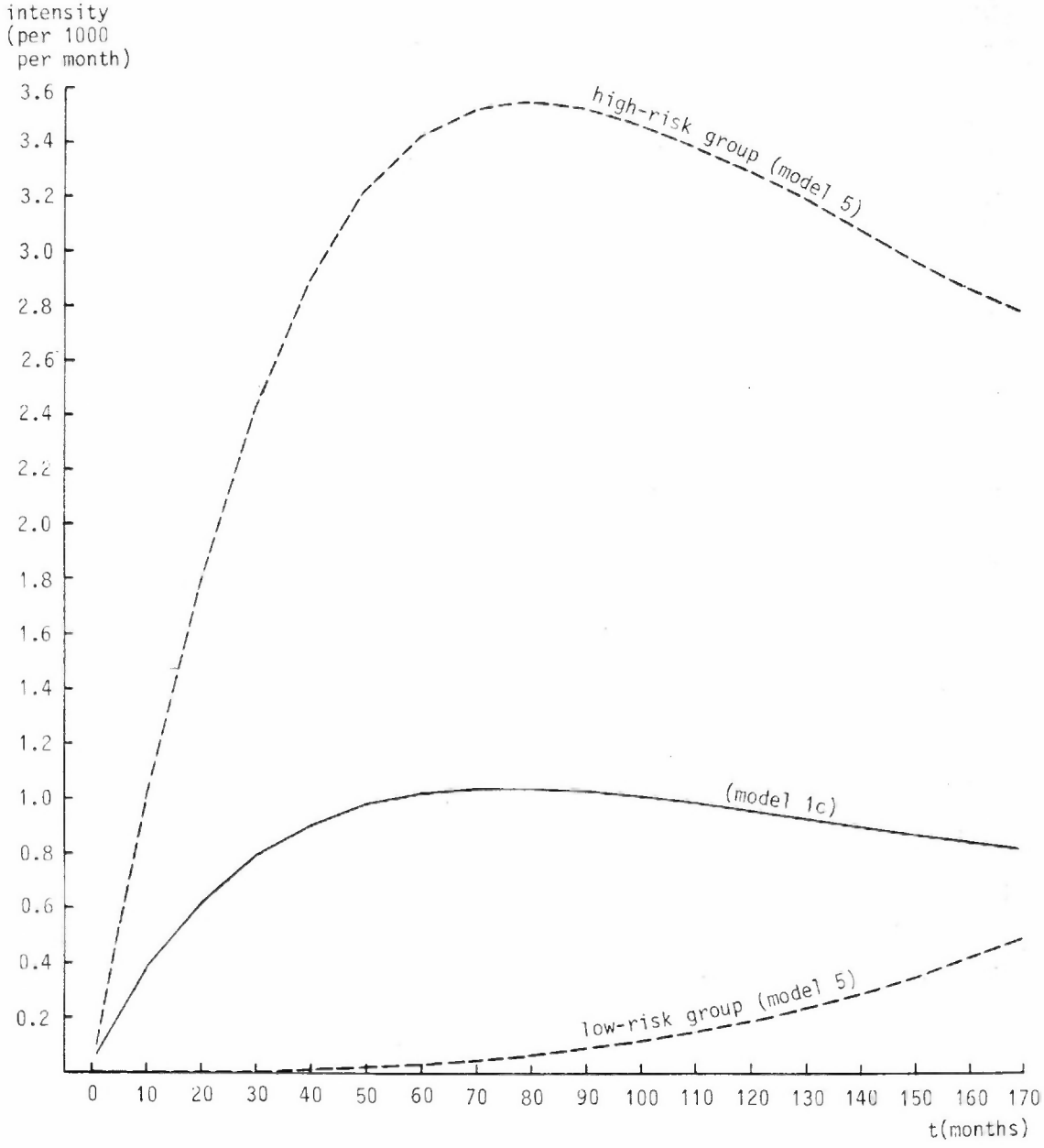
[1]) log-logistic hazards

[2]) log-logistic hazard (defined by c_1 λ_1) and Weibull hazard (defined by c_2)

Table 3 cont.

OCCUPATION	no occupation, unknown	0		0	
	pedagogical work, medical work	-0.234	(0.094)	-0.182	(0.077)
	clerical work, sales work	-0.055	(0.072)	-0.024	(0.058)
	agriculture etc.	-0.413	(0.228)	-0.360	(0.195)
	industry, craft etc.	0.188	(0.095)	0.160	(0.079)
	hotel, restaurant work, charwork	0.302	(0.097)	0.236	(0.079)
	technical work	0.035	(0.228)	0.073	(0.190)
	post, telecommunication	-0.092	(0.147)	-0.062	(0.119)
	other occupations	0.280	(0.144)	0.283	(0.119)
OCCUPATION FOR HUSBAND	no occupation, unknown	0		0	
	pedagogical work, medical work	-0.032	(0.164)	0.000	(0.135)
	clerical work, sales work	-0.173	(0.140)	-0.110	(0.113)
	agriculture etc.	-0.769	(0.168)	-0.553	(0.136)
	industry, craft etc.	-0.198	(0.134)	-0.116	(0.108)
	hotel, restaurant work, charwork	0.616	(0.174)	0.553	(0.141)
	sea transport	0.737	(0.166)	0.643	(0.137)
	other transport	-0.058	(0.145)	0.003	(0.118)
	technical work	-0.293	(0.162)	-0.209	(0.132)
	military work	-0.254	(0.147)	-0.172	(0.119)
	post, telecommunication	0.039	(0.214)	0.006	(0.177)
	other occupations	0.262	(0.152)	0.228	(0.124)
PARENTS' EDUCATION	unknown, not living with parents	0		0	
	low	-0.236	(0.100)	-0.169	(0.081)
	medium	-0.148	(0.123)	-0.091	(0.100)
	high	0.545	(0.158)	0.440	(0.126)
COUPLE'S RELIGION	both Norwegian Church	0		0	
	both other rel. society	-0.988	(0.217)	-0.802	(0.177)
	none of them member of rel. society	1.192	(0.227)	0.944	(0.189)
	other combinations	0.381	(0.078)	0.313	(0.065)
c_1		1.858	(0.048)	1.918	(0.054)
c_2		-		3.702	(1.009)
$\lambda_1 \cdot 10^3$		3.281	(0.872)	11.930	(1.100)
constant		-4349.796	(2546.413)	-4050.440	(2400.647)
q_1		0.056	(0.010)	0.289	(0.037)
q_2		0.230	(0.042)	-	
Θ_1		5.191	(0.327)	21.627	(5.297)
Θ_2		3.010	(0.209)	-	
-2 log L		49 651		49 654	

Figure 3. Predicted intensities[1)] based on model 1c and model 5



1) see note 1 figure 1

hazard has an almost constant level from 6 years duration, while there is a decline for the log-logistic hazard. Based on a log-logistic hazard it is actually impossible to obtain a sudden change from a steep rise to a virtually constant level. Figure 4 shows a similar plot for the shapes obtained for the Heckman-Singer models 2c and 4. In this case the two hazards have almost identical shapes.

==> tab 4

==> fig 4

4.4 Brief discussion of the duration dependence

The commonly observed divorce profile - with a steep rise in the initial stage of the marriage and a subsequent reduction or levelling out - is, according to our results, explained primarily by a selection mechanism. Apparently, the decline of the observed hazard in standard models is due to a very quick thinning-out of the most divorce-prone women (the high-risk group in for instance model 2c). It is somewhat surprising that according to the most flexible model (model 5) the divorce risk within the low-risk group keeps rising over the entire 14 years interval that we study. The longer the marriage has lasted, the more likely is the subsequent break-up. A similar profile was found for both high- and low-risk groups according to model 2c. This pattern could be consistent with an hypothesis that the spouses little by little "wear each other out".

