The Cost of Children: Differences between the Genders[*]

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Abstract

In this paper we estimate the opportunity cost of children. The underlying theoretical model is represented by a household production model. In the empirical analysis, we consider three different cohorts for men and women born between 1955 and 1970. For the women in the two oldest cohorts, the opportunity cost of *two* children is estimated to 28-29 per cent of full income, which in monetary units is close to estimated income difference between women employed in the public and private sector. The opportunity cost of fatherhood is generally positive, but only significantly positive for men born between 1960 and 1965.

Key words: Children, parenthood, opportunity cost, income loss

JEL code: D13, J13

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1. Introduction

The cost of children can be divided into two components: out-of-pocket spending, in terms of higher expenditures on food, clothing, housing etc, (see e.g., Blundell and Lewbel 1991, Browning 1992, Deaton and Muellbauer 1986, van Praag and Warmaar 1997, and Browning and Ejrnæs 2009), and the opportunity costs that the parents have when bearing and rearing children. An important aspect of the opportunity costs is the income that the parents forego by staying at home to bear and rear children and by not participating in market work.

To reduce the cost of children, the family policy in many countries provides financial support to both the out-of-pocket spending, via universal child benefit (allowance), and the opportunity cost, via paid parental leave and paid care of sick children. In Sweden, the provision of subsidised child-care in day-care centres is also an important feature of the family policy. As local governments have been the major providers of child-care in Sweden, there has been some variation in coverage and rules. However, the general ambition has been to provide care that allows both parents to work full time (Björklund 2006). In the design of the parental leave one have also earmarked some of the days (30 days since 1995 and 60 days since 2002) to the father and mother, the so-called father-mother months, to increase the equality between women and men. To further increase the equality between the genders, one has recently introduced an “equality bonus”, which aims to support a more equal utilisation of the days with paid parental leave. Today the mother uses most of the days. Although the Swedish family policy, in an international comparison, is well developed, it is likely that the cost of children is unequally distributed among the genders. The main objective of this paper is to estimate the opportunity costs of children for women and men in Sweden.

Compared to the pre-1970s, women's incomes have greater importance today, with the economic situation of most families based on two incomes. One reason for this is the abolishment of the joint tax assessment of spouses in the early 1970s. As income tax is based on an individual's rather than the household income, it is usually favourable to have two wage earners rather than one. In this respect the Swedish tax system differs from many other European countries, for example Germany. Another reason for the increase in female labour supply is the expansion of the childcare system over recent decades, making it easier to combine market work and parenthood.

From previous studies we know that women's income and labour market conditions are important determinants in the decision to have children. Usually women decide to have children when the income is sufficiently high (Hoem 1998, Andersson 2000, Duvander and Olsson 2001) and they have a permanent job (Persson 2001).[1] One reason for this is that the parental allowance is linked to the income from gainful employment. In this way, the design of Swedish family policy has strengthened the importance of women's incomes in families' decisions to have children, which also makes it of interest to study the opportunity cost of bearing and rearing children.

In the beginning of the 1970s the parental benefit rate was basically 90 per cent of the regular income. The benefit was both a pensionable income and taxable, and a minimum guaranteed benefit was granted parents on low income. The basic principle of the parental insurance was that it should be individual and should cover a loss of income. During the second half of the 1970s and the 1980s the parental insurance was further developed. The number of days with parental benefit increased and the usage of them became gradually more flexible. In the

[1] The increased education of women has also lead to a postponement of the first birth (Monstad et al. 2008).

beginning of the 1990s the decision is made to split the right to the parental benefit equally between the two parents. It had previously gone to the mother, with the possibility to partially transfer benefit days to the father. Except for the so-called father-mother month which is reimbursed with 90 per cent of the qualifying income, one parent can transfer his or her parental benefit to the other parent.

However, the Swedish depression of the 1990s deeply affected families with children, first through the sharp reduction in employment and later through the changes in family policy driven by the financial crises. In the mid-1990s, the state of the nation forced the government to limit its expenses by cutting or completely abolishing several sections of the parental insurance. As a part of the financial reconstruction program, the reimbursement level of the parental insurance was gradually lowered from 90 per cent to 80 per cent, and then to 75 per cent.[2] When the financial situation improved toward the end the 1990s, the reimbursement level of the parental insurance was raised again to 80 per cent of the income. [3] Taken together, the 1990s meant worsened economical terms for families with children until 1997. Conditions have since then improved. For a more comprehensive review of the Swedish family policy, see e.g. Björklund (2006).

In the analysis of the opportunity cost of children, we will apply a household production model. Although, there are a relatively large literature that has studied the effects of children on female labour supply (see e.g., Angrist and Evans 1998, Carrasco 2001, Hotz and Miller 1988, Nakamura and Nakamura 1992 and Rosenzweig and Wolpin 1980) and wages (see e.g., Datta Gupta and Smith 2002, Moffit 1984, Nilsen et al. 2004, and Waldfogel 1998), there are

[2] Between 1991 and 1995, the child allowance remained on the same nominal level (SEK 750/month) and was reduced in 1996 to SEK 640/month.

[3] The income loss principle is however being undermined since the limit of the parental insurance is tied to the price base amount. In 2001, the corresponding limit was SEK 23000/month, i.e. the reimbursement can be at most 80 per cent of SEK 23000/month.

fewer attempts to estimate the total opportunity cost of children, i.e., the total effect on income of work.

Previous studies that have estimated the total opportunity costs of children include for example Calhoun and Espenshade (1988). They present estimates of the opportunity costs of children in the United States as measured by the forgone hours of market work and earnings of women between the ages 15 and 55. The authors find that it is the labour supply reductions immediately following each birth that contribute most to the observed opportunity costs. Joshi (1990) used cross-sectional data of British women from 1980 to estimate the opportunity cost of childbearing. Joshi's results suggest a much higher opportunity cost for British women (£56,000 per child) than for the US women (£16,000 per child in the study by Calhoun and Espenshade).[4] The forgone hours for US women are estimated to be a little more than one year's full-time work per child, whereas the British examples represent approximately 13 full-time equivalent years for a two-child family. One reason for the large difference in the results may be due to the use of cross-sectional data in Joshi's study**,** as participation profiles based on cross-sectional rather than longitudinal data could exaggerate the effects of children on participation. Based on a cross-section data set for full time working women in Canada, Phipps et al. (2001) estimate the income loss associated with having children to 17-12.5 percent.

