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THE ENGINE OF FERTILITY - INFLUENCED BY INTERBIRTH EMPLOYMENT?

BY

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ABSTRACT

The decline in fertility is often related to the increased labor force participation among married women. This article discusses the relationship between fertility and employment by using a dynamic methodology of life-course analysis based on time series data. An important question in the article is whether the probability of having a child is influenced by employment. We emphasize the probability of a second birth, however we also give some attention to the third birth.

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1 INTRODUCTION

Since the second World War, Norway, as most industrial countries, has experienced rather sharp variations in fertility. During the years from 1945 to 1965 the total fertility rate rose from 2.44 to 2.95. This increase plateaued and by 1970 a new trend of decreasing fertility rates had begun. In 1984 the total fertility rate was 1.66, lower than ever before.

The decline in fertility coincided with increasing labor force participation among married women. From 1972 to 1981 the employment rate increased from 45 to 62 percent. The increase occurred among women with small children as well as among women with grown-up children. At the same time two major changes in the marriage pattern evolved: increased cohabitation without marriage (Brunborg 1979) and increased divorce (Social Survey 1983).

Other factors which might have been related to the changes in fertility and employment patterns were the rise in the level of education (Jensen 1983) and the introduction of modern contraceptives (Østby 1983). The education might have increased the motivation as well the possibilities for employment, while the modern contraceptives have given the women new possibilities of controlling their fertility.

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1) An earlier version of this paper was published as a working paper at the Center for Demography and Ecology, University of Wisconsin, Madison (Jensen 1985).

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Graduate student of statistics, Anne Marit Benterud, University of Oslo, has been in charge of the programming.

The purpose of this paper is to analyze the relationship between fertility and labor force participation in a life-course perspective. According to Elder and Rockwell (1978,p.2) a life-course perspective "locates individuals in age cohorts and thus in historical context". Three elements are important in a life-course analysis; the cronological age, the social age and the historical period. In our analysis time (the aging process) is the dynamic variable, while social age (age at first birth) as well as historical period (first child before a certain calendar year) are defined as covariates. The relationship between fertility and labor force participation has been a subject of great interest. It seems clear that an increase in labor force participation goes along with a drop in fertility in the western world. However it has been difficult to settle the causal relationship between the two phenomena (Smith-Lovin and Tickamyer 1978, Hout 1978, Cramer 1980).

Several studies with a life-cycle approach, have given a picture of the development of the labor force participation before, during and after the childbearing years. These activities are less separated in time for recent cohorts than for older ones. Sørensen (1983) analyzed this question by comparing her results to the four employment patterns among ever married women. The patterns were originally categorized by Elder and Rockwell 10 years earlier: conventional, interrupted, double track and unstable. The conventional pattern describes the case of women leaving the labor force by the time of marriage or first childbirth, while the double track pattern is the one where fertility and employment are not separated in time. She concluded: "... there has been a real decline in the propensity to follow a conventional pattern. The proportion following a pattern of role specialization was about the same in the two cohorts, and the double-track pattern has become more common among the younger cohort" (p. 329).

Bumpass and Sweet (1980) examined patterns of employment for the three stages of the life cycle: before marriage, between marriage and first childbirth and between the first and the second childbirth. By comparing marriage cohorts 1955-59 to marriage cohorts 1965-69, they concluded that the percent of women employed had increased over time at all three life-cycle stages. The percent who were working between first and second childbirth increased from 37 to 51. However, the increase was less clear when short-time employment was excluded, and by looking at the proportion of women who had been working at least one year during the birth interval, they found a decline for the youngest marriage cohorts. An interpretation of this would be that although there has been a trend towards higher inter-birth employment, a substantial proportion of this employment seems to have

short-term character. The analysis of Sørensen as well as the one of Bumpass and Sweet are based upon american data.

The cohorts of our study, 1940-59, started their family life during a period when it was more usual than before to combine childbearing with employment, approximately from 1960 to 1980. Our point of departure, however, will not be to analyze employment related to fixed stages of the life-cycle, but to analyze the influence of interbirth employment on the propensity of having a (next) child. Our approach is to use life table methods to estimate parameters in a multiple-state hazard model where also marital status is taken into account, in order to purify the effect of labor force participation on fertility.

Our general aim has been to improve the understanding of the rather dramatic socio-demographic development which has taken place in Norway in the last two decades. We will concentrate upon the interaction of fertility and employment among married women. However, we also have a secondary aim of studying fertility and employment as statuses changing over time. Several studies have emphasized the importance of a dynamic approach to the analysis of fertility and employment, and an increasing number of studies using such approaches have recently appeared (among others, Hout 1978, Cramer 1980, and Moffitt 1984).

Using a hazard model in which the rates are assumed constant over time segments, we analyze the parity specific fertility rate (intensity of having a next child) taking into account labor force participation and marital status at every stage of the life cycle. Background variables like cohort and education level are also taken into account.

The following questions are addressed:

- In what way does the labor force participation affect parity specific fertility?

- What is the effect on the second child fertility of having been in the labor force without interruption since first birth?

- What are the effects of covariates like level of education and age at first birth on second child fertility, and do women who started their reproduction early in our historical period (1960 - 1980)have a different fertility rate compared to those who started late?

- What is the spacing pattern of the third child compared to that of the second?

Our main, but tentative, conclusion is that the second child fertility is roughly the same for women in the labor force as for those outside it. Interbirth employment does not seem to cause a drop in fertility. The

data therefore do not give support to the hypothesis that the recently experienced drop on the total fertility rate is caused by an increase in female employment. On the other hand, we find a clear drop in the probability of a second birth among women who have been working without interruption since the first birth. Our data, however, unfortunately has a number of shortcomings. For this reason we have to be very cautious when drawing conclusions.

The causality concept we employ is one which seems appropriate for the social statistical analysis. Since the time aspect is taken properly into account by the hazard model, it is, in contrast to ordinary regression and correlation analysis, possible to make a distinction between cause and effect, and to conclude from the data which way the causal relationship goes. However, on a deeper level of analysis, it may be true that the drop in fertility, even in the second parity fertility, which has been experienced since the 1950's, is in part caused by increased female employment. It is in fact reasonable to believe that the improved opportunities for female employment and the fact that such employment was getting more common, did affect the childbearing of all women, also when they were outside the labor force. This question of causal relationship is a complex one. In our view it makes sense to pose the question at the level of a social statistical inquiry such as ours. And since we regard our paper as exploratory, both with respect to the methodology and to the substance, we find it appropriate to express our finding of no substantial difference in second parity fertility rate between female in and outside the labor force as a tentative conclusion of no causal effect of labor force participation on second parity fertility. We do this in the hope that it will provoke an interest both in the argument and in the matter.

2 DATA

The survey "Women and Work" gives retrospective information about childbirths, marital status and labor force participation of women born from 1915 to 1959. We concentrate upon the approximately 800 women born from 1940 to 1959.