Traditional theories contrast in a very marked way with our empirical suggestions that marriages are becoming more and more weak. Having the empirically observed hazard in mind, it has often been argued among demographers that investment in socalled marital specific capital (see e.g., Becker et al., 1977) tends to reduce divorce rates by increasing duration of marriage. Sticking to the economist concepts, we might say that this capital includes "goods" which are not so easily enjoyed when the marriage is broken, and which may be more valuable relative to other "goods" the longer the marriage has lasted. Of crucial importance is, for instance, contact with children, housing facilities that have gradually been built up through joint efforts, and the social network which has been created around the nuclear family.

In this connection we would like to repeat what we briefly mentioned previously: If we include number of children, and in particular the age of the youngest child, as time-varying covariates, we might have forced the hazard to decrease or level out after some years of marriage.

4.5 Importance of unobservables compared to the observed variables

It seems reasonable to give some consideration to the widely differing prevalence of divorce in the high-risk group compared to the low-risk group. The divorce risk in the high-risk group relative to the low-risk group is as large as 22 in model 2c (table 2), while a

Table 4. Parameter estimates with standard errors in models based on step-function hazards

		Model 3 Standard model		Model 4 Heckman-Singer model (two support points)	
AGE AT MARRIAGE (years)	log	-29.536	(3.359)	-44.945	(4.442)
	$\log^2$	4.324	(0.547)	6.662	(0.716)
TIMING OF FIRST BIRTH	Before marriage	0		0	
	Within 0-6 months	-0.407	(0.045)	-0.525	(0.062)
	Within 7-24 months	-0.713	(0.049)	-0.917	(0.068)
TIME AT MARRIAGE (months/12)	log	1661.892	(973.509)	2308.690	(1056.972)
	$\log^2$	-195.525	(114.784)	271.769	(124.625)
PLACE OF RESIDENCE	Eastern Norway non-rural	0		0	
	Eastern Norway rural, remaining non-rural	-0.447	(0.027)	-0.592	(0.038)
	Remaining rural	-0.898	(0.045)	-1.159	(0.061)
LENGTH OF EDUCATION (years-10)	log	1.966	(6.710)	3.075	(8.188)
	$\log^2$	-0.193	(0.717)	-0.305	(0.873)
EDUCATIONAL ACTIVITY	not studying	0		0	
	studying	0.287	(0.073)	0.396	(0.097)
LENGTH OF EDUCATION FOR HUSBAND (years-10)	log	-1.868	(4.322)	-3.868	(5.269)
	$\log^2$	0.123	(0.458)	0.314	(0.557)
EDUCATIONAL ACTIVITY FOR HUSBAND	not studying	0		0	
	studying	-0.080	(0.053)	-0.125	(0.068)
INCOME (/1000+1)	log	0.087	(0.046)	0.093	(0.058)
	$\log^2$	-0.017	(0.015)	-0.015	(0.019)
INCOME FOR HUSBAND (/1000+1)	log	0.224	(0.056)	0.274	(0.073)
	$\log^2$	-0.087	(0.013)	-0.112	(0.017)
OCCUPATION	no occupation, unknown	0		0	
	pedagogical work, medical work	-0.174	(0.064)	-0.202	(0.080)
	clerical work, sales work	-0.028	(0.047)	-0.041	(0.060)
	agriculture etc.	-0.361	(0.180)	-0.376	(0.201)
	industry, craft etc.	0.097	(0.061)	0.149	(0.081)
	hotel, restaurant work, charwork	0.188	(0.060)	0.241	(0.081)
	technical work	0.021	(0.155)	0.065	(0.195)
	post, telecommunication	-0.015	(0.098)	-0.063	(0.125)
	other occupations	0.185	(0.091)	0.241	(0.123)

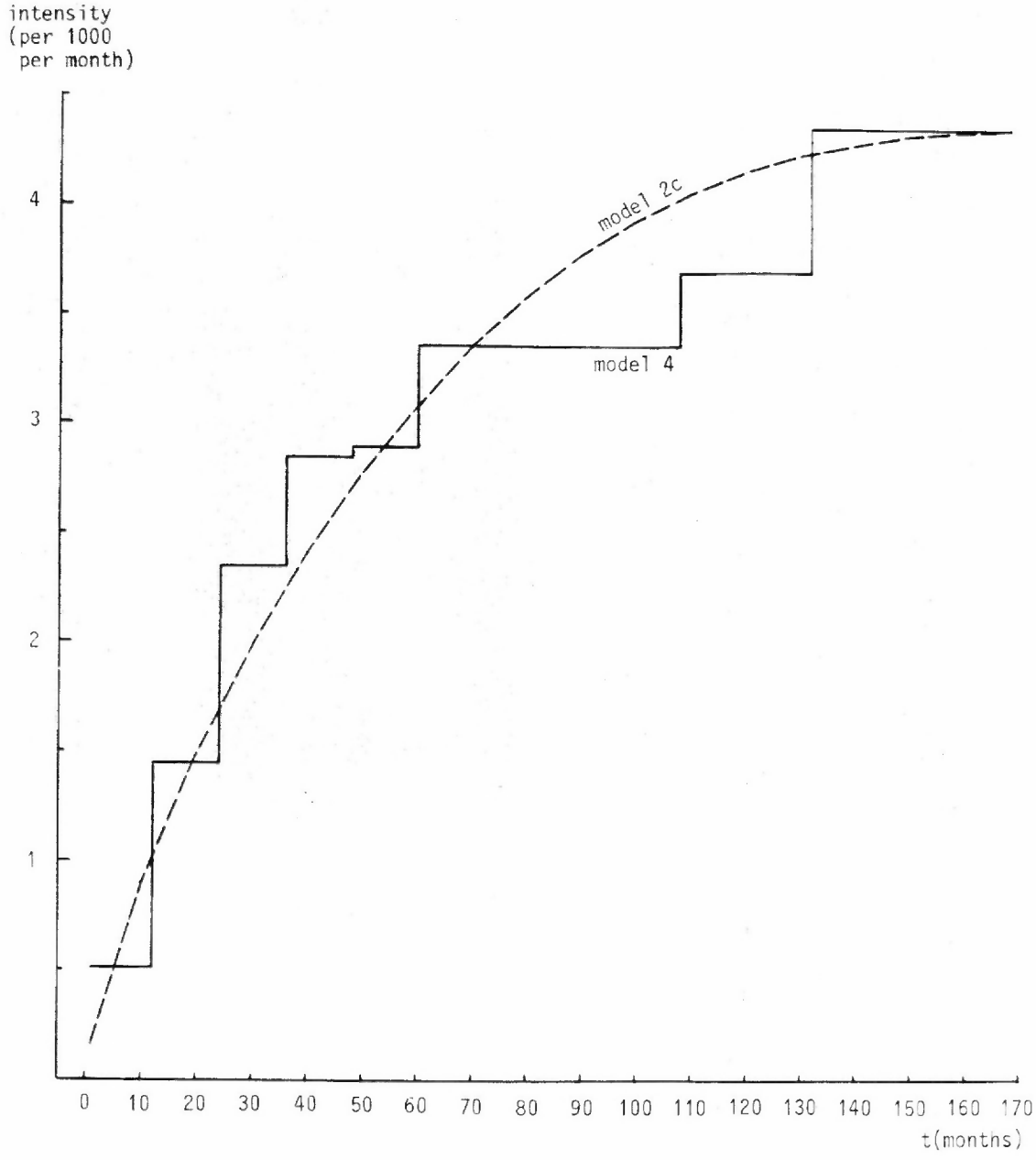
(cont.)