For men, there have been only a few attempts to measure the opportunity cost of fatherhood. Pencavel (1986) finds that young children are associated with longer work hours for men in the 1980 US Census, and Waldfogel (1997) reports that the wages of young men in 1980 and 1991 NLS samples are higher if they have two or more children. However, both of these

[4] Both costs are in 1986 values.

studies use cross-sectional data. Lundberg and Rose (2002) estimate the effects of children and the differential effects of sons and daughters on male labour supply and hourly wage rates in the US based on panel data. They find that fatherhood significantly increases the hourly wage rates and annual hours of work for men. Most notably, the male labour supply and wage rates increase more in response to the birth of sons than to the birth of daughters. Lundberg and Rose also compare OLS and fixed-effects estimates, suggesting that there is substantial heterogeneity bias in conventional cross-sectional estimates of the effects of fatherhood on men's outcomes.

To estimate the opportunity costs of children for men and women in Sweden we will therefore use a panel data set and apply a fixed-effects estimator.

The paper is organized as follows. In the next section, we present the economic model. In Section 3, we describe the panel data, and in the following section, we discuss the econometric method. The results are presented in Section 5**,** while Section 6 ends with a discussion.

2. Economic Model

In this section we present two approaches to describe the household's optimisation problem for bringing up children; the first approach focus directly on the allocation of time for home production and labour supply and on the conditions that determines this allocation, while the second approach focus on the opportunity cost of bringing up children. Both approaches give valuable insights to the household's optimisation problem.

As mentioned in the introduction the costs associated with the birth and care of children can be seen as the sum of two parts, the out-of-pocket expenditures for child maintenance (food, clothes, recreational activities etc.) and the value of the parents' joint home time. Under the assumption that the only time-consuming domestic activities are those associated with the birth and care of children, the household's decision problem can be represented by a model in which the parents maximize the quality of the child's life. The parents' home production for bringing up a child may thus be given by the function

$$q = F(H_{mf}, E_{mf}) \tag{1}$$

where q can be seen as the child's quality of life, reflected in the parents' preferences and economic environment. $H_{mf} = H_m + H_f$ is the parents' joint home time, and E_{mf} denotes the joint input of commodities. The function $F(\ )$ is assumed to be increasing in all its arguments and quasi-concave, in other words we assume that parental generosity improve the quality of a child's life.

In the allocation of time for joint home production, the parents maximize (1) subject to the time constraint

$$H_i \leq T, \qquad i = m, f$$

where T is total time available for each parent, and the joint budget constraint

$$E_{mf} \leq w_f L_f + w_m L_m + V_f + V_m, \qquad i = m, f\ , \tag{2}$$

where L_i, w_i and V_i denote the labour supply, the wage rate, and other income for the male, *m*, and female parent, *f*. As we are considering only the allocation of time for "child care" and disregarding leisure time, labour and home time must sum up to *T* for each parent,

$$L_i = T - H_i, \quad i = m, f. \tag{3}$$

Substituting (3) into (2) gives the budget constraint

$$w_m H_m + w_f H_f + E_{mf} \leq V_m + V_f + (w_m + w_f)T \equiv Y_m + Y_f \tag{4}$$

where $Y_m + Y_f$ is the household's full income.

The rate of return to the parents' joint home time, H_{mf}, which we denote as the shadow wage rate w^*, is the marginal rate of technical substitution of commodities for home time

$$\frac{\partial F(\cdot)/\partial H_{mf}}{\partial F(\cdot)/\partial E_{mf}} = w_f^* = w_m^* \tag{5}$$

where $\partial F(\cdot)/\partial H_{mf}$ is the marginal product of home time and $\partial F(\cdot)/\partial E_{mf}$ is the marginal product of commodities. As the rate of return to market work, L_i, is given by the market wage rate, w_i, the time allocation will be based on the level of the market wage and the shadow wage rate.

If we assume that the woman's wage rate is lower than the man's (which is the case in Sweden overall, see Section 3), and that the shadow wage rate, for all H_f less than *T*, exceeds the woman's market wage but not the man's, i.e. $w_f < w_f^* = w_m^* < w_m, \forall H_{mf} < T$, then the woman will use all her time for home production, $H_{mf} = T$, while the man will spend all his time in market work, $L_m = T$. However, if the woman's wage rate is equal to the shadow wage rate for some H_f less than *T*, the woman will engage in home production up to the point $H_f^* = H_{mf}^*$ where $w_f^* = w_f$ and use the rest of the time, $L_f = T - H_{mf}^*$, to raise income.

To describe the concept of the household's opportunity cost for bearing and rearing children and to better understand the organization of home production, we can also see the above optimization process as a two-stage procedure, where the household first decides on the time mix that minimizes the income forgone $(w_f H_f + w_m H_m)$ in order to attain a desired level of intermediate production H_{mf}, subject to the time constraints of the parents $H_j \leq T,\ j = m, f$. The optimal choice gives the conditional factor demand function and the total opportunity cost of the parents' joint home time $W^{mf}(H_{mf}, w_m, w_f)$, i.e. the minimal cost at wages w_f, w_m, and output level H_{mf}. Here, an increase in the net wage of either parent would raise the marginal cost of joint home time. Since it is quite possible that there are economics of scale in the time of child-minding, we may allow the total time for home production H_{mf} to be a function of the number of children, *n*, such as $H_{mf} = hn^{\alpha}$, with $0 < \alpha \leq 1$ as the economics of scale parameter and $W^{mf}(hn^{\alpha}, w_m, w_f)$.

The second steep in the optimization problem can then be formulated as a cost-minimizing problem of bringing up a child, where the cost to the parents of efficiently bringing up children is found by minimizing the total opportunity cost of joint home time and the out-of-pocket expenditures[5]

$$W^{mf}(hn^{\alpha}, w_m, w_f) + en^{\beta}, \qquad 0 < \alpha \leq 1, 0 < \beta \leq 1, \tag{6}$$

subject to the children's quality of life $q = F(H_{mf}, E_{mf})$. This cost, which in our model can be seen as the total cost of children, can be written as

$$C = W^{mf}(h^* n^{\alpha}, w_f, w_m) + e^* n^{\beta}, \tag{7}$$

where h^* and e^* denote the optimal values of *h* and *e*. Hence, the marginal cost of a child is

$$\partial C / \partial n = \alpha w n^{\alpha-1} + \beta e^* n^{\beta-1}, \tag{8}$$

where *w* is the marginal cost of joint home time. In the empirical application we will disregard the commodity costs and focus on the opportunity and marginal opportunity cost of children.

