Does public spending on the family in Sweden compensate the higher opportunity costs of children for the high educated?

07 March 2008

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Abstract

We examine family size and the generous Swedish parental income insurance in combination with almost universally available public child care of high quality and heavily subsidised. A likely explanation for the tendency that highly educated women have as many or more children as the low educated in Sweden is often said to be this combination of generous parental income insurance and inexpensive public child care. We try to verify whether the Swedish system of public intergenerational transfers really compensates the higher opportunity costs of children for high educated women. We use a longitudinal three percent sample of the Swedish population (LINDA) to test whether the hypothesis of subsidies compensating for opportunity costs can be falsified or accepted. Disposable incomes after tax and transfers is used as a measure of the policy impact for the individual. By interaction with current state tax status we can confirm that high earning women are not compensated by the direct transfer system. Our preliminary evidence indicates, however, that public intergenerational flows to children, in particular child care subsidies, may make up for this and provide the explanation for the peculiar Swedish fertility pattern by being a complement to female labour supply.

Introduction

In the whole world populations are aging with few exceptions. Only part of this aging is due to decreasing mortality rates. In particular for the highly developed industrial nations population aging is strongly influenced by falling fertility rates. This demographic state is sometimes called a second demographic transition (van de Kaa 1987) and recently attention has been drawn to the risk that there may exist a low-fertility trap below a certain level of the TFR (Lutz et al. 2006). The very low fertility in Japan, South Korea, Italy and other nations raises concerns that social and economic feedbacks together with demographic inertia may lead to a more or less irreversible trend of population decrease. While this per se may not be a bad thing the accompanying distortion of the population age structure leaving an ever decreasing share of active population to support an increasing share of dependents is a more troublesome issue.

In this paper we try to nail down how the Swedish institutional arrangements for intergenerational transfers affect fertility in different groups of women. More specifically we study low educated (at most secondary level) versus high educated (completed tertiary education) women and high income earners (state tax payers) versus low income earners. Although correlated these concepts are not the same.

The low fertility phenomenon is still rather new and not thoroughly understood. From an economic point of view it is most natural to try to understand it as a response to increasing relative costs for children. The recent shift in the cross-country correlation in OECD between fertility rates and female labor force participation from negative to positive have been taken to indicate that labor market institutions play a crucial role (Adserà 2004). Anglo-Saxon countries have, however, vastly different labor market institutions from the Scandinavian countries and still the fertility outcome is similar. Catholic Europe (with the exception of France) has very low fertility comparable to Japan and South Korea and still it would be hard to maintain that labor market institutions are very similar. We therefore find this explanation incomplete. Instead we would like to look closer at the actual relative costs of children.

There are, however, difficulties in achieving good estimates of how high costs of children really are, due to the non-market nature of most of the transfers made to the young. While we

through household expenditure studies can identify some of the costs of children we need costly time-use studies to identify the time costs (Klevmarken and Stafford) which in practice also will differ substantially dependent on real earnings and marginal tax and transfer effects. Another problem is that most developed nations have very costly subsidy systems and provide government services for the care and upbringing of children. These systems generate large intergenerational transfers that substantially change the relative costs of children although not always in obvious ways. For example mandatory education may actually increase costs for some parents. In many cases we do not even have the accounting data to compute the age related costs of public services.

Our aim here is to contribute evidence to this issue from Sweden. How important is the subsidy system for female labor supply and fertility decisions? Sweden is a particularly interesting case to study for several reasons.

First, Sweden has ever since its fertility crisis in the 1930s pursued very active family policies. Not for the sole or even explicit purpose of encouraging child births but mostly with this as an important side issue to consider in the design of social policies. One of the results of that seems to be that Sweden has a uniquely stable cohort fertility of two children per woman since 1900 and as far as we have data on completed fertility (Björklund 200?), i.e. up to women born in the 1960s.

Second, somewhat surprisingly the stable cohort fertility has been achieved in spite of a very high variability in total fertility rates exhibiting three very distinct and comparatively short baby boom episodes in the 1940s, the late 1960s and 1985-1995. Currently there are indications that a fourth boom is on the rise, see Figure 1. The implication of a cyclical TFR combined with more or less constant CFR is that timing of births must have varied quite substantially across cohorts. There is clear evidence that some of these changes in timing have been caused by changes in the social insurance systems (see Hoem about the "speed premium" for example).

Third, we have good data; there is access to individual panel register data stretching back to 1968 for 3 percent of the population. Moreover, these data can be linked to all kinds of register data also for relatives, spouses, former spouses, and cohabitants (at least if they have children). While we will not make full use of this potential in this particular paper it is

important because it opens opportunities to pursue issues we cannot solve here in future research using the same basic NTA framework as we have used here.