Table 4 cont.

OCCUPATION FOR HUSBAND	no occupation, unknown	0		0	
	pedagogical work, medical work	-0.054	(0.111)	-0.027	(0.141)
	clerical work, sales work	-0.131	(0.091)	-0.143	(0.119)
	agriculture etc.	-0.509	(0.113)	-0.613	(0.142)
	industry, craft etc.	-0.137	(0.086)	-0.153	(0.113)
	hotel, restaurant work, charwork	0.369	(0.107)	0.531	(0.145)
	sea transport	0.449	(0.105)	0.629	(0.143)
	other transport	-0.037	(0.093)	-0.038	(0.123)
	technical work	-0.228	(0.108)	-0.247	(0.138)
	military work	-0.198	(0.094)	-0.218	(0.124)
	post, telecommunication	-0.022	(0.143)	0.036	(0.185)
	other occupations	0.144	(0.099)	0.203	(0.130)
PARENTS' EDUCATION	unknown, not living with parents	0		0	
	low	-0.176	(0.065)	-0.208	(0.085)
	medium	-0.102	(0.080)	-0.133	(0.105)
	high	0.342	(0.100)	0.444	(0.132)
COUPLE'S RELIGION	both Norwegian Church	0		0	
	both other rel. society	-0.685	(0.159)	-0.836	(0.182)
	none of them member of rel. society	0.666	(0.127)	-0.897	(0.178)
	other combinations	0.236	(0.049)	0.324	(0.067)
constant		-3477.267	(2064.077)	-4826.083	(2240.838)
step function parameters:					
$a_1 \cdot 10^3$		1.791	(0.166)	0.985	(0.113)
a_2		5.023	(0.308)	2.836	(0.253)
a_3		7.696	(0.407)	4.579	(0.359)
a_4		8.778	(0.447)	5.564	(0.397)
a_5		8.368	(0.436)	5.647	(0.379)
a_6		8.431	(0.311)	6.556	(0.298)
a_7		7.963	(0.351)	7.214	(0.326)
a_8 [1]		8.500		8.500	
q_1		-		0.164	(0.023)
Θ_1		-		2.902	(0.115)
-2 log L		49 712		49 659	

[1] fixed to 8.500

Figure 4. Shape of hazard[1] according to model 2c and 4



1) see note 1 figure 2

relative risk of about 3 must be considered large for the effects of the observed variables. For instance, the risk of those with a premarital birth is 2.6 relative to those who have a more traditional birth-marriage-sequence. Women living in the non-rural areas of Eastern Norway and who have a child when they marry have a risk which is 8.7 times higher than that of women from rural districts in, say, Western Norway who get their first child subsequent to marriage. Even this large difference between two fairly extreme groups is smaller than the difference between the high-risk group and the low-risk group. Also when we apply group specific baseline intensities the influence of unobservables is important compared to the effects of observed covariates.

4.6 The impact of first birth timing on divorce when unobserved heterogeneity is taken into consideration

We now turn to the models estimated in order to throw some light on the correlation between first birth timing and divorce. As already referred to, it is well documented that there is a close link between timing of first birth relative to marriage and propensity of marital breakdown (see e.g., Billy et al., 1986; Christensen and Meissner, 1953; McLaughlin et al., 1986; Morgan and Rindfuss, 1985; O'Connell and Rogers, 1984; Teachman, 1983). These relations were confirmed in a recent study based on individual life histories extracted from the Central Population Register of Norway (Kravdal 1988). In particular, it was found that the high divorce risks among women who have got a child prior to marriage, is not confined to those who have married another man than the father of their child. Apparently, also the women who have got a premarital child with their husband, run a much higher risk of marital breakdown than those who have got their first baby in-wedlock.

Several explanations are advanced to account for the high divorce propensity of women who have a child when they marry or who are pregnant. One of the theories that have attracted a good deal of attention, claims that the marriages contracted subsequent to childbearing or conception are quickly arranged in order to "legitimize" the baby. According to, for instance, Furstenberg (1979), "such haste may produce less compatible matches".

It has also been argued that there is an association between first birth timing and some socioeconomic characteristics in the beginning of the marriage or later in life. O'Connell and Rogers (1984) have found that - controlling for age at marriage - couples who have a child before marriage or who were pregnant at marriage, are more economically disadvantaged than others. They believe that this also affects their divorce rates. In this connection we want to add that any effect of income or other socioeconomic characteristics may have a direct effect, but may also work in a more spurious way. If it is found that women with a premarital birth often have low education, the reason may be that an unplanned pregnancy has disrupted the educational carreer, and that this in turn affects the marital stability. Alternatively, there may be a tendency for women with low

education to have a baby out-of-wedlock as well as to experience a divorce later in life.

Our model estimates have shown that inclusion of the couple's educational level at marriage, the educational level of their parents and several other covariates does not diminish the relative divorce risk of women who have had a child prior to marriage. This has led us to hypothesize that there may be a certain spuriousness due to variables that we have not included. We hold the view that the couple's attitudes, and in particular their family values, may affect both their probability of having a child prior to marriage and their inclination to dissolve an unhappy marriage. Such an explanation has received some attention in the literature (e.g., Furstenberg 1979), but perhaps less than it might deserve.

Within the analytical framework we have chosen, we will never be able to confirm such an hypothesis, but we hope at least to find some support for it. Employing the Heckman-Singer procedure with a mixture of two survival time distributions, we are able to split the individuals into two groups: a high-risk group with women who are very divorce-prone, and a low-risk group with women who are likely to experience very stable marriages. Whether this heterogeneity should be explained by attitudes or other individual characteristics will, of course, remain a matter of speculation. If we estimate separate models for women with a premarital birth and for women who have had their first child more than 7 months after marriage, we can identify differences in the relative size of the high-risk group. According to our hypothesis we might expect that there are more women with "modern" values among those with a premarital birth, and that this could be reflected in a larger proportion in the high-risk group.

For simplicity we have assumed the same baseline intensity for both the high- and low-risk group.

It was shown in table 1 and table 2, and has already been commented on, that when more covariates were included, the effect of first birth timing actually increased (comparison of models 1a and 1c). An estimated Heckman-Singer model with two support points (model 2c), led to a further increase. In this heterogeneity model, however, we have forced the probability mass over the two support points to be equal for all groups, while we stated above that we expected to detect a larger proportion of couples selected for high divorce risks among women with a birth prior to marriage than among the others. Therefore, we have also estimated separate models for women who had their first child before marriage (in the remaining part of the paper referred to simply as group 1) and those who had their first child more than 7 months after marriage (referred to as group 2). Since the former group consists of no more than 3400 women, we had to impose some restrictions with respect to the number of covariates and categories. Table 5 shows the results obtained when only a subset of the covariates and the categories are included. This is called model 2b.