Each woman was asked about her childbirths and current marital status. She was asked about the month and year when she moved together with a man for the first time, whether this was a consensual union or a marri-

age, and for month and year of every change in this status. For our purpose we have divided the women into two groups, based upon whether or not they live together with a man. For the sake of brevity, we will use marriage or cohabitation as synonyms for all women living together with a man. Not living together with a man would either be a result of never having started marriage or a result of divorce, or having ended a consensual cohabitation. Bumpass (1984) has shown that abour two-fifths of children in the U.S. born to married mothers experience a disruption of that marriage before they reach age 16. We do not have the same information about norwegian children, but divorces is common enough to convince us of the importance to control for marital status of the mother. In this paper the marital status will mainly be treated as a control variable, although it is, as labor force participation and the number of children, an endogenous variable in the model.

The information of labor force participation do, however, have some shortcomings. We have information about the length of the time in the labor force between the first and the second child, but we do not have information regarding the starting or leaving points of this employment, which is ideally required by hazard models. Since employment rates increase with the age of the youngest child, we have placed the labor force participation close to the next childbirth. This will bias the results, since every woman who has worked at all during that interval will contribute to the flow-rates of working women by the transition to a next childbirth. We will thus have an overestimation of childbirths among workers. However this decision is apparently the best alternative available.

Another problem is created for the open interval, for those who have not had their second (or third) childbirth. The survey asked whether or not the woman was working immediately after the last childbirth,but this was a yes or no question and we have no information regarding when work was started after the last childbirth. We have calculated time as employed after last child by combining information of labor force participation before the actual birth, immediatly after, at the time of the interview and total length of time in employment.

A final aspect of the employment variable, is the lack of information of full-time and part-time work. As a consequence, a women having limited employment, as a part time job of a couple of hours a week and for a few months (the minimum to be reported was employment which lasted more than 3 months) may in principle be sufficient to regard her as being in the work state for the appropriate time period, which extends to the time at her second child if she ever has any.

The role of education as an activity before and between the childbirths also needs to be mentioned. The "Women and Work" survey contains information on when women finished school only for the period from 1970 to 1980. As a consequence we were unfortunately forced to use level of education as a static variable. Since level of education is developing in close connection with fertility, a more satisfactory analysis should have included level of education as one of the endogenous dynamic variables. Women, who are still pursuing an education are now formally represented as being in the non-working state. Since such women have a low fertility, we might thus have an underestimation of childbirths among non-workers.

These data problems make it difficult to construct a measure of labor force participation, and the possibilities for error are considerable. But the survey does represent our only source of reasonable data, and since our aim was to explore the methodology as well as to get new demographic insights, we accepted these limitations. It might be a slight comfort that we share our data problems with several studies using a dynamic approach of fertility and labor force participation (Hout 1978).

Fertility, cohabitation, and labor force participation constitute the time dependent endogenous variables in our study. Age at first birth, level of education at the time of interview, historical period, and whether the employment has been uninterrupted, are the main background variables for the second child fertility. Age at second birth, level of education, and distance (in months) between the first and the second birth are the background variables for the third child fertility.

3 MODELLING AND MEASURING INDIVIDUAL TRANSISION INTENSITIES BETWEEN SOCIODEMOGRAPHIC STATES

Much attention has been given to the use of life-table methods in various fields within demography. Our approach is based upon a hierarchical semi-Markovian setup, as described in Finnäs and Hoem (1980), Hoem and Selmer (1984), and Rodriguez et al. (1984). One difference in the methodology between these studies and the present one is the use of several time dependent endogenous variables. Studies similar to ours are reported by Menken et al. (1981), and Montgomery and Kisker (1985).

We consider each woman to be characterized by two different types

of variables. The endogenous variables are those which define her position in the state space. These are time dependent variables. The second set of variables are the background variables which determine the rate at which the woman moves about in the state space. We will use the term covariates for these background variables. The primary state variables are dynamic, they evolve over time, while the covariates are static in the sense that they are not affected by the state dynamic.

In Figure 1 the state space from the first to the second child is represented. This space of 8 states is three-dimensional since it is defined by the three time-dependent variables: number of children, cohabitation or marriage, and labor force participation.

The time from first child was divided into 16 segments as indicated in Figure 2, and the flow-rate is assumed constant within each segment. For each segment of duration since first birth, an occurrence/exposure birth rate has been computed, which is the sum of the number of children born divided by the sum of exposure time. We present the intensity rates per 1000 women per unit time (months).

For each fertility transition, that is, for each horizontal arrow in our state space diagram, a flow-rate (a step function with one step for each of the 16 duration segments) was calculated. This gives us a profile of the transition intensity as a function of duration time. The flow-rate may be interpreted segment by segment as the approximate conditional probability of having a child within one unit of time, given that the woman has not already had her second childbirth.

The state space for transitions from second to the third child could, in principle, be a direct extention of the state space in Figure 1. However, due to data problems discussed above, only the transition profiles from the first to the second childbirth will be given separately for workers and non-workers.

To explain the rationale of our model consider a woman who has her first child. By the birth of the first child the woman enters one of the four "boxes" on the left side in Figure 1, dependent on her status at the time of the first birth. The alternative states, from the upper corner and downwards are: Employed and married, employed and not married, not-employed and married and not-employed and not married. All of them are one-child "boxes". As time goes by our woman will possibly move to some other state, and this transition may later be followed by other transitions. At any time counted from the time she had her first child she will find herself in a state from which new transitions are possible. The transition intensities along the outgoing arrows from that state may be interpreted as the

strength of forces driving her to move in their direction. The probability interpretation of the intensity r(t) is that with probability approximately r(t)*h the women will make a transition along the arrow before a small amount of time, h, has elapsed given that she was in the state from which the arrow was pointing at time t. At the population level the intensity may be interpreted as a measure of the flow of individuals along the arrow relative to the number of individuals being at risk of this transition. In this paper we will interchangeably use the term flow-rate and intensity and we concentrate on the horizontal arrows in the state space, which give the fertility transitions.

The flow-rate interpretation is of course fundamental to the occurrence-exposure rate method of estimation, which we will use.

We are assuming that the woman is characterized by her present state and her covariates. There is thus no "memory" build into the system by which her previous history plays a role in addition to the covariates and the present state. If we were interested say in the effect of changes in marital status on the flow-rates toward a next child, however, this change could be defined as a history dependent covariate.

Since we are working with retrospective data our system is closed and there is no need to equip the various states with unspecified exit arrows for death, emigration or other occurences. The methodology we are employing, however, is most appropriately designed for prospective studies in which of course the system must be open.

As explaind above, our parity specific fertility rates are assumed to be constant over consecutive segments. The covariates, which are all categorical, are assumed to influence the fertility rate by proportionality parameters. The fertility rate at each state of labor force participation and marital status is thus fully parametrized, with the number of parameters equal to the number of segments (16) plus the number of parameters in the covariate structure. For example, the total number of parameters for each of the second child fertility rates are 16 + 2 + 2 = 20 if the covariates are age at first birth (3 levels) and education (3 levels) and if there is no interaction between age and education.