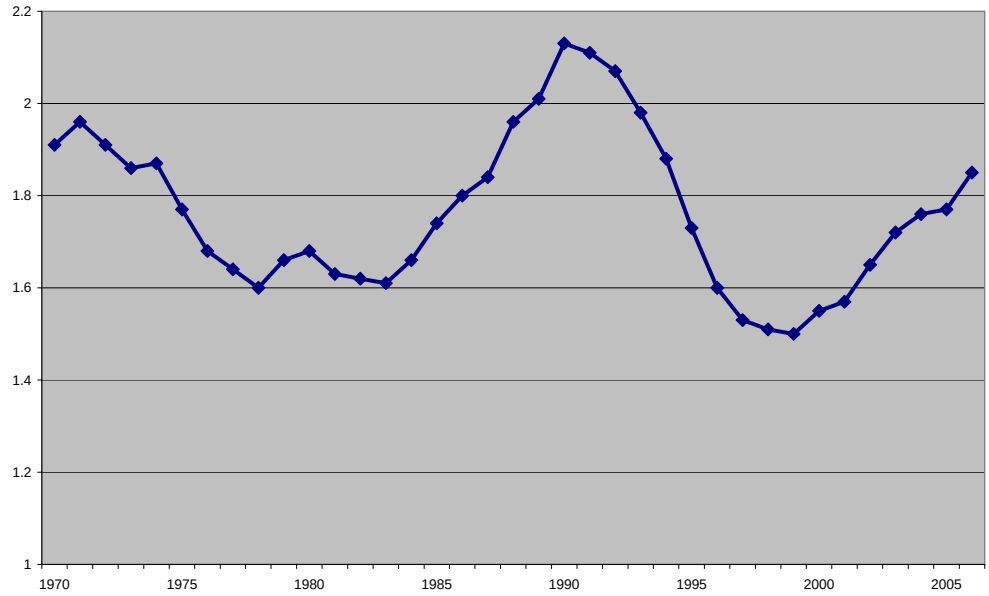

Figure 1 TFR in Sweden 1970-2006

The otherwise common pattern that women with higher education have fewer children does not generally hold in Sweden. In Sweden (using LINDA 2003 data, which will be described below) we see in Figure 2 that although fertility is delayed for those with higher education than secondary level the unconditional probability of having a new child is actually higher at the peak years than for other women. Partly this is an effect of individuals completing their education before having children.

However, this figure hides a substantial variation across educational orientation. Hoem et al. have meticulously documented a quite large variation in fertility across type of education and occupation in Sweden for cohorts with completed fertility. Within each broader educational category they find that fertility falls with length of education but the diversity across categories is so large as to obscure any general negative correlation. There may be many explanations for this, ranging from self-selection to differences in working conditions and social context. One is for example not surprised to learn that midwives have the highest fertility but it is maybe not expected that police women have fairly average fertility. Whether these patterns will remain stable also for younger cohorts we do not really know.

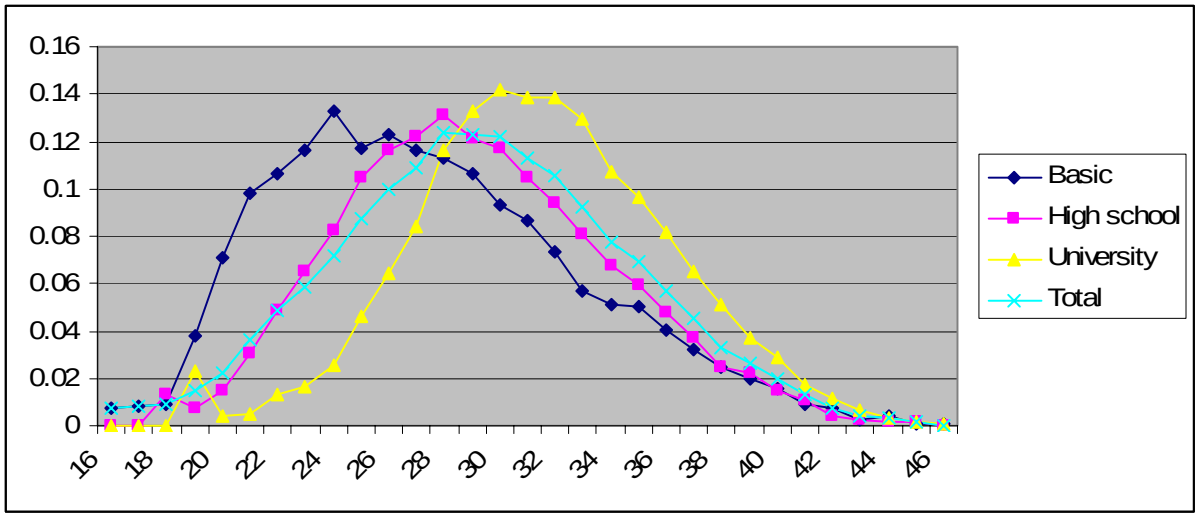

Figure 2 Probability of a new child by mother's education and age group, 1993-2003