==> tab 5

Table 5. Parameter estimates with standard errors for two separate sub-populations, using a Heckman-Singer strategy with two support points and a log-logistic or Weibull hazard (model 2b)

		Group 1[1])		Group 2[2])	
AGE AT MARRIAGE (years)	log	-16.101	(13.209)	-80.450	(9.536)
	$\log^2$	2.082	(2.129)	12.043	(1.518)
PLACE OF RESIDENCE	Eastern Norway non-rural.	0		0	
	Eastern Norway rural, remaining non-rural	-0.651	(0.145)	-0.684	(0.073)
	Remaining rural	-1.479	(0.205)	-1.496	(0.124)
LENGTH OF EDUCATION	Elementary	0		0	
	More than elementary	0.195	(0.147)	0.117	(0.072)
LENGTH OF EDUCATION FOR HUSBAND	Elementary	0		0	
	More than elementary	-0.118	(0.133)	-0.327	(0.072)
PARENTS' EDUCATION	unknown, not living with parents	0		0	
	Elementary	-0.487	(0.227)	-0.034	(0.159)
	More than elementary	-0.818	(0.381)	0.326	(0.181)
c		1.757	(0.129)	1.838	(0.077)
$\lambda \cdot 10^3$		-		4.442	(1.468)
constant		19.658	(20.541)	131.442	(14.945)
q_1		0.109	(0.030)	0.088	(0.017)
Θ_1		3.203	(0.322)	3.602	(0.212)
-2 log L		4 583		15 494	

[1]) women with a premarital birth. Weibull hazard
[2]) women who have had their first child more than 7 months after marriage. Log-logistic hazard

The results for group 1 revealed that the parameter λ would be very small. It was difficult, however, to find the exact value corresponding to a maximum of the likelihood. This was solved by substituting with a Weibull function.

As previously supposed, there is a larger proportion of high-risk women in group 1 than in group 2, but the difference is rather small. In group 1 the proportion is 11 per cent, while it is 9 per cent in group 2 (In a group consisting of women who were pregnant at marriage the proportion was 13.) We may conclude that only a small part of the difference that has previously been found between divorce risks for women in group 1 and women in group 2, is due to a larger group of high-risk women in the former group. An interesting question that we will try to answer is whether there are large differences in divorce risks between group 1 and group 2 among the high-risk women regarded as a separate population, and among the low-risk women as well.

In order to answer this question we start with an illustration (see figure 5) of divorce differentials for a certain group of women (married at age 22, elementary education both for the woman, her parents and her husband, and living in the non-rural parts of Eastern Norway). The intensities are predicted according to table 5.

==> fig 5

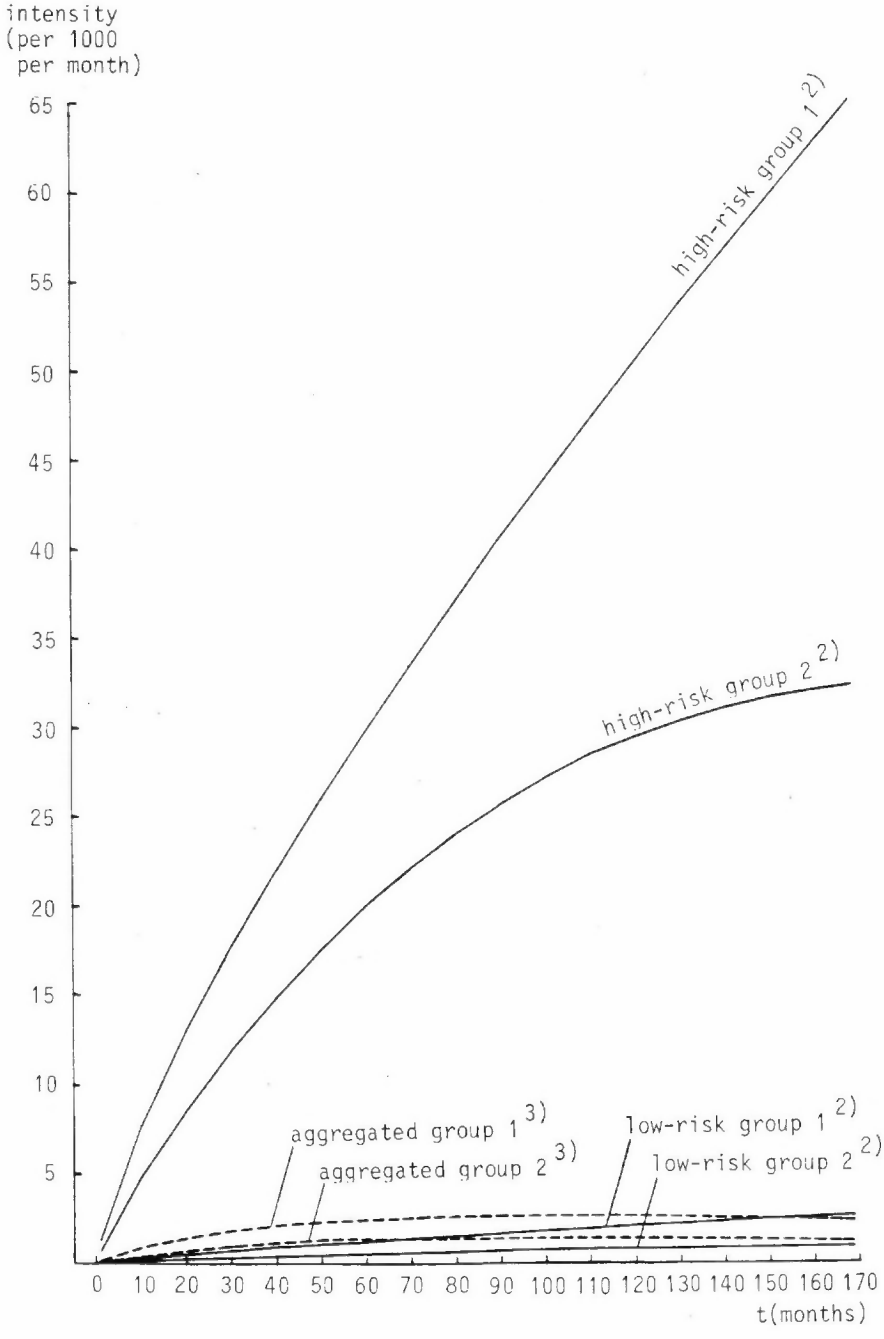
To compare the intensities when there is non-proportionality between group 1 and group 2, we have preferred to calculate the integral A of the intensity over the entire duration interval. For high-risk women in group 1 this integral is 6.32, and for low-risk women it is 0.26. The corresponding values for women in group 2 are 3.75 and 0.10. (The partial divorce probabilities ($F = 1 - e^{-A}$) for these four sub-populations are 0.998, 0.227, 0.977 and 0.097, respectively.) This means that within the high-risk group the A-value for group 1 is 1.68 times that of group 2, whereas this quotient within the low-risk group is 2.51.

Now, we shall compare these results with the results from a standard model. The parameter estimates are shown in table 6, and predictions are plotted for a group of women in figure 5 (dotted lines). This is, of course, the same group as for the other curves in figure 5.

==> tab 6

Based on this model we get A-values equal to 0.37 for group 1 and 0.20 for group 2 (and partial probabilities 31.1 and 18.2 per cent). This yields an A-quotient of 1.86, which is higher than 1.68 obtained for the high-risk group as a separate population, and lower than 2.51 obtained for the low-risk group. These figures, of course, would vary with the value of age at marriage, education etc., but results not tabulated show that we get an acceptable picture of the

Figure 5. Predicted intensities for women[1] with a premarital birth (group 1) and women who had their first child more than 7 months after marriage (group 2)



1) Married at age 22, living in the non-rural parts of Østlandet, elementary education both for the woman, her parents and her husband.
2) Based on the model estimates given in table 5.
3) Based on the model estimates given in table 6.