Since the likelihood for each separate transition rate is proportional to the Poisson likelihood with a log linear structure in the parameters, and with occurrence-exposure rates as sufficient statistics (Kalbfleish and Prentice 1980, see also Whitehead 1980) the method of maximum likelihood is well suited for estimating the parameters of the model. We calculated the occurrence and exposure probabilities in SPSS and fed them into GLIM (Baker and Nelder 1978) in which the models were fitted and eva-

luated. Unfortunately, the data handling capacities of GLIM are limited, which caused us some extra work, but GLIM is well suited at maximum likelihood fitting of transformed linear models. Technically our approach is almost identical to that of Rodriguez et al (1984).

4 RESULTS AND DISCUSSION

4.1 Transition from the first to the second child

We may now have a look at the transition rates from the first to the second child for married women, given in figure 2. Let us call these the second child fertility rates. As we see, the second child fertility peaks at 2.5 - 3 years after the first birth, and it levels out at a non-negligible level after 5 - 6 years.

Figure 3 displays the flow-rates among married women who are working and those who are not. In interpreting Figure 3, it is important to be aware of the fact that the females may change their status at the segments before childbirth. The figure describes the fertility rate of women in the working/non-working state at a given duration after their first birth, disregarding their transition history since first birth. The figure provides a comparison between those women who were working, and those who were not working at duration, t. One should also remember that because we were lacking specific information, the time spent at work between first and second child was assumed to occur just before the second child was born.

The main impression from Figure 3 is that second child fertility is roughly the same for working and non-working women. A closer look at the figure, however, suggests that the workers' fertility is somewhat more peaked 3 years after the first child, while the non-workers' fertility is marginally more spread out through the interval, and a little higher at the earlier segments. One possible interpretation of this might be that there seems to be a higher share of planned childbirths among workers. But the main conclusion is that second child fertility does not reveal clear differences between workers and non-workers neither in the level nor in the form. This is an unexpected result.

On the other hand, we get a considerable difference between the two

groups of women when we examine mean birth intervals in months. Among women who have at least two children, the oldest of which was at least 5, the mean interval is 41.4 months for workers compared to 31.7 months for non-workers. This difference is also noted in other studies.

Bhrolchàin (1983) has analyzed the consequences of employment on the spacing of children. She used the stages from marriage to the first child and then the stages between each successive birth until the fourth. Ellingsæter and Iversen (1984) have analyzed three phases: before marriage, from the marriage to the first child and between the first and the second child. The last mentioned analysis is based upon the same data as ours. They reach the common conclusion that women who have been working between childbirths have longer birth intervals than women who have not.

Bhrolchàin (1984) concluded from her study: "An important point to note is the agreement throughout all data sets considered, that inter-birth working is associated with substantially longer interval length" (p. 57). This is taken as evidence of two different kinds of strategies of childbirth and work. The first strategy is to have children in close succession, to avoid interbirth work, and to begin work soon after the birth of the second child. The second strategy is to have large gaps between births of successive children, and to work between births as well as after the second birth. The result is "...two employment effects on spacing - positive and negative" (p. 57).

There are several problems connected with this use of average interval length. The main problem is the confusion of cause and effect. So far, investigations of female labor force participation seem to agree on the fact that the age of youngest child has a considerable impact on employment. It is reasonable to believe that this mechanism functions for one-child mothers as well as for mothers of higher parity. This means that the probability of being employed increases with the age of the first child. Women who happen to have long birth intervals will therefore more often be in the labor force than those who happen to have their second child soon after the first. Longer birth intervals give a higher probability of being employed, and this does not of course imply that low fertility is caused by employment.

Both the study of Bhrolchàin and the study of Ellingsæter and Iversen analyze labor force participation in relation to the average length of birth intervals among women who have closed the interval. As both studies deal with changes in historical development this is not a problem for the older women who have finished their childbearing. However for the most recent cohorts this approach will result in an additional problem of

selectivity, since those women who have had an early first birth and a rapid next birth, have a greater probability of being represented within each birth interval than the "slower" childbearers. This problem of selectivity is severe when we focus on employment because of the interaction between age when entering motherhood, and education as shown in several studies (Rindfuss, Rumpass and St.John 1980; Rindfuss and St.John 1983; Kiernan and Diamond 1983; Marini 1984) and an interaction between employment and level of education (Bowen and Finegan 1969; Sweet 1973).

The difference between life table methods and the method of average birth intervals is that, in the first case, all women in the survey who have their first child contribute to the second child fertility estimate until they have their second childbirth or are censored by time of interview, while the average is calculated among women who have at least two children. In addition, and this is the most important point, confusion of cause and effect is less likely with the life table method, since the life table method takes the time aspect properly into account.

The hazard model revealed a different picture of the relationship between employment and fertility than did comparisons of the average number of months between births. Figure 3 seems to imply that there are no important differences in the fertility between working and not working women. However, at this stage we are not quite confident of such an interpretation because of the severe shortcomings of our data with respect to the registration of labor force participation and because women under education are included in the group of non-workers.

Let us turn to the effects of the covariates. In addition to age at first childbirth and level of education, we also introduce a covariate of historical period. We defined this covariate in order to get a measure of the changes in the historical period in which the women reached adulthood, during the period from 1960 to 1980. Since this was a period of considerable historical change in fertility as well as in employment, we have chosen a covariate which give us a measure of the impact of the historical period independently of the impact of our other variables. Our question was whether the women who started their reproduction before a specified year would have a different level of fertility to those who started after this year. We wanted a division of the whole period which more or less would split our sample in half. As discussed briefly in the introduction, several changes took place at the end of 1960s, and the beginning of the 1970s, which could reasonably be related to a change in the fertility. To see whether an historical shift in fertility did take place around 1970, regardless of the age of the women, we introduced a covariate which indicated

whether her first child was born before 1968. The year 1968 was chosen for its symbolic value including political commitment and the foundation of several feminist organizations. Although the proportion of young people who actually took part in these movements was limited, the year is often regarded as an historical watershed for young people reaching adulthood in that period, and for many women of higher age.

Furthermore we defined a covariate measuring the effect of having been employed without interruption since first birth. By this covariate we wanted to get an impression of the impact of having an extensive work commitment in the childbearing years. The effects for all covariates are presented separately for workers and non-workers.

In Table 1 we present the gain in fit by introducing covariates in our multiplicative model. The reference model is the model to which we estimate the effect of introducing a covariate or a set of covariates. By introducing the covariate age at first birth for non-working women, the gain in fit was 5.8 units of deviance, which is to be compared to the chi square distribution at 2 degrees of freedom. The rationale for this procedure is that since age has 3 categories, we have introduced 2 new parameters to the model: the ratio of the fertility between medium aged mothers and young ones and the ratio between old mothers and young ones. The young mothers are serving as a reference group. Minus - 2 - log - likelohood - ratio between this model and the null model is 5.8 (the deviance is not precisely equal to the - 2 - log - likelihood ratio, see Baker and Nelder (1978)), which is to be compared to the chi square distribution with the number of degrees of freedom equal to the number of new parameters introduced in the model. A large increase in the fit does of course indicate that the covariate introduced helps to explain the variation in the data. From Table 1 it is seen that age alone or education alone poorly explains the variation. The simple model of adding age and education to the pure duration model is the most satisfactory model involving these two covariates only, but a deviance of 9.6 for non-workers and 7.5 for workers at 4 degrees of freedom is hardly impressive. When the binary historical covariate 1968 was added to the model with age and education and duration we obtained an increased fit of 32.3 units of deviance at 1 degree of freedom for non-workers, while there is almost no gain in fit by introducing this covariate to workers (2.4 units of deviance at 1 degree of freedom). The binary covariate; employment without interruption, shows strong explanatory power (30.8 units of deviance at 1 degree of freedom).