[5] As there also is reasonable to assume that there is economics of scale in out-of-pocket expenditures (as younger brothers and sisters can be handed down clothes and toys from older siblings and the commodity market may offer quantity discounts on certain items), we also allow, E_{mf}, to a function of the number of children such as $E_{mf} = en^{\beta}$, with $0 < \beta \leq 1$.

3. Data

To study the effects of children on forgone earnings, we use a panel data set for people born between 1955 and 1970. Information on income, parental allowance, sickness benefit, unemployment benefit, social allowance, study allowances, education, and year of education has been drawn from register data for the period 1985–1998. The individuals included in the data set were initially asked to participate in a survey on family circumstances and childbearing, and the information of the birth dates for the children are based on information from the survey. Of the 5000 randomly selected individuals from the Swedish population 2,950 individuals answered the questionnaire (1,620 women and 1,340 men), making the panel data comprising of 41,300 observations.

To examine changes in household responses to children over time, we divide the sample into three cohorts and two genders: men and women born 1955–1959, 1960–1965 and 1966–1970. We denote the cohort of people born 1955–1959 as the first (or oldest) cohort. People born in 1960–1965 and 1966–1970 will consequently belong to the second and third (or youngest) cohorts. Means and standard deviations of some key variables are reported in Table 1.

Compared to women, a larger proportion of the men (55 per cent) are classified as having a low level of education, i.e. they have at most two years' education at upper secondary school. For the women, 50 per cent in cohorts 1 and 2 are classified as having a low level of education. For the first two cohorts, the proportion of people with a high level of education, i.e. those with more than two years of higher education, is about the same for both genders. As the tables reveal, the gender difference in educational level increases in the youngest cohort, in which the women have extended their education. For this cohort, we also observe, compared to men, a larger proportion of women with a high level of education.

Table 1 about here

As men on average are older when they become a parent, the average number of children in each cohort is lower for men compared to women. For the women in the youngest cohort the average number of children is 1.3, while the women in the oldest cohort on average have 2.1 children. About 79 per cent of the women in the oldest cohort do not plan to have any more children, while the corresponding figure for the women in the youngest cohort is 28 per cent. For the sample, the time between the births of the children decreases for younger cohorts. On average, the time between the first and second child was 3.8 years for the oldest cohort, while it was 3.2 and 3.0 years for the second and third cohort. This difference may be due to both cohort effects and age effects, as the average age is 32 for the youngest cohort and 42 for the oldest cohort.

For younger cohorts a larger proportion of the population is employed in the private sector. The largest increase is for women, although men are more frequently employed in the private sector.

Although we have observed that the women are at least as well educated as the men, the hourly wage rate is generally lower for women than men in Sweden. During the period covered by our panel data set, the wage difference between men and women in the manufacturing industry has been fairly constant, with, on average, a 11 per cent higher hourly wage rate for the men.[6] One explanation for the lower wage rate for women is that they tend to hold lower positions in a company. For both men and women the real wage increased from

[6] The wage difference between men and women is larger if we consider all sectors in the economy. Considering all sectors in the economy, the wage difference amounted to 16 percent in 2008 (the Swedish National Mediation Office, 2009).

1985 to 1989, whereupon it fell until 1994, 1992 being an exception. After 1994, the real wage has been increasing, with substantial increases during the last three years of the period that we consider in this study. In 1998, the real hourly wage rate was about 25 per cent higher than it was in year 1985.[7]

3.1 The effects of children

Figure 1 presents the annual income in real terms from market work and parental allowance for women with and without children. As can be seen from the figure, the income difference between women with and without children increased over the period 1985–1990 for the two oldest cohorts. At the beginning of the 1990s there is a reduction in the average annual income of women without children, probably as a result of the recession and rise in unemployment, which reduced the income difference between women with and without children. After 1993, the real income for childless women increased, which tended to exaggerate the income differences for the women in the youngest cohort.

The reasons for the lower incomes of women with children may be manifold; however, one major reason is the reduction in labour supply. As can be seen from Table 2, women with children generally have a lower labour supply than women without children in year 2000. However, the difference is somewhat lower for the women in the oldest cohort. This may be due to the fact that these women have to a larger extent returned to the labour market after having children. Men with children in the first and third cohorts also work less overtime compared to men without children. The largest difference is found for the youngest cohort.

[7] The number refers to the hourly wage rate for men and women employed in the manufacturing industry. Source Statistics Sweden.

For the men in the second cohort the pattern is reversed, with more overtime for men with children.

Figure 1 about here

Although the conditions in 2000 give a relatively clear picture of the impact of children on labour supply, it is also interesting to see what happened to labour supply when the men and women had their first child. Table 3 reveals that 8 per cent of the women in the first cohort stopped working when they had their first child; the corresponding figure for the women in the third and second cohorts was 4 per cent. Compared to the women in the oldest cohort, there was also a larger proportion of women in the two youngest cohorts who did not change their labour supply when they had their first child: 29 to 31 per cent for the women in the second and third cohorts compared to 25 per cent for the women in the oldest cohort.

Table 2 about here

One reason for a lower change in the labour supply in the younger cohorts may be due to the increased number of days with parental benefit that took place in the end of the 1970s and the 1980s. As can be seen from Table A1, in the appendix, there has also been a gradual extension in parental leave for women. For example, 50 per cent of the women in the first cohort stayed at home for 10–18 months with their first child, 59 per cent of the women in cohort 2 and 65 per cent of women in the youngest cohort. The time on parental leave has also increased for the men, but from a much lower level. About 22 per cent of the men in the oldest cohort stayed at home for 1–3 month with their first child, while the fraction increased with 5 percentage points, to 27 percent, for the men in the two youngest cohorts. About 26 to

29 per cent of the men did not take paternal leave when they had their first child, and about 35 per cent of the men that took paternal leave stayed at home for less than one month.

Compared to the two oldest cohorts, the figures in Table 3 indicate that almost twice as many of the men and women in youngest cohort did not work when they had their first child: 8 per cent for the men and 22 per cent for the women. On average, the individuals in cohort 3 were also younger that the individuals in the second and third cohort when they had their first child, suggesting that a larger part of these individuals had not entered the labour market when they had their first child. During 1990 to 1993, there was also a drastic increase in the unemployment rates in Sweden, due to the economic crisis, and the unemployment rates continued to be on a high level for the rest of the period that we consider in this paper. However, during the years 1990 to 1993 the number of births in Sweden continued to be very high, about 120,000 per year.