Table 6. Parameter estimates with standard errors for two separate sub-populations, using a standard model and a log-logistic hazard (model 1b)

		Group 1[1]		Group 2[2]	
AGE AT MARRIAGE (years)	log	-14.906	(9.066)	-52.403	(6.629)
	$\log^2$	2.060	(1.463)	7.804	(1.065)
PLACE OF RESIDENCE	Eastern Norway non-rural.	0		0	
	Eastern Norway rural, remaining non-rural	-0.431	(0.092)	-0.489	(0.049)
	Remaining rural	-1.016	(0.125)	-1.096	(0.087)
LENGTH OF EDUCATION	Elementary	0		0	
	More than elementary	0.192	(0.099)	0.099	(0.051)
LENGTH OF EDUCATION FOR HUSBAND	Elementary	0		0	
	More than elementary	-0.096	(0.090)	-0.215	(0.050)
PARENTS' EDUCATION	unknown, not living with parents	0		0	
	Elementary	-0.277	(0.167)	-0.006	(0.125)
	More than elementary	-0.534	(0.260)	0.235	(0.137)
c		1.705	(0.138)	1.849	(0.088)
$\lambda \cdot 10^3$		8.598	(2.429)	10.802	(1.353)
constant		25.394	(13.995)	85.014	(10.283)
-2 log L		4 585		15 513	

[1]) women with a premarital birth
[2]) women who have had their first child more than 7 months after marriage

general situation. The A-quotient in the standard model has an average of 2.59 (not weighted), which agrees fairly well with differences in β-estimates around 0.75 between these two birth-marriage sequences. Most quotients attain values between 1.5 and 3.5, and the standard deviation is 1. Within the low-risk sub-population the A-quotient is generally larger than obtained on the basis of the standard model. Within the high-risk population it is more difficult to draw a clear conclusion, but the average (not weighted) is 2.48, and this is slightly smaller than 2.59.

We believe that the value of such arguments, whether they are based on A-quotients or probability (F(t)) quotients, which would have been an acceptable alternative, should not be over-emphasized. However, it seems reasonable to conclude that within the high- and low-risk populations there is an effect of first birth timing not very different from that found on aggregate level (i.e, with standard models). Neither inclusion of several covariates nor controlling for unobserved heterogeneity reduces the large effect of first birth timing on divorce propensity.

5. SUMMARY

In this article we have applied a Heckman-Singer type of duration models. Our focus has been on judicial divorce in first marriage.

The analysis is based on individual birth and marriage histories extracted from the Central Population Register of Norway. These biographies are linked to socio-demographic characteristics recorded in the Population Censuses 1960, 1970 and 1980. The model estimates are based on data for all Norwegian women married in the period 1968-1970. Such a large data set allows us to include several covariates that are assumed to be important determinants, and gives the opportunity to apply flexible functional forms for the hazard.

It appears that even with 14 covariates included in the model, there is still a considerable amount of unexplained variation in divorce intensity. Applying two support points we find that there is a much higher divorce intensity in one group than in the other. This difference in intensity appears to be large compared to the effects of observed variables. However, the difference in intensity as well as the size of the high- and low-risk groups depend, of course, on the model specification. Imposing a multiplicative structure on the hazards, we find that about 14 per cent of the population are members of the high-risk group, where the divorce intensity is 22 times higher than that for the remaining 86 per cent of the population. In other words, one part of the population are very divorce prone, while the majority have characteristics that make marital break-up quite unlikely. We are apparently fairly close to a socalled "mover-stayer" situation. If we, however, introduce group-specific baseline hazards, we find that 29 per cent of the population are divorce-prone. The intensity for the high-risk group is considerably lower than that found in the model with equal baseline hazards.

Another result that we consider important is that within the

low-risk group the divorce intensity rises with marital duration. Within the high-risk group, however, the intensity declines after about 6 years of marriage. When we assume equal baseline hazards, the profile of the low-risk group dominates, so that there is a monotone increase both within the low- and high-risk group.

The finding that the divorce propensity tends to increase steadily with marital duration seems to be in contrast with the theories contending that investment in marital specific capital tends to depress divorce rates with increasing duration. On the contrary, the results may indicate that the spouses gradually "wear each other out", and that the usually observed hazard which emerges in standard models, to a large extent is due to a selection mechanism, where the divorce-prone are thinned out during the marital life course.

Furthermore, it appears that the covariate effects estimates are rather insensitive to the omission of unobservables. Truly, all effects are somewhat larger in the Heckman-Singer model than in a standard model, but the relative importance of the covariates and the ranking of the importance of the categories is unchanged.

Our hypothesis that the proportion of divorce-prone might be larger among women with a premarital birth than among those who conceived their first child in a marital union, was not confirmed empirically. In both these groups there are about 10 per cent high-risk women, and among the high-risk women first birth timing has virtually the same effect as we found in standard models where unobserved heterogeneity was not taken into account. In other words, even when we include several explanatory variables and control for unobserved heterogeneity there remains considerable variations in divorce intensity between women with a premarital birth and those with a first child conceived in a marital union.

The results presented in this paper demonstrates that the inclusion of unobserved heterogeneity by means of the Heckman-Singer approach seems to be a promising avenue for further research on marital stability - in the sense that new empirical evidence which could challenge existing dissolution theories, might be produced.

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Paper VIII

LIKE MARRIES LIKE - THE SAFEST CHOICE ?

A Brief Study of Homogamy and Heterogamy in Norwegian Marriages

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1. INTRODUCTION

Family sociology has a long tradition in studying potential marriage partners not only as individuals but as members of groups (Blood, 1967, Faris, 1964). Even in societies where mate selection is apparently free, some mechanisms tend to ensure that the marriage partners are members of more or less the same groups. To "marry in" is defined as homogamous marriages and "to marry" out as nonhomogamous or heterogamous marriages. Studies of homogamy in age, church affiliation and socioeconomic status have been most frequent, but since most of the studies are carried out in the United States, the tendency to choose a marriage partner from the same ethnic group and race has received a lot of attention too.

Numerous studies confirm homogamy as the general rule considering age and socioeconomic background. When it comes to individual characteristics, psychological variables and personal appearance, the notion that homogamy is the dominating pattern seems far more questionable. A saying tells us that "Birds of a feather flock together" or "Like will to like", in Norwegian expressed as "krake søker make". The founding father of empirical social science in Norway, Eilert Sundt, demonstrated the disposition to marry homogamously in Norway in the middle of the 19th

century (Sundt, 1967). A sociological study of mate selection and occupational status (Øyen, 1964) confirmed this a century later.

It is also conventional wisdom that marriages between equal mates are preferable, and that they are the safest choice, in the sense that they are likely to prevent marital instability (cfr. the Norwegian expression "like barn leker best").

Data describing the socioeconomic background of spouses are often scarce in large scale demographic analyses. Given that kind of data, it has been more usual to focus separately on her and his background as determinants of the family pattern, than on the character of the union. This paper is strictly confined to a brief inspection of homogamy and heterogamy in marriage formation and dissolution. In a society which is not necessarily more egalitarian than some decades ago, but where characteristics of socioeconomic status can be more obscure and less formal, it is time to ask whether the old saying "Birds of a feather flock together" still makes sense.

Our analysis is part of a far more comprehensive study of divorce patterns in Norway (Kravdal and Noack, 1988). Unfortunately, the available data, the Central Population Register and censuses, only contain a few variables that can be used to distinguish between homogamous and nonhomogamous marriages.

2. DATA AND METHOD

The analysis is based on individual birth and marriage histories extracted from the Central Population Register of Norway (Kravdal and Noack, 1988). These biographies are linked with cross-sectional information from the three Population Censuses 1960, 1970 and 1980.