Turning now to Table 2, we here present our adjustment estimates for workers and non-workers, the adjustment being the factor by which the

fertiltiy rate of the reference group is to be multiplied. The first category is serving as a reference for each covariate, and this is indicated by 1.00 in the estimate column. For the model which includes no interactions, the multiplicative effects may be combined simply by multiplication. As an example consider a women who is in the labor force, who was in the medium age group at her first birth, and who has more than twelve years of education. A woman who started the childbearing after 1968 will have a second child fertility rate which is about 0.88 * 1.45 * 0.62 = 0.79 as large as a reference women who was in the youngest age group when she had her first child, who has less than 10 years of schooling and had her first child before 1968. We have also computed confidence intervals for the multiplicative effects. These are unsymmetric because they are obtained by taking the anti-log of the appropriate symmmetric confidence intervals of the log-linear parameters.

In Table 2 we find that increasing age at first birth has a negative impact on second child fertility for workers only. The effect of the variable as a whole is not statistically significant, however, neither for workers nor for non-workers.

The effects of education should be given special attention. Having an educational level of more than 12 years seems to have a negative effect on second child fertility rates among non-working women, while the effect is positive for the workers. Although nearly statistically significant at the 10 per cent level, the effect should not be overemphasized. This effect has, however, also turned up in a study of cumulative number of children and employment at the time of the interview (Jensen 1981). We see from Table 1 that education as well as age at first birth has very little effect on second child fertility.

We also find that women, who had not yet had their first child by 1968, had a smaller second child fertility than those who already had started childbearing by this date. This applies both to workers and non-workers, but the impact is much stronger among the non-workers, and only significant for them. An interpretation of this could be that the potential for a decline was larger among the non-workers since the workers already were adjusted to a relatively low level of fertility. If this interpretation is reasonable, it could also shed light on the small difference in the second child fertility among the workers and non-workers. It appears that the historical changes over the period studied affected non-workers to a greater extent than workers. Simultaneously, of course, there was an increase in the proportion of women who worked.

From our data we see no important differences in the second child

fertility between women who are working and those who are not. The overall probability of having a second child as a worker is 89 percent, compared to 86 percent among the non-workers. Both calculations are based upon data for married women 8 years after first childbirth. In order to get a picture of the impact of extensive work commitment during this period, we defined work throughout the period (without interruption) as a covariate the reference group; workers. By this definition a much lower second child fertility for women who have been employed without interruption since first birth is found. The probability of having a second child among these women was 37 percent lower than the figure for second child fertility of all workers (married women 8 years after first child birth). All percentages are based upon the reference group, which is lowest age at first birth and lowest level of education. The effect of this covariate is strongly negative and significant.

In table 3 we have calculated the probability of a second child among all women with interbirth employment and who have worked through the interval without interruption. Our calculations are based upon a model with interaction between age at first birth and education (Duration + age + education + age * education + work whithout interruption) at a duration of 8 years after first birth.

We find that the level of second birth is clearly lowered by work without interruption for the majority of groups by age at at first birth and education. Among the workers without interruption the number of women is relatively low in the two groups; lowest age at first birth and highest level of education and highest age at first birth and lowest level of education,which makes the results for these two groups relatively uncertain.

It is interesting to note that work in general, as well as work without interruption does affect the second child fertility to a lesser degree among women at the highest level of education than other women. Most clearly do we find a negative effect of work without interruption for women at a medium level of education.

These results suggest that <u>limited employment has little impact on fertility, while extensive employment has considerable impact</u>. Women with an uninterrupted interbirth employment are still a minority. In our sample 48 percent of the two child women had not been working during the interval between the first and second child. Thirty-eight percent had been working some of the time while only 14 percent had been working all of the time.

4.2 Transition from the second to the third child

While most women in Norway have two children, we find a considerable drop in the proportion of women who have a third child. Figure 4 shows that 81 percent of the women have a second child within eight years after their first birth, while 39 percent have a third child within another eight years. Both percentages are based upon the reference group of women with low age at first birth and low level of education. This means that of all women who have entered motherhood in our sample only 40 percent will have three children. The curve for the second childbirth is also steeper than that of third childbirth. By looking at the third child fertility, we see that the interval distribution between first and second child and between second and third child differs markedly (figure 2 and figure 5). While the second child fertility was strongly peaked between a year and a half to about three and a half years the third child fertility seems to be rather constant from 1 1/2 years after the second child was born. The "3 year norm" seems to have been active for the timing of the second child. No similar pattern of the timing of the third child seems to be working. This result is in accordance with the findings of Rodriguez et al (1984) who analyzed births, parity 3 to 8. They concluded: "... our results suggest a distinct lack of pattern in cessation of childbearig by birth order (or in timing for that matter) at least beyond the second birth" (p 26).

Separate duration profiles for the third child fertility rates for workers and non-workers are not presented. The low number of women who had three or more children did not allow separate estimation of third child fertility rates for the two groups. However, assuming a common duration profile, we have fitted multiplicative models, and we will present the effect of the covariates separately for the two groups, as an indication of the differences between those who have had no work after the second child and those who have had some.

Table 4 shows that the covariate distance between the first to the second child has the strongest effect on third child fertility among workers (18.6 units of deviance, 1 degree of freedom), and that also it has a strong effect among non-workers (11.5 units of deviance, 1 degree of freedom). We also see that age at second child and education have a strong effect, but only among non-workers.

Table 5 shows a negative and significant effect of education on third birth transition rates among non-workers. The effect is very strong for the highest level of education, indicating a level of the third child

fertility about 40 percent of that among women at low education. The positive effect of education, which appeared in Table 2 among the workers does also emerge in Table 5. In another article we have showed that level of education has a significant and clearly negative effect on the entrance to motherhood (Jensen 1985). This leads us to a conclusion that education has a negative effect on first child fertility, but well educated women who have entered motherhood do not have a second or third child fertility which is lower than less educated women. This finding is in accordance with conclusions drawn by other researchers (Rindfuss et al 1980, Rodriguez et al 1984).

Women who had not been working and were at age 25 or more at their second childbirth had a probability of a third childbirth which was less than 40 percent of the fertility for women at ages less than 21. For the workers the corresponding figure was about 50 percent, although the age variable is not significant for this group.