Table 3 about here

4. Econometric Model

To estimate the opportunity cost of children we use a fixed effects model. The base specification can be written as

$$y_{it} = X_{it}^{'}\beta + D_{it}^{'}\lambda + \mu_i + \varepsilon_{it}, \qquad i = 1,...,N, \tag{9}$$

where y_{it} is the annual income from work and parental allowance for individual *i* at time *t*. D_{it} is the *i*th observation of a set of dummy variables that represents the number of children, while X contains additional explanatory variables. μ_i is the individual specific effect that

captures unobserved heterogeneity and ε_{it} is an idiosyncratic disturbance. β, λ and $\mu = (\mu_1,...,\mu_N)$ are parameter vectors to be estimated, $\gamma = (\beta, \lambda, \mu)$.

The variables included in *X* are age, age squared, work experience and education, divided into three categories: those with low, medium and high education. The variables that represent educational level take the value zero prior to the year of the highest exam and one thereafter. In addition we control for two other income sources, unemployment benefit and sickness benefit, by dummy variables that take the value one if the individual has received sickness or unemployment benefit for a given year at the same time as the income from work and parental allowance is zero. By constructing the sickness benefit dummy variable in this way, the short-term sickness benefit that is associated with the care of sick children is captured by the dummy variable of the child. Work experience for each period is defined as the number of years since the highest education exam, minus the number of years with parental allowance and no income from work for the years after leaving education.

We also include a dummy variable that controls for type of employer. This dummy variable takes the value one if the individual is employed in a privately owned company and zero elsewhere. As we are only observing employment status in the year 2000, we assume that the individual has had the same type of employer during the years of employment. Therefore, the indicator variable that is included in the regression is the product of the dummy variable of employment status in the year 2000 and an indicator variable that takes the value one if the individual has income from work in a specific year and zero otherwise.

To account for the non-linear effects that the number of children might have on a parent's income**,** we use dummy variables to represent the presence of children. We include three

dummy variables that represent the presence of exactly one, two and three children, and a fourth dummy variable that represents more than three children, as there are so few observations for households with four or more children.

As the opportunity cost can be expected to differ for individuals with different educational levels, we also consider an alternative specification of the fixed effects model (10). In this model, we interact the dummy variables for the number of children with the variables for educational level, such that the model can be written as

$$y_{it} = X_{it}^{'A}\beta + D_{it}X_{it}^{'E}\lambda + \mu_i + \varepsilon_{it} \qquad (10)$$

Here, X^A contains the same set of variables as X except for the educational variables. The educational variables and an additional variable labelled *student*, which takes the value one for the years before the highest education exam and zero thereafter, are included in X^E.

For inference purposes, we apply a Newey-West estimator of the covariance matrix to account for serial correlation and heteroskedasticity.

Although panel data are superior to cross-section data in the analysis of the opportunity cost of parenthood, the fixed effects approach may still suffer from some shortcomings. For example, the fixed effects estimated may still exhibit endogeneity or omitted variable bias. One reason is that the timing of parenthood may be caused by, or correlated with, actual or expected shocks to the income variable. For instance, men and women may decide to have a child when they think that their income is sufficiently high, or when they expect to receive a rise in income. A second reason is that individuals with higher growth rates of income may be more likely to have more children, Lundberg and Rose (2002). To overcome the problem of

endogeneity, one may use an instrumental variable procedure. However, such a procedure would require data on some variable that is correlated with the measures of fertility, but uncorrelated with the error terms. We have not been able to find such an instrument.

5. Results

In Table 4 we present the regression results for the women according to the model specification in equation (9). For the two youngest cohorts, we see that all parameters are significant. As the age variables become insignificant in the initial specification of the income equation for the oldest cohort, we exclude the squared age variable for this cohort. For the oldest cohort, all variables except work experience for those with a low level of education have a significant effect on income. As expected the marginal age effect declines for older cohorts.

If we study the effects of children for the youngest cohort, we see that one child reduces the woman's income by about SEK 27,000 per year or with 31 percent of full income, which we measure as the average income of women without children, while two children reduce income by SEK 39,000 per year or with 46 per cent. The income reduction for a woman with three children amounts to SEK 48,000 per year. The results thus suggest that there are economies of scale in bringing up children, see also Table 5. For example, amounts the marginal income reduction of a second child to 12,880 SEK or 15 per cent of full income[8], while a transition from two to three children, reduces income by approximately SEK 8,000 per year, or 10 per cent of full income. This effect is significant at a 7 per cent significance level.

[8] The marginal income reduction of SEK 12,880 for a second child is compared to the average income of women without children.

It is important, however, to be aware of the fact that many of the youngest women have no income during some of the periods. If we only consider the periods when the women have income from work, the percentage income reduction for one child reduces from 31 to 24 per cent, while the marginal effect of a second child reduces the income by 12 per cent.

Table 4 about here

Comparing the opportunity cost of children to the opportunity cost of working in the public sector, i.e., the estimated income difference between women working in the private and public sector, we find that the opportunity cost for one child is lower than the income loss of working in the public sector. For the women in the youngest cohort the opportunity cost of *two* children exceeds the estimated income difference of SEK 32,000 per year, while the opportunity cost of *two* children for the women in the two oldest cohorts are close to the estimated income difference between women in the private and public sector, for these cohorts. The higher incomes for the women employed in the private sector, may be a result of both higher hourly wages and a higher labour supply.

For the women in the second cohort we find the same pattern of income reductions because of children as for the youngest cohort, although the effects are smaller for the women in the second cohort: SEK 19,000 per year for one child, amounting to a 17 per cent income reduction, and SEK 32,000 per year for two children. The income change for a second child SEK 13,000, amounts to 11 per cent of full income. The further income reduction of SEK 2,800 per year for a third child is not statistically significant, see Table 5.