The age of first birth also differs over time. In the period these data (LINDA) cover there is a clear tendency of delayed births from about age 27 to 29 of the first-time mothers, see Figure 3. These tendencies vary depending on education attainment. Mothers with just high school seem to have established the largest increase. In spite of the observed delay, there is, as Figure 1 showed, a growing number of children over the period.

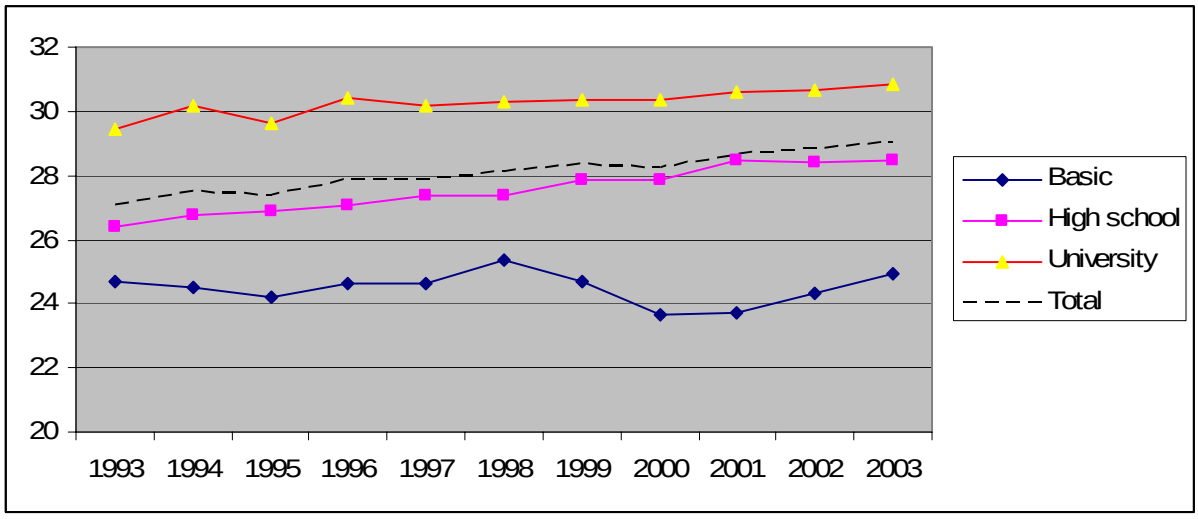

Figure 3 Women's average age at first child, by education level

A potential partial explanation for these patterns in Swedish fertility data is in Ohlsson and Lundholm (1989) who from a theoretical point of departure argue that public daycare have been used as a complement to female labor supply in order to increase female labor market participation and in particular supply labor for the expansion of the public sector since the 1970s. A very strong gender segregation across sectors may speak in favor of this hypothesis.

The basic idea is that household production of care services have been replaced by more efficient public sector production using extensive and costly public childcare as an instrument to achieve this transformation without causing negative pressure on fertility. While certainly an interesting hypothesis firm evidence for this is hard to produce since we have very little data to determine whether household production or public production of these services is the more efficient.

More education for women is generally found to decrease fertility. There are a number of different theoretical explanations for this. Higher opportunity costs interacting with higher child costs through a quality-quantity trade-off (Becker 1960, 1981; Cigno 1991) are standard economic explanations that would be in line with the day care effect by offsetting part of the rising costs. Oppenheimer (1994) also argues that higher education increases female independence thus increasing the proportion that never enters into a relation with children. Cultural explanations rely on a similar reasoning emphasising the expanded choice of life styles available to women with higher education (van de Kaa 1987) and as a result making it less attractive to get children preventing some of these choices. It has also been argued that prolonged education per se delays family formation up to ages where biological factors start to make it difficult to conceive (Kravdal 2001, Gustafsson 2001).

Our purpose here is to explore how the intergenerational transfer system affects fertility by changing opportunity costs for women. Assuming that the variation across type of education is mostly exogenous we are interested in the extent to which subsidies from the transfer system affects fertility choices differentially and whether this is due to income effects or education per se. While education level is correlated with income, preferences for types of education will also be associated with substantial differences in expected life cycle income. In particular Swedish definitions of tertiary education will for example include many care service categories.