The delay of the second birth has a negative and significant impact on the third child fertility, both for workers and for non-workers. The probability of a third child is less than 70 percent for the non-workers and less than 30 percent for the workers if the time between the first two children is more than 30 months relative to those who have less than 30 months between the children. Also this result is supported by the analysis of Rodriguez et al (1984). They suggest "the reproductive process as an engine with its own inbuilt momentum" and in which previous birth intervals are strong factors when giving the probability of a next birth: "There is a strong correlation between behaviour in successive intervals, probably reflecting variations in fecundity, coital frequency, contraceptive use and efficacy, and breast feeding propensity, with those having long previous intervals being less likely to progress to a further birth." (p.27). A discussion is going on to which degree the effect of the length of previous intervals may be explained by unobservables (Heckman et al 1985), however, here we shall be satisfied by the main conclusion of the impact of length of birth interval on fertility without the further examinations of these processes. In our view this may imply that the pattern of fertility may be less dependent upon traditional background factors than has previously been assumed. A separation between higher and lower fertility women has not been possible from this study of employment, age at first childbirth and level of education. However, the last observation, that previous spacings has such a large effect on third child fertility, may indicate that there are important individual differences with respect to fertility. These differences seems to go across and not parallel to background variables.

5 CONCLUSION

In this paper we have taken a dynamic approach to the study of fertility and employment over the life course. We have employed multistate hazard models, and we have estimated parity specific fertility rates of step function form and with proportionality between groups by the method of maximum likelihood. The two dynamic variables: labor force participation and marital status are modeled into the state space and are regarded as endogenous. Other grouped background variables such as education, age at first birth, etc. are treated as exogenous. Women who have not had a second (or third) birth are censored by the time of interview.

The results are discussed in two sections: we separately consider the intervals from the first to the second birth, and from the second to the third birth. The main emphasis is placed upon a discussion of the transition from the first to the second child, but we also devote some space to analyze the differences between this birth interval and the subsequent third child fertility.

We found, unexpectedly, no significant difference in second child fertility by employment. In concluding we wish to discuss three aspects of this finding.

1) It may partly be a result of shortcomings of our data
2) It may be a result of certain aspects of the methodology
3) It may reflect a part of "Norwegian reality".

Data: as explained in section 2 there are several shortcomings of our data, which by our method will lead to an overestimation of the second child fertility for women in the labor force, and an underestimaton for those outside the labor force and not under education. It is hard to asses the magnitude of these biases, but they are probably not strong enough to destroy the tentative conclusion.

Methodology: the next question is whether the result partly is an artefact of the methodology we have used. In contrast to the method of comparing the mean birth interval for two child mothers who had/had not worked between the births, which may be called the backward method, our forward

method based on the hazard concept is taking the dynamic aspect of time more properly into consideration. The backward method will actually lead to severe selection biases, and the results obtained by this method are hard to interprete.

Two different definitions of employment are used in the backward and the forward methodology. By the backward method the women are partitioned into workers and non-workers according to their status at their second childbirth. Women with only one birth are not taken into account. The partition of workers and non-workers is regarded as fixed. As women tend to join the work force as time goes by since their first childbirth, the non-workers group is in a sense purified by the backward method. In the forward method we do not operate with a fixed dichotomy between workers and non-workers. The fertility rate is estimated at each point in time since the first child birth, and this is done separately for those who were inside and outside the workforce at that time. By the forward method the woman is allowed to change her work status. This means that the non-workers group at a given time consist of women who remain at home for the time being, but who may join the labor force later on. Early after the first birth we may say that the workers group consists only of women who were employed through most of the time since the first birth. Since only 14 percent of the women in the sample worked throughout the interval, the occurrences and exposures of non-workers are based on 86 percent of the sample for the early intervals after the first birth.

As we see it is difficult to draw comparisons between results based upon a grouping of the women by the backward method and the grouping of the women based on the forward method. Although our results are biased by limitations of the data, we think the forward method of studying fertility and employment gives insights which are difficult to obtain by the backward methodology.

"Norwegian reality": Do we then have supporting evidence that the fertility rate actually remained pretty much the same between workers and non-workers in Norway since the late 1950's?

A norwegian fertility survey, conducted in 1977, showed that most women agreed to a norm of two, and to a lesser degree, three children. Above 50 percent of the women in the childbearing years (age 20-34) answered that the ideal number of children was two. (Noack and Østby 1981). Among women aged 30-34 the distribution of the number of children was as follows: 11 percent had no child, 14 percent, had one while 75 percent had two or more children (Noack and Østby 1981, p. 181).

In order to understand the results of this analysis,another aspect to take into consideration is that the labor force participation at this stage of life still is relatively low in Norway. In 1972 only 35 percent of these mothers were employed, while the figures were about 50 percent (all women whose youngest child was less that 7 years) ten years later (Social Survey 1983). These are quite low figures. Most of the employed women with small children worked part-time,which indicates that there is a clear future potencial for more labor force participation among women who are not employed between the two births at the time of this survey.

It is probable that the non-workers group consists of women who give preferences to childbearing on behalf of employment, but it is also probable that a considerable group of these women adjust their fertility behavior to future labor force participation. An interpretation of the effect of the historical variable 1968, may give support to this argument. We found that women who had their first child after 1968 had a considerably lower probability of a second child compared to women who had their first child before 1968. This effect was much stronger among the non-workers compared to the workers. We belive that the low frequency of inter-birth employment indicates that a considerable part of these women are influenced by the general trend in society towards higher labor force participation and lower fertility, but they have other preferences than inter-birth employment. It is also probable that women who are still studying constitutes a greater part of the non-working women who had their first birth after 1968, than among the women who started birthgiving earlier.

In general there is little variation in the frequency of having a second child left to be explained by employment. Our results indicate that most of the variation in the second child fertility is simply explained by the passing of time. It would seem that women in Norway have their second child pretty much independent of whether they have been employed or not after the first birth. This finding, however, is radically altered when we take into consideration the extent of employment. While we do not have any significant effect from labor force participation in general, the effect is very strong and negative for those women who were employed without interruption after the first birth. In this case we also escape the methodological problems of making choices where to place periods of employment.

One conclusion from this study is that it has shown the importance of including a measure for the extent of the labor force participation, instead of treating this as a "yes" or "no" variable. An interesting question is then, how much employment is "needed" to have this negative effect on fertility? According to this we find it important for future research

to make distinctions in the measurement of employment effects on fertility. Our analysis indicates that employment in a general term is not necessarily an activity which competes with childbearing, while extensive employment does have a clear effect of reduced fertility. Still the majority of norwegian women do have at least two children in spite of difficulties in combining work and small children. Only the minority of women with the most extensive work commitment do not fulfill this norm, which seems to be widespread throughout our society.