The effects on income of the first and second child for the women in the oldest cohort are about the same as for the women in the youngest cohort. The point estimates differ by only SEK 2,000 for the first child and SEK 1,000 for the second child. However, if one compares the percentage loss in income, the difference becomes larger, as the income level is higher for the women in the older cohort. For women with one child in the oldest cohort income is reduced by about SEK 25,000 or 19 per cent, whereas the additional income loss for a second child is SEK 14,000 or 11 per cent. As for the other cohorts, the additional income reduction from having a third child is not significant for the women in the oldest cohort. One should remember that the individuals in the youngest cohort were quite young in the second half of 1980s, the beginning of our sample period, and not all had entered the labour market, so the comparison with respect to income should be interpreted with caution.

The results in Table 4 also suggest that work experience has a significant impact on income for women with a medium and high level of education, while it is only significant for women with a low level of education in the youngest cohort. As the table reveals, the marginal effect of work experience declines for older cohorts, probably as a consequence of an age effect. For women with a medium level of education in the third cohort, one additional year of work experience results in an income increase of approximately SEK 2,000, while the corresponding figure for women with a medium level of education in the first cohort is about SEK 5,000.

Table 5 about here

In Table A2 in the appendix we present the results from the respecified income model (10), in which we also consider the income effects of children for women with different educational levels. The variable that has been interacted with the child dummy variables takes the value

one from the year the individual left education and a zero value for the time periods before that. We consider the same three educational levels as in the previous model specification (9), where education was interacted with work experience. To control for having children before leaving education, we include a “student dummy variable” as a fourth interaction variable. The student dummy variable takes the value one for the periods before leaving education and zero thereafter.

As expected, we find that the opportunity cost increases with educational level. For example, the income reduction for women with a low level of education with one child in the youngest cohort is approximately SEK 23,000 per year, whereas the corresponding income reductions for women with medium and high levels of education are SEK 29,000 and SEK 43,000. For women with a low, medium or high level of education, this corresponds to an income loss of 23, 25 and 29 per cent respectively.

Regarding economies of scale, we find the same pattern as in the previous model specification, i.e. the marginal effects declines as the number of children increases, see Table 5. For all educational levels and cohorts, the results suggest that the marginal effects of the first and second child are significant (the exception is a second child for women in the youngest cohort with a high level of education), whereas there is no support for a significant income reduction for a third child. One explanation for these results is that the additional adjustment in labour supply of a third child is relatively small, and that most of the adaptation takes place for the first two children. Generally, both the absolute income reduction in SEK and the reduction in relation to income is greatest for the women with the highest level of education.

For women with up to two children in the two youngest cohorts, the results generally suggest that there is a significant difference in the marginal income reduction between women with low and middle levels of education, and low and high levels of education, whereas there is no significant difference in the marginal opportunity cost between women with middle and high levels of education.

For the women in the oldest cohort, we find the same pattern as for the women in the other two cohorts. The loss in income due to parenthood for women with a low level of education is at about the same level as for the women in the youngest cohort, whereas the income change for the women with a medium or high level of education is about the same level as for the women in cohort 2.

For the youngest women, thus in cohort 3, we find that the opportunity cost of children is lowest for the women that had not finished there education when their children were born. This result seems reasonable, as one may expect that the income is lower for this group of women. However, the result may also be due to the fact, that this group decided to stay at home with their children for a shorter time than women with finished education, as one may expect that the benefit from the parental allowance also is lower for these women. The unemployment rates among young persons were also high during the 1990's, and as indicated in Table 3, 22 per cent of the women in the youngest cohort did not work when they had their first child. This suggest that a relatively large part of women had a very low parental allowance, or just the minimum guaranteed benefit, as the parental allowance is linked to the income from gainful employment.

However, for the women in the oldest cohort, and for the women in the second cohort with many children, the results suggest a higher opportunity cost of children for women without finished education. The reason for this may be manifold, but the presence of children in the family, may have postponed the educational decision and the exam, resulting in an additional income reduction compared to the women who had finished their education when their children were born. The presence of children may also have affected the choice of education and choice of employer, in favour of a more "child" or "family-friendly" employer, which may offer flexible working conditions or demands less overtime work, but in return offers a lower wage. Generally the public sector is considered as more family-friendly employer, see e.g., Nielsen et al. (2004).

Table 6 about here

In Table 6, we present the income regressions for the men. Contrary to the findings from the income regressions for the women, we find that the income for the men increases as a result of parenthood. Generally, an increased number of children results in a further increase in the income. Similar results have been found by Lundberg and Rose (2002). They found that fatherhood significantly increases the hourly wage rate and annual hours of work for men. Korenman and Neumark (1991) found that married men earn more than single men. Their analyses of data from one firm's records of reviews, wages and personal characteristics indicate that the effect of marriage derives from promotions rather than a premium for married men within a job category. Taken together, their findings suggest that much of the marriage premium can be attributed to increased productivity of married men, perhaps due to returns to specialization within the household. The positive income effects in our results are, however, only significant for the men in the second cohort.

For the US, Gray (1997) finds that the marriage premium has fallen over time and attributes this to a declining specialization of husbands and wives. Our results also indicate that there is a fall in the "child" premium for men in the youngest cohort compared to men in the second cohort. To gain some insight into whether the men change their labour supply due to fatherhood, we have estimated multinomial logit models for their labour supply in the year 2000, in which we control for the number of children, education, employer and age. In the regression, the alternative with more than 40 hours of work per week is used as the base alternative, cf. Table 2. Although the results from the multinomial logit models in Table A3, in the appendix, suggest that an increased number of children reduces the probability of working more than 40 hours per week, *t*-tests indicate that the effects are generally not significant. However, it should be noted that for the youngest men, i.e. the men in cohort 3, there is a significant effect of less overtime and an increased probability of working 40 to 35 hours per week as the number of children increases, which suggest that there is a declining specialization of husbands and wives in the youngest cohort. The result should, however, be interpreted with caution since the children are also youngest in cohort 3, and that the significant labour supply adjustments that we observe may be due to the presence of small children, which may affect the labour supply to a larger extend than older children.

From Table 4 and 6, we may also note that the marginal income effect of being employed in the private sector is higher for men than for women. This is probably an effect of both higher hourly wages and a larger labour supply for men. The marginal effect of work experience is about the same for men and women with low levels of education, while men with a high and medium level of education have a higher return of work experience compared to women.

6. Discussion

From the results in this study, we have seen that the women carry the opportunity cost of bearing and rearing children. If the market wage for the woman is lower than for the man, this can be seen as an efficient allocation of time since such a solution will minimize the household's cost of children. A higher allocation of home time for the women may also be efficient if the female and male roles in home production are not interchangeable, as for example with the woman's role in childbearing, or the woman has a higher marginal product of home time than the man.