A descriptive look

From descriptive data it seems, at a first look, that high income (i.e. career work and high opportunity costs) still interferes with child bearing. In Figure 4 women who payed state tax in the previous year has been selected and the frequency of birth over age is compared with the total and other women. In Sweden state tax on income is only paid above a threshold

income of (presently) around 300 000 SEK (approximately 33 000 EUR). The few Swedish women that pay state tax earn more than other women and have a long delay in child bearing just as the highly educated with a peak probability at 32. They do seem to compensate their lower probability to have a new child before 30 by a higher fertility at 30+.

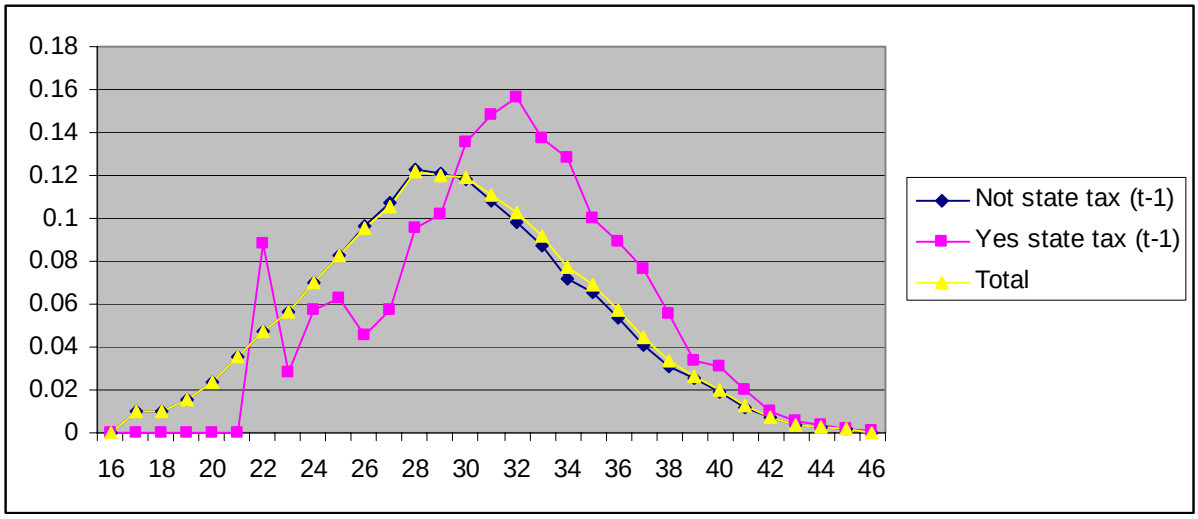

Figure 4 Probability of a new child by the event of the mother paying state tax, 1993-2003

In Figure 5 we examine the difference with respect to the event of experiencing unemployment part of a year or not (i.e., having received payment from the unemployment insurance). These women differ from other women by a lower probability of having a new child after 25. These descriptive data thus indicates that there may well still be a career barrier to fertility in Sweden while tertiary education per se only delays fertility. Unemployment (presumably associated with low income) also acts as a barrier. Thus women in the tails of the income distribution seem to be less likely to have children than the groups around the mean.