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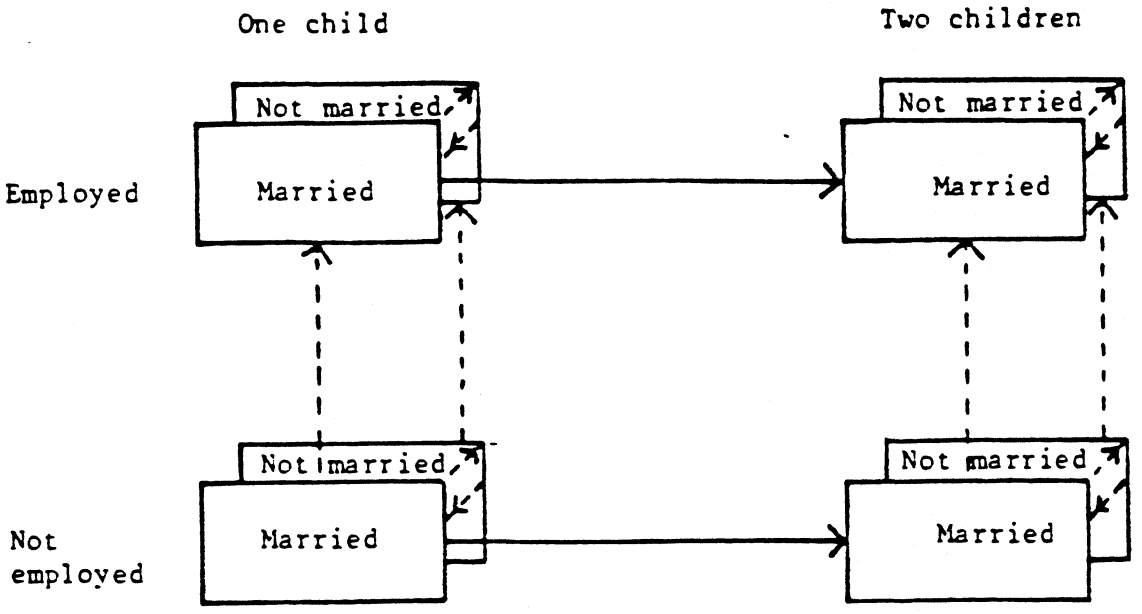
Figure 1: Model for transition intensity from 1 child to 2 children



Note to figure 1: The horizontal unbroken arrows indicate the transitions from the first to the second child, which are analyzed in this article. The vertical, broken arrows indicate the transitions from not employed to employed. The figure does not have any arrow from employed to not employed, since our data only had duration and not the exact time of interbirth employment. We are assuming that employment, if any immidiately preceeded the second birth. The remaining broken arrows indicate the transitions in marital status. Our calculations are based upon those women who are in the "boxes" of married women at each time-unit.

Figure 2: Second child fertility rate (from first to second child) All women per 1000, month

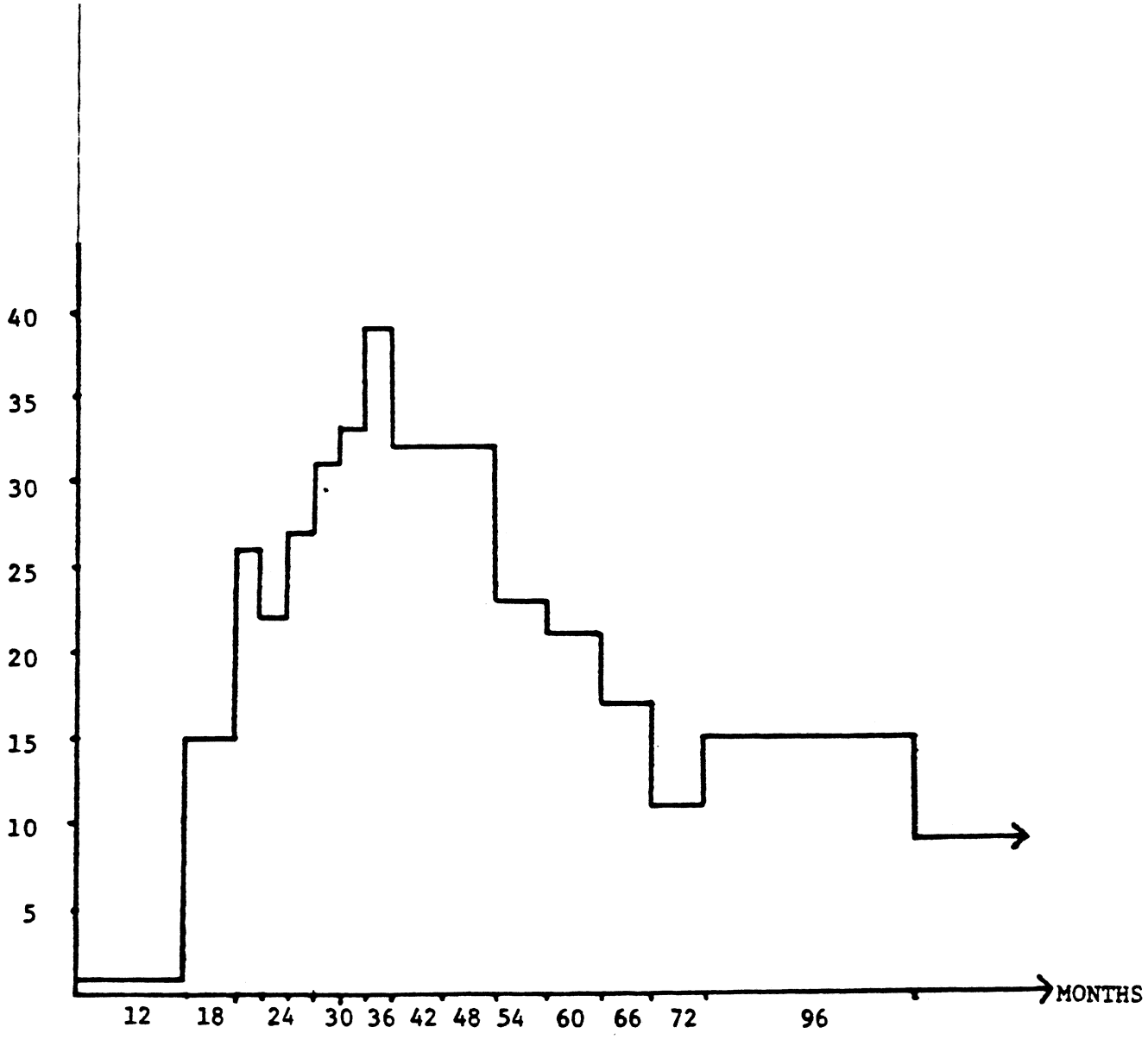


Figure 3: Second child fertility rate, workers and non-workers. Married women, per 1000, month