However, there is some evidence that women have lower wage rates than men, even though their educational level is at least equal to men's. If women earn less for the same kind of work, one might say that they are carrying bubble costs: one in the labour market and one in the home production of bearing and rearing children, as it usually is optimal for the household to allocate home production to the parent with the lowest hourly wage rate.

To reduce the costs difference of children between men and women, one have recently introduced a bonus in Sweden to parents that divide the days with parental allowance more equally between them. The highest bonus of SEK 6900, in 1985 years prices, is paid to the household if the man and the women divide the months with parental allowance equally between them. Although the introduction of the bonus system reduces the income differences between the parents during the months of parental allowance, it is likely that the bonus system has a minor effect on the households labour supply adjustments that take place after the statutory parental leave.

Therefore, to reduce the cost difference of children between the genders, it would probably be more efficient, and more valuable for the household, if the market wage for the same kind of work was made equal for men and women. Since this is more likely to affect the households' distribution of the labour supply adjustment, that take place because of parenthood.

The result suggest that the opportunity cost of *one* child for the women in the two oldest cohorts amounts to 17-19 per cent of full income, or SEK 19,000-24,000 per year in 1985 values, whereas the marginal income loss of a *second* child is estimated to SEK 13,000-14,000. Furthermore, do the results suggest that the opportunity cost of *two* children, which is the average number of children for these women, is at about the same level as the estimated income different between women employed in the private and public sector. Although, it may not be independent decisions to have children and work in the public sector, it is still of interest to note that the opportunity cost for the average woman of having children is equal to the cost of choosing to work in the public sector compared to the private sector.

Furthermore, do the results suggest that there are economics of scale in bearing and rearing children, with significant differences in the marginal income loss in the transition from no child to one child, and from one to two children, while the effect of a third child is insignificant. This suggest that the additional labour supply adjustment of a third child is relatively small, and that most of the labour supply adjustments take place for the first two children.

In addition, we also find that the opportunity cost increases with educational level. However, for the women in the oldest cohort, cohort 1, and for the women in cohort 2 with many children, we find the highest opportunity cost for women who had their children before they

had finished their education. The reason for this may be manifold, but the presence of children in the household may have postponed the educational decision and the exam. Resulting in an additional income reduction compared to women with a finished education when their children were born. The presence of children may also have affected the educational choice and the choice of employer, in advantage of a more family-friendly employer, which may offer flexible working conditions but also lower wages.

Contrary to the findings of the income regressions for the women, we find that the income for the men increases as they have children. The positive income effect is, however, only significant for the men born between 1960 and 1965. There is no support from the labour supply models that the men increase their labour supply as they become fathers, on the contrary we find a significant effect of less overtime work for men in the youngest cohort, i.e., among the men born between 1965 and 1970, due to fatherhood. This may suggest a decreased specialization between husband and wives in the youngest cohort.

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Appendix

Table A1: Month on parental leave with the first child, in percent

	Women			Men		
	Cohort 3	Cohort 2	Cohort 1	Cohort 3	Cohort 2	Cohort 1
No parental leave	0.9	1.3	3.0	27.8	25.5	29.1
< 1 month	0.6	0.7	1.4	33.9	35.1	38.9
1-3 month	0.9	1.3	1.2	27.0	27.3	22.2
4-9 month	7.6	13.9	21.1	7.4	9.6	7.7
10-18 month	64.4	58.5	50.0	2.2	1.8	2.1
> 18 month	23.3	23.8	23.2	0.4	-	-
	2.3	0.4	-	1.3	0.7	-

Note: Cohort 1 = people born 1955-1959, Cohort 2 = people born 1960-1965, Cohort 3 = people born 1966-1970.

Table A2: Fixed effects income model for women born between 1955 and 1970

Variable		Cohort 3	s.e.	Cohort 2	s.e.	Cohort 1	s.e.
Age		30.46	1.47	11.97	1.75	3.39	0.23
Age squared		-0.55	0.33	-0.16	0.03		
1 child	low level of edu.	-22.77	2.25	-14.95	2.15	-23.88	2.62
	medium level of edu.	-29.83	2.92	-24.64	3.19	-20.70	3.17
	high level of edu.	-42.77	8.49	-25.48	5.46	-29.12	4.60
	before leaving edu.	-16.37	4.89	-13.85	6.37	-36.53	5.88
2 children	low level of edu.	-34.95	2.93	-25.66	2.77	-38.47	3.06
	medium level of edu.	-45.51	3.89	-39.90	3.88	-36.37	3.86
	high level of edu.	-39.67	11.40	-38.38	7.01	-43.59	5.28
	before leaving edu.	-30.82	8.10	-28.35	7.50	-52.47	5.88
3 children	low level of edu.	-43.44	4.53	-28.85	3.78	-46.26	3.84
	medium level of edu.	-54.57	12.56	-36.48	6.97	-31.21	5.18
	high level of edu.	-		-42.07	8.13	-46.17	7.58
	before leaving edu.	-		-55.74	11.14	-45.24	6.84
4 or more children							
	low level of edu.	-63.22	8.98	-30.41	6.23	-34.49	4.83
	medium level of edu.	-		-65.37	11.06	12.42	9.25
	high level of edu.	-		-	-	-67.19	19.95
	before leaving edu.	-		-	-	-56.76	13.69
Working experience low level of education		1.86	0.35	0.08	0.32	0.09	0.29
Working experience medium level of education		5.29	0.46	4.00	0.44	1.63	0.36
Working experience high level of education		20.27	1.47	10.33	0.87	4.26	0.56
Unemployment benefit		-71.15	4.35	-49.65	4.60	-55.25	4.09
Sickness benefit		-22.46	7.07	-45.19	5.40	-31.43	6.44
Student		-25.91	2.41	-21.48	3.22	-5.41	4.69
Private employment		31.43	2.92	30.61	4.46	39.85	4.82

Note: Standard errors computed from heteroscedastic-consistent matrix. Cohort 1 = women born 1955-1959, Cohort 2 = women born 1960-1965, Cohort 3 = women born 1966-1970. Low level of education (a maximum of two years at upper secondary school), medium level of education (three years at upper secondary school or a maximum of two years' higher education), high level of education (more than two years of higher education).