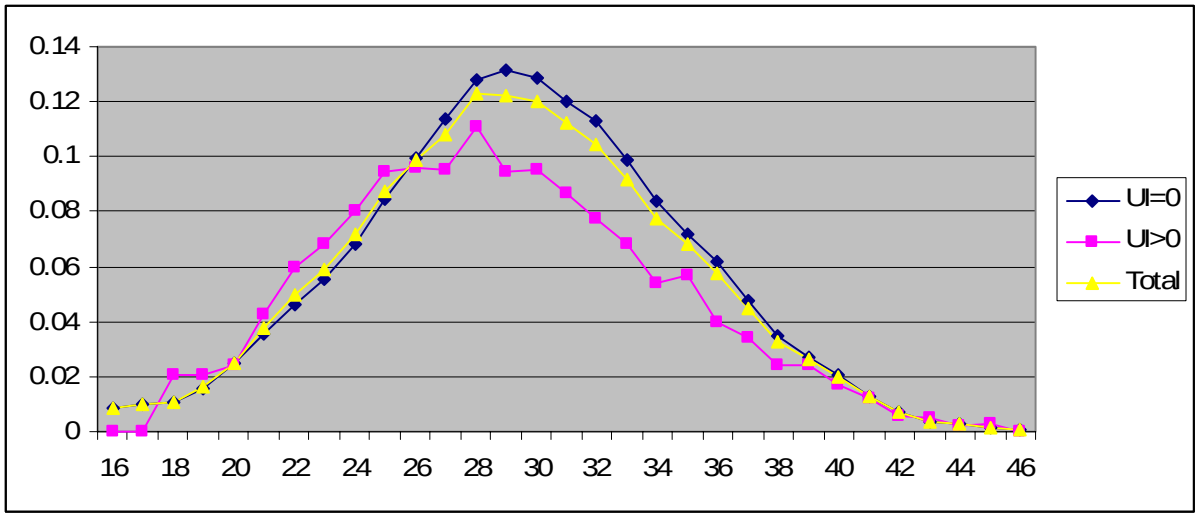

Figure 5 Probability of a new child, by unemployment insurance and age group (women only)

These descriptive data are only suggestive regarding to what extent women feel constrained in their fertility choices. There are issues of selection and other causal factors that need be studied more closely. They do, however, point in the direction that highly educated women feel less constrained to have a new child as long as they are not competing in high income jobs. On the other hand unemployment does seem to interfere at least for the somewhat older women who are expected to be established on the labour market.

Thus we need to explore how the intergenerational transfer system affects different groups of women and their households. In the next section we first give an account of the basic institutional facts of the Swedish system for public intergenerational transfers.

Subsidy systems

The main features of the Swedish system for family support and education will be very briefly described here.

Compulsory school for nine years is completely financed for all residents in Sweden (even if run privately). Normally school start takes place in the fall of the year the child becomes 7 years and finishes the year the child becomes 16 years. Recently a pre-school year for six year old children has been added to this system. Pre-school/child care is available from the child is between 1-2 years up till they have finished fourth grade in compulsory school. A means-tested fee is paid with some local variation in the level but on average subsidies amount to around 90 percent of the actual cost (more if you have siblings enrolled at the same time).

These daycare centers are mostly publicly run but also parents' cooperatives are common (and subsidised to the same degree). Some subsidised day care in family homes still exist but have become rare. Around 80 percent of pre-school children are enrolled in the system. There is locally still some rationing with queuing systems but in general everyone who wants to can place their children in day care after some minor delay. Privately financed alternatives are, of course, rare although there is some complementary care provided by nannies and au-pair girls in the homes of the wealthy, mostly by immigrant labor. Another private alternative is the privately owned child care cooperatives. These are financed through public grants, but parents usually have a big saying concerning the use of the money, and the direction of the cooperative.

Upper secondary level education (3-4 years) is not mandatory but enrolment is today above 90 percent. This is also publicly financed and those who enrol get a study allowance of the same amount as the child allowance for children below 16. Tertiary education is provided free of charge but with grade tested admission as rationing mechanism. Students have the right to a study allowance and if they choose to also public study loans up to a given amount. The level is not very high but should allow for independent living outside the parental home. Presently nearly 50 percent of a cohort eventually enrols in some type of tertiary education. The system also encompasses vocational training of many types apart from traditional academic institutions. This is important especially since nursing have become an academic discipline.

There is a universal child allowance with an amount of about 100 EUR a month up to 16 years. Families with 3 or more children living at home get an extra allowance. The parental insurance grants 80 percent of your regular income if you have qualified by nine months work before delivery. The parental leave is granted for 480 days but the 80 percent replacement level only holds for 390 days of which 60 days is reserved for each parent and the others can be shared (so-called daddy-months). The remaining 90 days only qualify for a low flat rate allowance. The rules admit partial withdrawal and are in general very flexible. A large part of the population also has extra insurance through collectively agreed income insurances filling out the difference wholly or partially. After the birth 10 days are also granted to the parent who is not on parental leave, i.e. in general the father. Up till the child is 12 years you also have the right to stay home to care for a sick child with the same level of income replacement as for parental leave.

There is a means tested housing allowance that mainly supports single parents. Students get an extra allowance if they have children. One of the parents, generally the mother also gets extra pension rights for each child. There are a number of other supports in case of divorce, military service etc., which are of minor importance.

One of the most important subsidies is the quite high subsidies on child care. The child care issue becomes complicated since it also has an indirect effect on non-parents because the increase in female labor supply also increases the net tax revenue creating incentives also for non-parents to support subsidies politically. Blomqvist and Bergstrom 19?? has in a stylised model analysed the issue and comes to the result that in the Swedish tax system child care subsidies up to 75 percent yields an increase in net tax revenue.

But do the subsidies change opportunity costs to such a degree that child bearing decisions are affected? To answer that question we need to go to micro data. The evidence in previous literature is often ambiguous regarding the effect of subsidies on fertility decisions. While economists are prone to believe in the efficiency of subsidies demographers and sociologists are sceptical and emphasise other factors such as social norms.