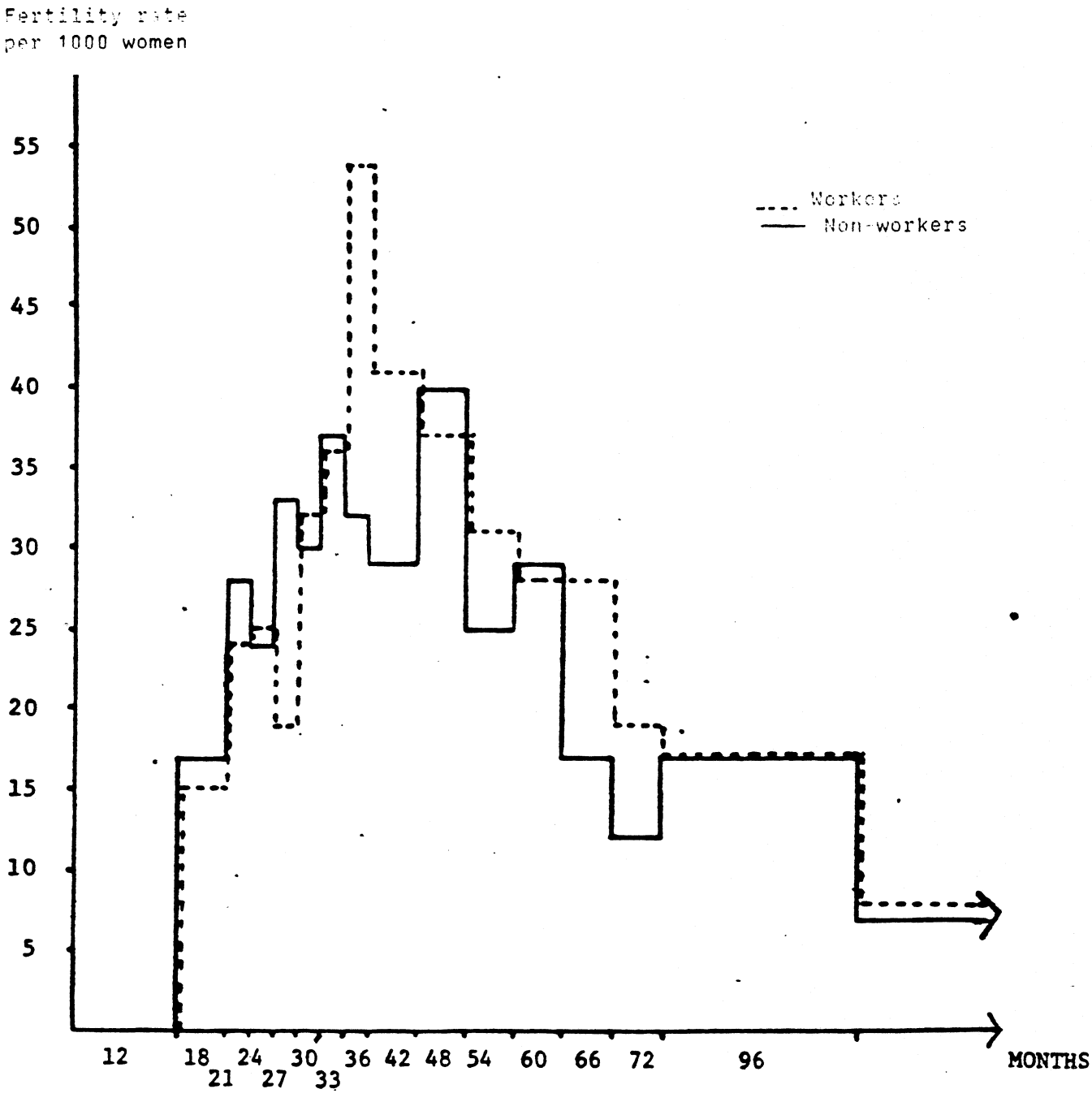


Table 1. The gain in fit by introducing richer models, second child fertility

Models	Non-work		Work	
	Deviance[1]	Degree of freedom	Deviance	Degree of freedom
Reference modell: Duration since first birth				
New covariates:				
Age at first birth	5.8	2	2.1	2
Education	5.2	2	2.9	2
Age + education[2]	9.6	4	7.5	4
Age + educ + age * educ[3]	14.8	8	12.4	8
Reference model: Duration + age + educ				
New covariates:				
1968	32.3	1	2.4	1
Reference model: Duration + age + educ + age * educ				
New covariates:				
Work at all intervals			30.8	1

1) Scaled deviance difference between the reference model and the fitted model, is, compared to the χ^2-distribution with the indicated number of freedom measuring the gain in fit.

2) We write the multiplicative model in its log lonear form. That age + education is added to the model means that the intensity of the reference model is adjusted by multiplicative factors, one dependent on age and the other on education.

3) Interaction terms are denoted by products, like age * educ.

Table 2. Multiplicative effects of the covariates on fertility from first to second child. Married women

Covariate	Non-work		Work	
Age at 1. birth	Estimate[1]	Conf.int.[2]	Estimate	Conf.int.
Less than 21 years	1.00		1.00	
21-25 years	1.29	(0.97,1.61)	0.88	(0.67,1.16)
More than 25 years	0.99	(0.67,1.47)	0.67	(0.47,0.95)
Level of education				
Less than 10 years	1.00		1.00	
10 to 12 years	0.80	(0.65,1.00)	0.99	(0.72,1.37)
More than 12 years	0.59	(0.38,0.90)	1.45	(0.99,2.12)
First child				
Before 1968	1.00		1.00	
After 1968	0.41	(0.32,0.52)	0.62	(0.39,1.00)

1) Estimates are based upon the multiplicative model duration + age + educ + 1968

2) Confidence interval 90 percent.

Table 3. Probability of a second child 8 years after first birth for all workers, and workers with uninterrupted employment, by age at first birth, and level of education. Percent

Education	All workers			Workers with uninterrupted employment		
	Age at first birth			Age at first birth		
	Under 21	21-25	More than 25	Under 21	21-25	More than 25
Less than 10 years	92	94	74	63	68	41
10-12 years	92	93	85	62	65	53
More than 12 years	100	98	96	100	77	99

Figure 4: Cumulative probability of having a second and third childbirth among all women who have entered motherhood, within 8 years after previous childbirth. Percent