Table A3: Multinomial Logit model for men's labour supply in year 2000

Variable	Cohort 3	s.e.	Cohort 2	s.e.	Cohort 1	s.e.
40-35 hours per week						
Number of children	0.24	0.11	-0.08	0.10	0.01	0.09
Middle edu	-0.46	0.24	-0.50	0.26	-0.69	0.25
High edu	-1.03	0.40	-1.18	0.33	-0.96	0.31
Private employment	-0.42	0.25	-0.26	0.24	-0.52	0.22
Age	-0.23	0.08	-0.04	0.08	0.09	0.06
Constant	7.23	0.60	1.64	2.95	-3.63	2.54
34-25 hours per week						
Number of children	0,10	0,33	-0.23	0.39	-1.40	0.55
Middle edu	-0.92	0.84	-0.28	1.24	-	-
High edu	-0.08	0.86	0.96	0.94	-	-
Private employment	-0.45	0.72	-0.14	0.89	-0.88	0.85
Age	-0.41	0.25	-0.26	0.32	0.08	0.26
Constant	10.39	8.00	6.00	11.79	-5.19	11.17
< 25 hours per week						
Number of children	0.27	0.29	-0.63	0.41	0.63	0.45
Middle edu	-0.55	0.72	-	-	-	-
High edu	-0.77	1.10	-	-	-	-
Private employment	-0.30	0.70	-0.79	0.84	-	-
Age	-0.12	0.23	0.46	0.32	-1.41	0.95
Constant	1.18	7.29	-19.63	12.01	52.09	37.88

Note: Cohort 1 = men born 1955-1959, Cohort 2 = men born 1960-1965, Cohort 3 = men born 1966-1970.

Table 1: Means and Standard Deviations of Key Variables for Women and Men

	Women			Men		
Variable	Cohort 3	Cohort 2	Cohort 1	Cohort 3	Cohort 2	Cohort 1
Age at first child	25.24	26.40	26.55	26.95	28.34	29.26
	(3.63)	(4.21)	(5.08)	(3.23)	(4.28)	(4.88)
Low level of education	0.44	0.50	0.50	0.54	0.55	0.56
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Medium level of education	0.40	0.32	0.33	0.34	0.27	0.27
	(0.49)	(0.47)	(0.47)	(0.48)	(0.44)	(0.44)
High level of education	0.15	0.17	0.17	0.11	0.18	0.17
	(0.36)	(0.38)	(0.38)	(0.32)	(0.38)	(0.38)
Number of children	1.30	1.90	2.07	0.92	1.49	1.88
	(1.10)	(1.13)	(1.15)	(1.04)	(1.24)	(1.22)
Don't plan to have more children	0.28	0.58	0.79	0.20	0.40	0.65
	(0.45)	(0.49)	(0.40)	(0.40)	(0.49)	(0.48)
Employed in the private sector	0.38	0.32	0.24	0.65	0.61	0.59
	(0.49)	(0.47)	(0.43)	(0.48)	(0.49)	(0.49)

Note: Standard deviations within parenthesis. Cohort 1 = women born 1955-1959, Cohort 2 = women born 1960-1965, Cohort 3 = women born 1966-1970. Low level of education (a maximum of two years at upper secondary school), Medium level of education (three years at upper secondary school or a maximum of two years' higher education), High level of education (more than two years of higher education).

Table 2: Number of hours worked per week, in percent, in year 2000

Number of	Women		Men	
hours worked	No children	Children	No children	Children
		Cohort 3		
More than 40	50.0	16.7	65.9	53.3
40-35	38.6	49.4	28.5	41.5
34-25	4.5	27.9	3.4	1.9
Less than 25	6.8	5.9	2.2	3.3
		Cohort 2		
More than 40	41.5	15.3	55.7	59.3
40-35	47.7	50.3	40.2	37.8
34-25	7.7	26.3	1.0	1.9
Less than 25	3.1	8.2	3.1	1.1
		Cohort 1		
More than 40	39.5	24.2	64.5	60.1
40-35	51.2	46.2	29.0	38.5
34-25	-	22.7	6.5	0.6
Less than 25	9.3	6.9	-	0.8

Note: Cohort1 = people born 1955-1959, Cohort2 = people born 1960-1965, Cohort3 = people born 1966-1970.

Table 3: Percentage changing their labour supply when they had their first child

Change in	Women			Men		
hours worked	Cohort 3	Cohort 2	Cohort 1	Cohort 3	Cohort 2	Cohort 1
Stopped working	4.3	4.2	7.9	0.9	0.4	0.3
Reduced hours worked	44.1	50.3	55.0	5.3	8.9	9.0
No change	28.9	31.2	24.8	83.8	84.3	84.9
Increased hours worked	1.2	1.8	0.8	2.2	1.8	1.8
Did not work	21.6	12.5	11.5	7.9	4.6	4.1

Note: Cohort 1 = people born 1955-1959, Cohort 2 = people born 1960-1965, Cohort 3 = people born 1966-1970.

Table 4: Fixed effects income model for women born between 1955 and 1970

Variables	Cohort 1	s.e.	Cohort 2	s.e.	Cohort 1	s.e.
Age	31.30	1.45	12.70	1.72	3.31	0.23
Age squared	-0.57	0.03	-0.17	0.03	-	-
1 child	-26.53	1.75	-19.34	1.79	-24.45	1.96
2 children	-39.41	2.34	-31.98	2.33	-38.43	2.47
3 children	-47.73	4.22	-34.82	3.22	-40.30	3.22
4 or more children	-67.41	8.88	-40.21	5.56	-25.75	4.15
Working experience low level of educated	2.06	0.33	0.43	0.30	0.08	0.28
Working experience medium level of edu.	4.93	0.41	3.51	0.39	2.10	0.33
Working experience high level of educated	19.70	1.24	9.86	0.67	3.69	0.48
Unemployment benefit	-71.24	4.36	-49.66	4.60	-54.96	4.12
Sickness benefit	-21.59	7.11	-45.52	5.43	-32.15	6.52
Student	-24.45	2.36	-20.00	2.93	-14.66	2.90
Private employment	31.99	2.90	30.41	4.44	38.63	4.80

Note: Standard errors computed from heteroscedastic-consistent matrix. Cohort 1 = women born 1955-1959, Cohort 2 = women born 1960-1965, Cohort 3 = women born 1966-1970. Low level of education (a maximum of two years at upper secondary school), Medium level of education (three years at upper secondary school or a maximum of two years' higher education), High level of education (more than two years of higher education).