In the literature in public economics several different mechanisms for how the tax and transfer system affects fertility decisions versus labor supply have been discussed. Some mechanisms are based on efficiency problems in discerning individual ability and thus the extent to which daycare should be subsidised for parents of different types. The public provision of private goods as education and daycare may also have external effects in many dimensions. One is as a complement to labor supply, such that increases in labor demand can be accommodated without raising costs, an argument found in Ohlsson and Lundholm (1989) for example. There are further complications to consider since altruistic parents would also take into consideration the compound effect of day care and education on the child's future wellbeing.

Framework

Human beings spend large resources both in time and consumption on the upbringing of children. The difference is very marked in relation even to such close primate relatives as

chimpanzees (Robson and Kaplan AER) and in traditional societies the major part of the time costs lie on the women, making it necessary to rely on male surplus production of consumption goods. In modern societies increased opportunities for females to obtain market work and education have vastly increased the relative cost of female household production generally and in particular for having children. In most societies there is some degree of public subsidies for at least basic education and health care for children. In many countries there is also some degree of general family subsidies contributing to lessen the costs of children by tax allowances or child allowances and some form of maternal or parental support during a parental or maternal leave of greatly varying duration. In Sweden these systems are complemented by a great number of other support and insurance systems.

In the Swedish context these subsidies form part of a very comprehensive intergenerational transfer system. There are still private transfers within the family that also contribute to distributing the costs of children also over grandparents. In Figure 6 the private and public net transfers between age groups in 2003 are summarised. Private transfers are on average only moving downwards to those below 30 while public transfers also move upwards to those over 65. The costs of children and elderly are thus spread over the whole population through the tax system and familial transfers play a relatively small role in comparison to countries like Japan or Taiwan for example. The subsidy system is largely, with some minor exceptions, universal such that practically all citizens get something back at some stage of their life cycle.

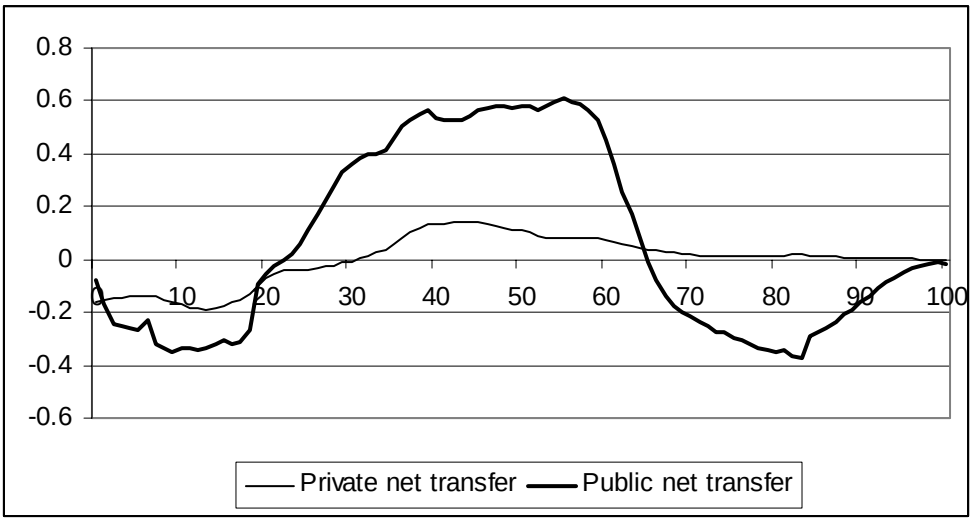

Figure 6 Net transfers, public and private; population weighted and normalized to labor income of the age group 30-49

The opportunity costs of a child are therefore offset by subsidies. A rather large part of these transfers are indirect and accounted as government consumption making the distribution across individuals intransparent. By the NTA distribution across age groups we can make a consistent estimate for individuals that actually add up at the aggregate level. The same holds for private transfers where our information in general is even more incomplete.

Theoretical background

There are theoretical choice models for how parents should make their choices in an optimal way (for example Ermisch explicitly deals with day care costs). We see little point in reiterating these formal models here but note that it is a rather complicated simultaneous choice of household labor supply, consumption level and utility for spending time with children against that of own leisure that in Sweden undoubtedly also involves a bargaining game between the male partner and the female partner. Assumptions on substitution parameters and the degree of parental altruism will be important for optimal outcomes. Even without parental altruism a quite extensive foresight regarding future costs is required for the individual and the household in order to make optimal choices. Without simplifications we get little guidance for our empirical investigation.