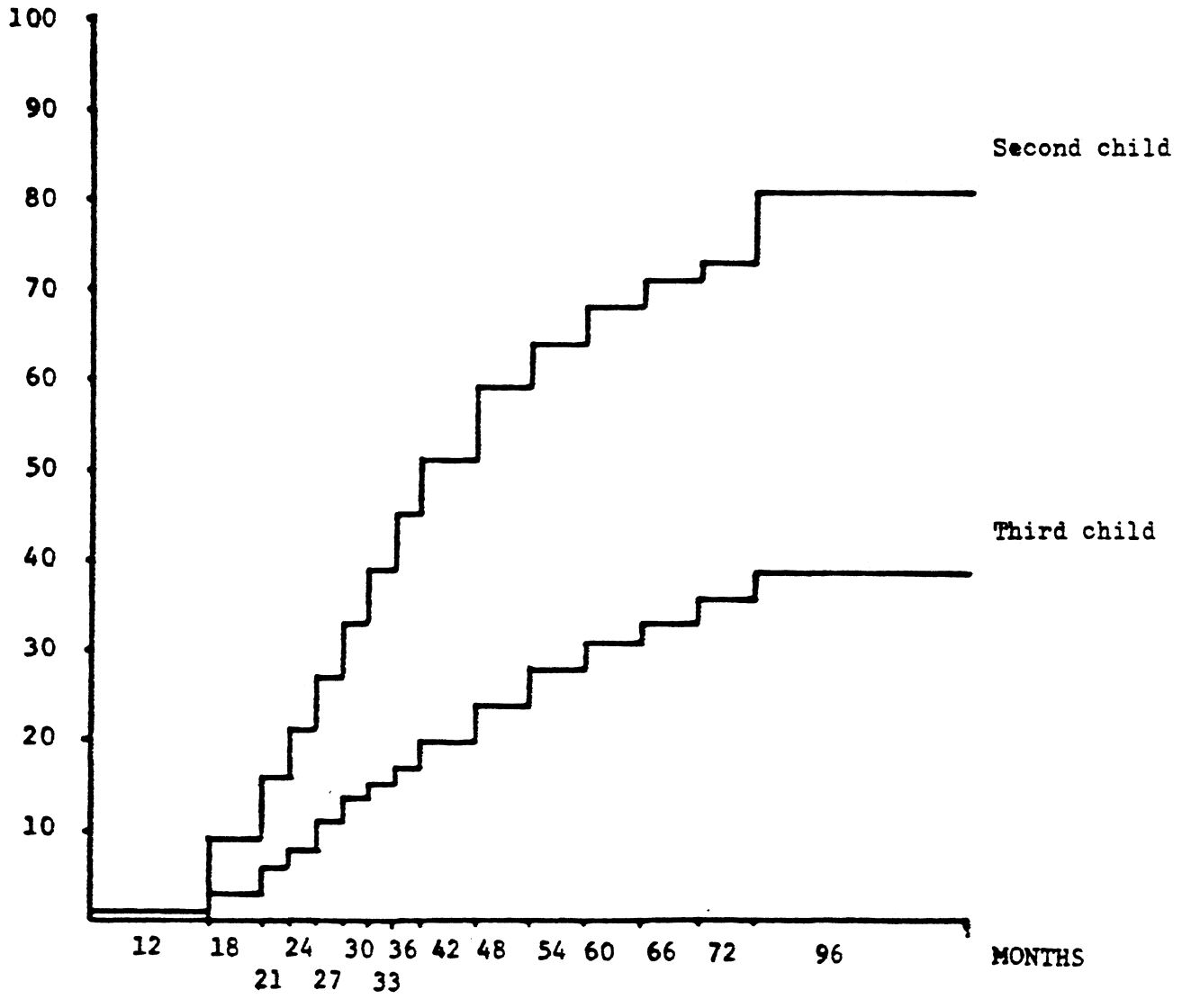


Figure 5: Third child fertility rate. All per 1000 women, month

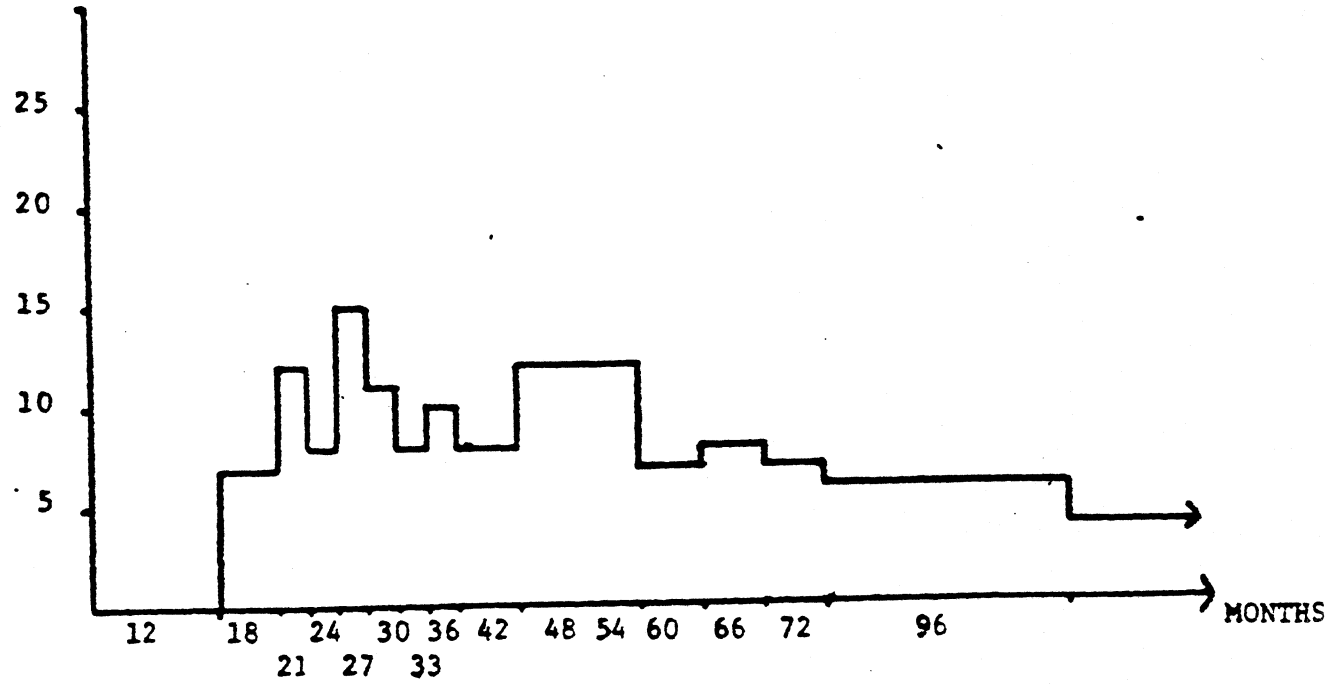


Table 4. The gain in fit by introducing richer models, third child fertility

Models:	Non-work Dev.[1] / d.f.		Work Dev. / d.f.	
Reference model: Duration since second birth				
Covariates:				
Age at 2. birth	24.7	2	4.5	2
Education	14.1	2	1.4	2
Distance 1-2 child	11.5	1	18.6	1
Age + educ + distance	34.1	5	24.8	5
Age + educ + dist + age * educ	39.2	9	27.1	8[2]

1) Our estimates are based upon the multiplicative model (age + educ + distance).
2) See note 2 to table 2.
1) See note 1 to table 1.
2) Degrees of freedom are one less for workers compared to non-workers due to no observation in one of the cells.

Table 5. Multiplicative effects of the covariates on fertility from second to third child. Married women

	Non-work		Work	
Age at 2. birth	Estimate[1]	Conf.int.[2]	Estimate	Conf.int.
Less than 23 years	1.00		1.00	
23 to 26 years	0.69	(0.49,0.99)	1.59	(0.85,2.98)
More than 26 years	0.37	(0.21,0.64)	0.54	(0.21,0.72)
Level of education				
Less than 10 years	1.00		1.00	
10 to 12 years	0.78	(0.56,1.50)	1.12	(0.57,2.22)
More than 12 years	0.42	(0.22,0.80)	2.27	(0.82,6.30)
Distance 1-2 child				
Less than 30 months	1.00		1.00	
30 months or more	0.66	(0.48,0.92)	0.28	(0.16,0.48)

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