The data file comprises all women who have lived in Norway for some period after 1960, and allows for a detailed inspection of some aspects of the demographic development up to 1984. Unfortunately, only the formal marriages are registered. Couples living in a consensual union, which has become a progressively more common life-style among young Norwegians, are considered as not married.

In the present paper, we focus on only two complete marriage cohorts: women who entered a first marriage in 1968 or 1978, and who were still married (not separated) in 1970 or 1980, respectively. Their marital instability during the period 1970-1984 or 1980-1984 is assessed in a

life-table framework with multivariate hazard models. We have used a piecewise constant baseline hazard and categorical covariates. The model parameters are estimated by the LOGLIN program (Olivier and Neff, 1976).

A few supplementary calculations are carried out in a late stage of the analysis, primarily in order to throw some more light on the age difference between the spouses. These calculations are based on the proportion who have divorced from 1970 or 1980 and up to 1984. Women not living in Norway by the end of 1984 are excluded. The effects on this proportion of some sociodemographic covariates are estimated in logistic regression models.

3. VARIABLES

Our attention is devoted to heterogamy and homogamy along three different dimensions: age at marriage, education and religious denomination. These characteristics are defined for all couples except a few hundred for whom the educational level or the religious denomination is unknown.

Information about education and church affiliation are collected in the population censuses, and refer to the situation two years after marriage. We hold the view, however, that these variables are pretty stable. Presumably, their value has not changed much - for instance due to a mutual influence between the spouses - during the two first years in marriage. But there may, of course, have been an adaption if we also include the "going steady"period.

4. PREVALENCE OF HETEROGAMY IN NORWEGIAN MARRIAGES

4.1 Age heterogamy

We have chosen to define marriages where the husband is 8 or more years older than the wife and marriages where the wife is minimum 4 years older than the husband as age heterogamous unions. It appears in table 1 that less than 1 of 10 couples are in an age heterogamous or socalled "May-December" union.

Age standards in mate selection are undoubtedly ruled by prescriptions on what is proper or ideal, although we do not know the specific norms or

social reactions towards those who find a much younger or older partner. In selecting minimum 8 years as the indication for heterogamy in husband-older marriages and only 4 years for wife-older marriages, we assumed that husband-older unions are socially more acceptable.

Table 1. Number of couples, by age difference between the spouses.

	1968 cohort		1978 cohort	
	number of couples	per cent	number of couples	per cent
Husband 8 or more years older	2 126	8.7	1 546	8.3
Husband 5-7 years older	3 490	14.2	3 165	16.9
Husband 0-4 years older	16 073	65.4	11 815	63.1
Wife 1-3 years older	2 734	11.1	2 006	10.7
Wife 4 or more years older	155	0.6	197	1.1
Total	24 578	100.0	18 729	100.0

Table 1 reveals that husband-older marriages are at least far more common than an age-discrepancy the other way around. Among less than 1 per cent of the couples the wife is minimum 4 years older than the husband. On the other hand, about 8 per cent of the unions are husband-older heterogamous marriages. These calculations only include first order marriages for the women.

Our results agree fairly well with comparable figures from United States and Canada, countries where the norms for mate selection do probably not deviate much from those in Norway. Veevers (1984) refers that about 8-10 per cent of all marriages are husband-older-marriages (at least 10 years older) and a little below 5 percent are the wife- older-category (at least 5 years older). These percentages are certainly higher than ours, which may be due to the fact that also second and higher order marriages for the women are included.

Veevers points out that during the 20th century there has been an increasing preference for age homogamous marriages, except for bride-older marriages which seem to have been slightly more prevalent. We do not know

the long term trends in Norway. From 1968 to 1978, there has, however, been a remarkable stability in the proportions of age heterogamous unions.

4.2 Educational heterogamy

We use three categories for educational attainment. The low level includes those with only compulsory education, the medium level consists of those with secondary education (on A-grade) or vocational training of minimum or average standard, and the high level includes those having a more advanced vocational education as for instance nurses, and those with more than twelve years of general education. With respect to educational attainment, there are only minor sex differentials in the two cohorts, but the average level has increased for both sexes during the decade from 1970 to 1980. The educational gap between women and men, which was fairly small even in 1970, has gradually diminished.

Table 2. Number of couples, by educational difference between the spouses.

Education of the couple	1968 cohort		1978 cohort	
	number of couples	per cent	number of couples	per cent
Husband high/wife low	386	1.6	256	1.4
Husband one level higher	5 875	23.7	3 828	20.5
Husband high/wife medium .	2 108		2 098	
Husband medium/wife low	3 767		1 730	
Same level	13 777	55.5	10 485	56.1
low	4 192		1 227	
medium	7 658		6 703	
high	1 927		2 555	
Wife one level higher	4 565	18.4	3 871	20.7
wife high/husband medium .	1 438		1 451	
wife medium/husband low	3 127		2 420	
Wife high/husband low	218	0.9	252	1.4
Total	24 821	100.0	18 692	100.0

In marital unions in Norway there are not very large differences in educational level between the spouses. If we define the combination low/high as educationally heterogamous marriages, less than 3 per cent of the marriages are in this category. In more than half of the marriages the spouses have obtained the same educational attainment, and for the remaining couples the differences did not exceed more than one level (table 2). The proportion of educationally heterogamous marriages is quite similar in our two cohorts. The figures reveal,however, that the proportion where the wife has more education than her husband, has increased slightly from the 1968 cohort to the 1978 cohort. This, of course, reflects that the rise in the average educational level has been somewhat steeper for women than for men.

4.3 Religious heterogamy

Since the large majority (87.8 per cent) of the Norwegian population are members of the Norwegian Church (Population Census 1980), religious homogamy will obviously be the main pattern in mate selection.

In addition to members of the Norwegian Church, we can identify members of other religious communities, persons without membership in any religious community (referred to below as non-members) and unknown church affiliation. Our data do not distinguish between Catholics, Methodists, Pentecostals etc. Analyses from other countries with more diversity in religious background, have shown a marked tendency to marry a partner from the same community.

Table 3 reveals that with the broad categories that we have used in this analysis, there is very little religious heterogamy. More than 9 of 10 are living in a religiously homogamous marriage. One half of the heterogamous marriages is a combination of one spouse being a member of the Norwegian Church and the other a member of another religious community. In the other half of heterogamous marriages, one of the spouses is a non-member and the other a member of the Norwegian Church.

Comparing our two marriage cohorts, the proportion of religiously heterogamous marriages has increased from 5 per cent in the 1968 cohort to 11 per cent in the 1978 cohort. This growth is closely connected to a general increase in the proportion who are not members of any religious community. 1.9 per cent of the brides and grooms from the 1968 cohort were non-members, compared to 6.7 per cent of the 1978 cohort. There has been an increase in membership of religious communities other than the

Norwegian Church,too, but this has been more moderate.

We believe that religious activity is a more important determinant of family behaviour than formal church affiliation. Measures of religious activity, as number of church attendances or religious meetings, are, however, typically survey data and are not available in a census analysis like this.

Table 3. Number of couples, by religious denomination of husband and wife.