To be clear about what we are doing we need to frame our basic hypotheses and assumptions a little more specifically. Our data material also pose some restrictions regarding tractable assumptions on the problems we are able to deal with. Moreover, the purpose here is exploratory, seeking to find out if there is any empirical ground in Swedish data to answer the question posed in the title, i.e. whether high educated women in Sweden are compensated for their higher opportunity costs through the public transfer system.

Our first assumption makes a simplification regarding who makes the decision to have a new child.

Assumption 1. The female is assumed to be the part that actually takes the decision to have a new child.

We make the assumption although we know that it is in general a joint decision of the spouses, because it considerably simplifies the definition of the subsidy received (*S*). It could be argued, however, that Swedish legislation regarding abortion and child support for single

women actually overrides the male's bargaining power to a rather large extent. By conditioning on household characteristics we can to some extent control for the male's influence, but we lack the data to identify with certainty households that cohabit without children.

Because our interest lies in the policy influence on fertility decisions we do not aim to identify all influential factors for the decision. We are interested in the net effect of total public policy not in the isolated impact of one specific policy. We therefore need to specify a measure of this. We state as a hypothesis.

Hypothesis 1. Everything else equal the expected opportunity costs with compared to without a new child will be decisive for having a child at time *t* for individual *i.*

Conditional on individual characteristics we thus assume that it is the opportunity cost ex ante that counts. Because the ex ante value of child care subsidies cannot be directly measured we make the following simplifying assumption.

Assumption 2. Child care subsidies are a complement to labor supply shifting the supply schedule of females outwards but not affecting the budget constraint in other ways.

That is we assume that the female can either abstain from work or take the lump subsidy but then must commit to working full time with the child in day care. This is not strictly true in the Swedish system since there is a choice to work part time and pay a little less in fees. There is also flexibility in the parental leave insurance that allows parents in certain tax intervals to gain by part time work. This means that there are incentives in the combination of systems that would counteract the positive labor supply effect implied by Assumption 2. We cannot efficiently control for part time work in our data, however, which forces us to ignore this issue for the moment.

The childcare subsidy at the moment of decision about a new child reflects an expectation of future labor supply, incomes and hence future tax rate. Because the Swedish tax system is (in most intervals) progressive, increased labor supply will increase the expected income in the future. This means that the opportunity cost in terms of future income losses is radically cut by child care subsidies. Since stylised facts are that income profiles of the higher educated are

much steeper than for low educated this is more valuable to the high educated. The loss due to the break in the career path by having a new child thus is much diminished. To see this clearly assume two polar cases. One woman faces a future flat wage profile, to her there is no career cost and the only opportunity cost in terms of lost future income is the direct loss of income during parental leave. The high replacement level in the Swedish parental insurance means that for most people there is practically no loss, or even some overcompensation, partly due to marginal tax and transfer effects, but also because some work related costs such as commuting are avoided. For a woman on a strict career path, however, advancement may be delayed or even not realised in the long run. This raises the opportunity cost far beyond the direct income loss. To her the child care subsidies are thus much more important.

Hypothesis 2. Child care subsidies should be relatively much more important to high educated women.

Other factors such as time required for children may intervene to diminish this effect but we cannot efficiently control for that.

These assumptions and hypotheses are, of course, highly stylised, Since a state tax of 20 percent kicks in at an annual income of about 300 000 SEK (and at around 400 000 SEK becomes 25 percent) there is a kink in the tax schedule when you start paying state tax. The descriptive statistics in the introduction combined with this kink implies that women paying state tax receive a smaller reduction in relative tax rate when having children. This leads to the hypothesis (or perhaps rather conjecture):

Hypothesis 4. Females paying state tax will ceteris paribus be less likely to have a child, irrespective of education.

Furthermore, since taxable income is reduced (unless one happens to have 100 perccent replacement) those close to the ceiling obtain a marginal tax rate decrease that actually increases their disposable income leading to a fifth hypothesis:'

Hypothesis 5. Females paying state tax the year before having a new child will ceteris paribus be more likely to have a child if they no longer pay state tax the year they have a new child.

This is a very simple framework to give some direction to our exploratory search for evidence that public subsidies compensate for higher opportunity costs of high educated women in the Swedish data. Below we outline our estimation strategy in detail.

Estimation strategy

On the margin, individuals or households make choices (about fertility) from their expectations about the opportunity cost in the short and the long run. We have little useful information on the long run so we will focus here on the short run subsidy given to the parent during the first year or so of the baby's life. Thus we provide information on how timing of births is affected in the sample which need not tell us much about the final number of children.