Table 5: Income effects of children for women born between 1955 and 1970, in thousand SEK and percent of income

Variables	Cohort3 SEK	p-value	% of inc	Cohort2 SEK	p-value	% of inc	Cohort1 SEK	p-value	% of inc
0-1 child	26 530	.00	30.85	19 340	.00	16.95	24 450	.00	18.69
1-2 children	12 880	.00	14,98	12 640	.00	11.08	13 980	.00	10.69
2-3 children	8 320	.07	9.68	2 840	.27	2.49	1 870	.43	1.43
Low level of education									
0-1 child	22 770	.00	22.53	14 950	.00	12.85	23 880	.00	19.17
1-2 children	12 180	.00	12.05	10 710	.00	9.21	14 590	.00	11.71
2-3 children	8 490	.08	8.40	3 190	.32	2.74	7 790	.03	6.25
Medium level of education									
0-1 child	29 830	.00	24.94	24 640	.00	19.67	20 700	.00	15.10
1-2 children	15 680	.00	13.11	15 260	.00	12.18	15 670	.00	11.43
2-3 children	9 060	.53	7.58	-3 420	.65	-2.73	-5 160	.16	-3.76
High level of education									
0-1 child	42 770	.00	29.31	25 480	.00	17.82	29 120	.00	19.30
1-2 children	-3 100	.66	-2.12	12 900	.00	9.02	14 470	.00	9.59
2-3 children				3 690	.99	2.58	2 580	.65	1.71

Note: Cohort 1 = women born 1955-1959, Cohort 2 = women born 1960-1965, Cohort 3 = women born 1966-1970. Low level of education (a maximum of two years at upper secondary school), Medium level of education (three years at upper secondary school or a maximum of two years' higher education), High level of education (more than two years of higher education).

Table 6: Fixed effects income model for men born between 1955 and 1970

Variable	Cohort 3	s.e.	Cohort 2	s.e.	Cohort 1	s.e.
Age	17.95	1.95	18.81	2.29	2.59	0.33
Age squared	-0.25	0.04	-0.25	0.04		
1 child	1.73	2.91	6.78	2.67	-0.12	2.68
2 children	7.09	3.90	10.64	3.31	5.89	3.32
3 children	11.87	8.57	13.74	5.29	6.48	4.63
4 or more children	30.36	21.79	12.04	8.01	-16.93	7.08
Working experience low level of education	2.62	0.41	-0.68	0.45	0.49	0.39
Working experience medium level of edu.	7.63	0.61	5.33	0.57	3.81	0.52
Working experience high level of education	27.84	1.79	19.23	0.98	10.51	0.81
Unemployment benefit	-74.70	3.81	-62.46	4.56	-71.38	6.31
Sickness benefit	-11.17	7.03	-25.87	7.74	-30.30	7.97
Student	4.47	3.75	4.64	5.09	0.91	6.03
Private employment	60.01	3.89	77.30	5.56	95.52	6.43

Note: Standard errors computed from heteroscedastic-consistent matrix. Cohort 1 = men born 1955-1959, Cohort 2 = men born 1960-1965, Cohort 3 = men born 1966-1970. Low level of education (a maximum of two years at upper secondary school), Medium level of education (three years at upper secondary school or a maximum of two years' higher education), High level of education (more than two years of higher education).

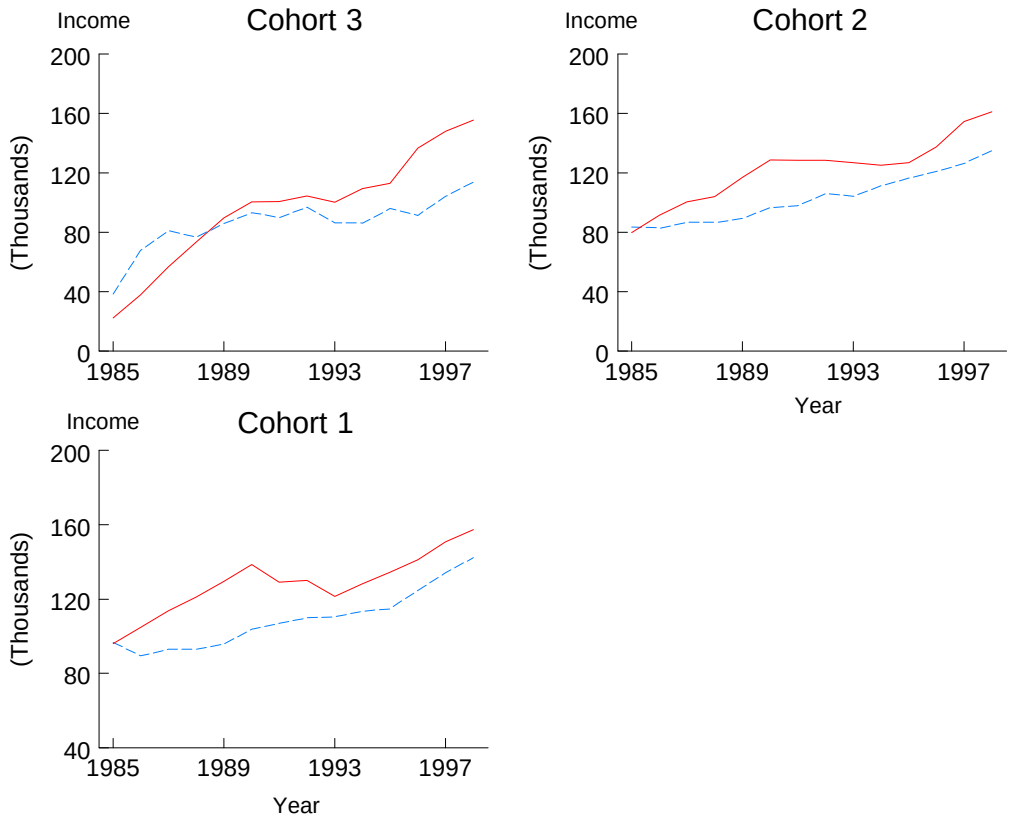

Figure 1: Women's annual income from market work and parental allowance (in 1985 values, SEK thousands). Solid line = women without children, dotted line = women with children. Cohort 1 = women born 1955-1959, Cohort 2 = women born 1960-1965, Cohort 3 = women born 1966-1970.