Religious denomination	1968 cohort		1978 cohort	
	number of couples	per cent	number of couples	per cent
Same denomination	23 129	94.6	16 439	89.3
Both members of the Norwegian Church	22 624		15 413	
Both members of another religious community	334		410	
None of them members of a religious community	171		616	
One of the spouses member of the Norwegian Church and the other member of another religious community	731	3.0	806	4.8
One of the spouses member of a religious community and the other not member of any religious community	582	2.4	1 171	6.4
The Norwegian Church	560		1 089	
Another religious community	22		82	
Total	24 442 [1])	100.0	18 416 [2])	100.0

1) We have excluded 813 couples for whom religious denomination was unknown for one of both of the spouses

2) We have excluded 968 couples for whom religious denomination was unknown for one of both of the spouses

5. DOES HETEROGAMY AFFECT MARITAL STABILITY?

The theory about homogamy has played an important role in describing principles related to mate selection. Most of the attention has,however, been devoted to the quality of homogamous versus heterogamous marriages (Lewis and Spanier,1979). Quality of marriage has been defined in numerous and extensive ways in family sociology, using terms as happiness, satisfaction and integration. As demographers, we prefer the simplest and most definite concept,namely the formal marital break-up. Is it true then, that homogamous marriage serves as better prevention of divorce than heterogamous marriage ?

5.1 Age heterogamy

Our results suggest that there is a very weak association between age heterogamy and marital stability. The proportions who have experienced a divorce, are displayed in table 4. Only the very small number of couples where the wife is more than 4 years older than the husband, have a divorce propensity that differs from average. This applies to both marriage cohorts.

Large age differences between the spouses indicate, of course, that one of them has a fairly high age. If all women who have entered a first marriage after 1964 are grouped together, the proportion of women older than their husbands varies from 6 per cent among those who were 20-22 years at marriage, to 37 per cent among those who were 30-34 years (Kravdal and Noack, 1988). On the other hand, a much older man indicates a very young bride or a man who is perhaps more than 30. In the latter case, the actual marriage, which is known to be the first for the woman, may be the second for the husband.

With this pattern in mind, it was reasonable to anticipate that wife-older marriages might have a relatively low divorce risk due to the fairly high age of the wife at marriage. The results shown in table 4 go counter to this expectation, however.

In multivariate models where a control for age at marriage is included, we find that the effect of age difference is higher than that obtained in the more simple calculations. This is shown in the two last columns in table 4. According to some logistic regression models $\log(P/1-P)$, where P is the divorce probability, is more than 1 higher when the wife is more than 4 years older, than when the spouses have almost the

same age. This corresponds fairly well with hazard models based on all marriages contracted after 1965 (Kravdal and Noack, 1988), where a relative intensity of about 2 was found.

Table 4. Association between divorce and age difference.

	Proportion divorced (per cent)		Effect according to a logistic model	
	1968 cohort[1]	1978 cohort[2]	1968 cohort[3]	1978 cohort[3]
Husband 8 or more years older ..	12.1	5.2	0.12	0.09
Husband 5-7 years older	12.5	5.1	-0.02	0.04
Husband 0-4 years older	12.4	4.5	0.00*	0.00*
Wife 1-3 years older	12.7	4.3	0.36	0.35
Wife 4 or more years older	14.2	6.6	1.19	1.39

1) Proportion of all women living in Norway 31 Dec. 1984 who divorced between 1 Nov. 1970 and 31 Dec. 1984.
2) Proportion of all women living in Norway 31 Dec. 1984 who divorced between 1 Nov. 1980 and 31 Dec. 1984.
3) According to the model $\log (p/1-p) = x \cdot \beta$, where P is the proportion defined in 1) and 2), x is a covariate vector and β the corresponding effect vector. Age at marriage (of the women), educational level of both spouses and educational activity of both spouses are included as covariates.

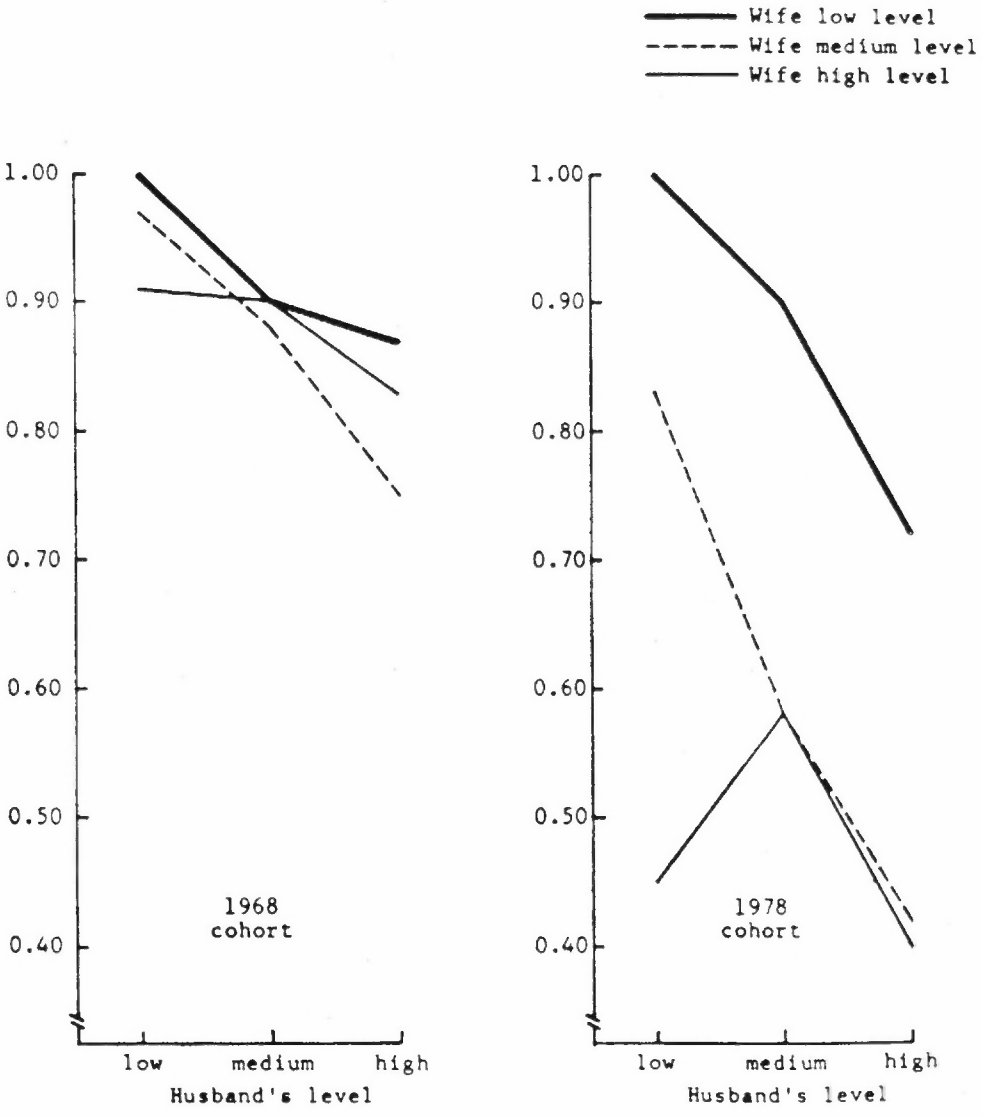
* Arbitrarily selected as a baseline group.

5.2 Educational heterogamy

We have estimated hazard models with an interaction term between husband's and wife's educational level and activity, and with age at first birth, timing of first birth and place of residence included as covariates. Figure 1 shows the joint effect of husband's and wife's educational level on the relative divorce intensity. It appears that when the husband has a low educational level, an increased level of the wife tends to depress the divorce intensity. In other words, heterogamy in the

sense that the wife has considerably higher education than the husband, is not associated with particularly high divorce rates. For higher levels of husband's education the effect of woman's education is less clear, though in both cohorts the intensity is highest when she has only a primary education.

Figure 1. Relative divorce intensity[1] by educational level of both spouses



1) According to a model where age at marriage, timing of first birth, place of residence and education are included as covariates. Low level for both husband and wife is chosen as the baseline group.

Preliminary calculations have indicated that educational activity has a substantial effect on the divorce intensities. The men or women who are studying two years after marriage, apparently face quite a different marital situation than the others. Consequently, we have also paid some attention to this variable. In particular, it seems that a studying wife is associated with high divorce rates, whereas the husband's educational activity has a considerably smaller effect.

Table 5 provides clear evidence that wife's educational activity affects marital instability. Spouses who are both studying also display higher divorce proportions. This structure is not changed when variation in the eduactional level is controlled for. We will emphasize,however, that couples where both were students two years after the marriage, constitute no more than 1.4 per cent of the cohorts, and couples where only the wife was under education constitute 2.2 per cent. The prevalence of student marriages has increased slightly during the decade under study.

Table 5. Proportion divorced, by educational activity. Per cent

	1968 cohort[1]	1978 cohort[2]
Neither wife nor husband studying	12.1	4.5
Only husband studying	14.6	4.7
Only wife studying	19.3	8.4
Both spouses studying	18.8	6.7

1) see 1) table 4
2) see 2) table 4

5.3 Religious heterogamy

Our results do not entirely confirm the view that religious homogamy is connected with a higher degree of marriage stability than heterogamous marriages. Table 6 shows the relative divorce intensities according to hazard models. The overall pattern differs only marginally from one cohort to the other.

The large group of couples who are homogamous in the sense that both spouses are members of the Norwegian Church are chosen as baseline group. Looking at the homogamous diagonals for the two cohorts, we notice the low

Table 6. Relative divorce intensity by religious denomination of husband and wife[1].

a) 1968 cohort

Wife's religion	Husband's religion		
	Norwegian Church	Other religious society	Not member of any religious society
Norwegian Church	1.00*	1.36	1.42
Other religious society	1.36	0.59	-
Not member of any religious society	1.99	-	2.36

b) 1978 cohort

Wife's religion	Husband's religion		
	Norwegian Church	Other religious society	Not member of any religious society
Norwegian Church	1.00*	2.80	1.45
Other religious society	1.02	0.45	-
Not member of any religious society	1.92	-	1.97

1) According to a model where age at marrriage, timing of first birth, place of residence and religious denomination are included as covariates.

* Baseline group

\- Fewer than 50 couples

divorce propensities for homogamous couples where both have their church affiliation outside the Norwegian Church. For the few couples in this group, the divorce intensity is only about half of the intensity for the

baseline group (both members of the Norwegian Church). On the other hand, couples who are both non-members of any religious community, have a divorce intensity which is more than twice the risk in the baseline group.

If we consider marriages where only one of the spouses is a member of a religious community other than the Norwegian Church, it appears that heterogamy is associated with a higher than average dissolution propensity. For these couples the divorce risk exceeds that of the couples where both spouses belong to another religious community, and it also exceeds that of the baseline group, which is a very strong evidence of a heterogamy/heterogamy effect. In the absence of such an effect, a risk intermediate to that of the baseline group and that of the couples where both are members of another religious society would have been more likely.

A different conclusion is reached when we focus on the couples consisting of at least one who is not a member of any religious society. Relative to the baseline group couples with two non-members have very high divorce risk, but the excess risk is lower if only one of the spouses is a non-member. In these heterogamous marriages the stability is lower than in the homogamous marriages consisting of two non-members, but higher than in the homogamous marriages consisting of two members.

6. SUMMARY AND DISCUSSION

Our analysis confirms the strong homogamy inclination in mate selection. The preference for marrying within the same age, educational and religious group is approximately the same in marriage cohorts from the late 60s and the late 70s.

In many societies, homogamy is due to the formal arrangements in mate selection. In our own society, however, mate selection is expected to be a result of romantic love. In principle, the choice is not influenced by the will and vested interests of other people. The tendency to homogamy in social and status characteristics is ordinarily explained as a result of individual preferences, norms and values and availability.

The norm and value model for mate selection implies that persons from a different group are regarded as inappropriate or even "illicit" marriage partners. Couples seriously violating these norms may be subject to social reactions. The sanctions may be psychological, attributing unfavorable traits as infantile dependency needs or paternalism to the marriage partners, and questioning their marital happiness. Vera, Berardo and

Berardo (1985) have illustrated that such prejudices are not only popular notions, but are widespread and taken for granted in the scientific literature, too.

In demography, the availability explanation has commonly been related to the age and sex distribution in the marriage market. Most attention has been paid to the consequences of age imbalance, known as the "marriage squeeze". The marriage market is, of course, seen in terms of other variables too, as for instance race and education (Goldman, Westoff, Hammerslough, 1984).

Concerning availability, numerous studies have also underlined residential propinquity as a major factor in assortative mating. In pointing to this literature, Broderick (1988) refers Bossard's conclusion that "cupid may have wings, but they were not adapted to long flights".

The decreasing educational gap between the sexes has of course improved the chances for educational homogamy. In the last years, some Norwegian social scientists have claimed that younger women will be more inclined to choose higher education than the men. If this will be the case, we can possibly anticipate more educational heterogamy in the future.

Irrespective of the reasons for marrying homogamously, persons who select a partner from a different group are traditionally supposed to be more divorce prone than others. Our results do,however, only partly confirm this assumption. The negative effect of heterogamy is most dominant in terms of church affiliation. With respect to age, only very large differences seem to have any effect, and for education there is hardly any effect at all. These results are in good accordance with the analysis of Bumpass and Sweet (1972). They too conclude that the association of educational heterogamy with high divorce risk is not generally supported, while they find higher marriage instability in unions, where the spouses are divergent in age and religious affiliation.

Several explanations are advanced to account for the apparent effect of heterogamy on marital stability. The greater divorce risk is partly seen as a result of negative sanctions from others and partly as a result of lack of common values, beliefs and interests. Furthermore, psychological models have underlined that persons who choose to marry out and thus deviate from the group norms, possibly will be more inclined to deviate from other family norms as well.

Lewis and Spanier (1979) have systematically examined several hundred

studies of marital stability and quality, and they maintain that "The greater the premarital homogamy, the higher the marital quality". More recent studies have, however, thrown doubt upon the effect of heterogamy (Vera, Berardo and Berardo,1985). They note that many studies confirming the negative effect of heterogamy, were performed some decades ago or even in the first part of the century. They suppose that sociocultural factors as education and religion may have less effect today than before. Some of this criticism also claims that even values and norms acquired during early childhood may be more changeable over the course of life than previous studies have taken for granted.

In their recent study Vera, Berardo and Berardo suggest another alternative interpretation, pointing to the fact that many of the effects attributed to heterogamy may be spurious. For instance, the effect of age heterogamy may rather be an effect of socioeconomic background than of the spouses being raised in different periods of time and being in different stages of life.

Compared to previous studies, our own brief investigation serves to weaken the impression of a negative effect of marrying heterogamously. Defining and measuring homogamy and heterogamy is, however, not an easy task. An age discrepancy between the spouses of, say, 8 years may be acceptable in one society but not in another, nor in the same society a decade or two later. Choosing other criteria for homogamy/heterogamy can, of course, alter the conclusions. The main outcome of our study, still confirms the old saying that "Birds of a feather flock together". We cannot say whether the few birds which prefer to fly their own routes, will have tougher or more exciting trips, but apparantly their chances of remaining a couple are not much lower.

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