To formalize we must define what we mean by the subsidy. The short run subsidy is the difference in the (expected) disposable income in the event of having a new child as opposed to not having a new child. A perhaps more relevant comparison would be between the expected difference in disposable income of mothers who has a new born child and are on parental leave. The question is then rather how differences in subsidies in this group are linked to the choice of family size. The basic idea is that the greater the subsidy the higher level of fertility, at a given age etc. For individual *i* at time *t* the disposable income is

$$DISP_{it} = INCOME_{it} - TAX_{it} .$$

One can note that tax will depend on the income, but also that income will include public transfers. Tax is the sum of all taxes paid, including income taxes and payroll taxes. Income is the gross income, which includes market income and taxable and nontaxable transfers. Under certain assumptions (e.g., a given wage rate and a progressive tax system), the average "tax rate" (given by TAX/INCOME), is thus the inverse of labor supply. In reality this is only true for the "average person" since wages differ, taxes paid a given year relate to incomes from the year(s) before, although they sometimes are paid in advance, transfers are means-tested against last year's income, etc.

Our interest lies in examining the following micro relation, where we compare the differences in disposable income across women in fertile age with differences in their family's size, N_{it}, given her age etc.,

$$N_{it} = \alpha_1 + \beta_1 X_{it} + \gamma DISP_{it} + \delta DISP_{it} * STATE_{it} + \varepsilon_{1it},$$

Controls, like the age, are included in the vector X_{it}. Thus this equation catches the timing decision regarding fertility. It does not say anything explicitly about completed or desired number of children. Let us focus on the kink in the tax and benefit system introduced by the state tax. We would expect $\gamma>0$, since increases in the disposable income are linked to having a larger family, at the current age, education, etc. But we would also expect $\delta<0$, because women paying state tax are less compensated when they are on parental leave.

There are two types of endogeneity in this equation: 1) The disposable income is endogenous to the number of children in the family and 2) the event of paying state tax is endogenous to the event of having a child in the current year.[1]

The first endogeneity comes from the fact that labor supply is endogenous to the choice of family size. The average disposable income is generally increasing in factor income (earnings, income from self-employment and capital). As tax and transfer systems are highly complex the relationship is of course highly non-linear: in an economy with a progressive tax system, the increase is smaller at higher levels of factor (labor) income. But the increase is smaller also at the lower end due to substantial income support for low income groups. The second endogeneity arises because a somewhat lower income from parental insurance due to replacement rates less than 100 percent may shift the tax status in this respect. This means that we will get a biased estimate of the differences in disposable income if we just compare across observed groups. Due to selection, the regime is not random with respect to the decision to have or not have a new child.

To make causal inference we need exogenous variation that is linked to the tax rate but not to the number of children (after conditioning out controls). For one subgroup there is such variation. We argue that the month of birth, conditional on a new child born, serves as a good instrument. First, it should be a valid instrument, i.e., perfectly uncorrelated with the family size (N_i). That is

[1] One can note that education may also be endogenous but, as mentioned, in this analysis we will assume it is not.

$$E(N_i \mid newborn_i, month_i) = E(N_i \mid newborn_i).$$

Second, the birth month of the child (if any) should be highly correlated with the mother's tax rate (or labor earnings, or other types of income) in a given calendar year. This is because the income during the calendar year is the measure on which the current tax is based. This instrument hence exploit the fact that tax authorities (usually) collect tax only once every 12 months, but that income jumps occur much more often (as when a child arrives and the mother leaves her job for parental leave). It also exploits the fact that tax schemes are far from smooth. Instead it is often the case that marginal tax rates jumps at certain thresholds such as the threshold for paying state tax. One could argue that this might give incentives for planning the month of birth as a function of maternal income. The actual seasonal pattern with minor peaks in March (conception in the summer vacation) and in September (conception around the Cristmas and New Year holidays) does not indicate any such planning but is rather a function of time available for intercourse.

Our equation structure for the subgroup with a new child is hence modified to

$$\left[N_{it} \mid NEW_{it} = 1\right] = \alpha_1 + \beta_1 X_{it} + \gamma DISP_{it} + \delta DISP_{it} * STATE_{it} + \varepsilon_{1it}$$
$$DISP_{it} * STATE_{it} = \alpha_2 + \beta_2 X_{it} + \sum_{m=1}^{11} \lambda_m D_{it}^m + \varphi STATE_{it-1} + \varepsilon_{2it}$$

where D_{it}^m is a dummy indicating if there was a baby born in the m^{th} month in year t.
Second, we illustrate in Figure 7 that mothers with babies born in different months of the year have varying probabilities to be a state tax payer. If the baby is born late in the year then the risk is significantly higher than early in the year. The income threshold for when you start paying state tax is rather high (only about 10 percent of women 25-45 pay state tax). Therefore the probability rises more rapidly in the end months of the year.

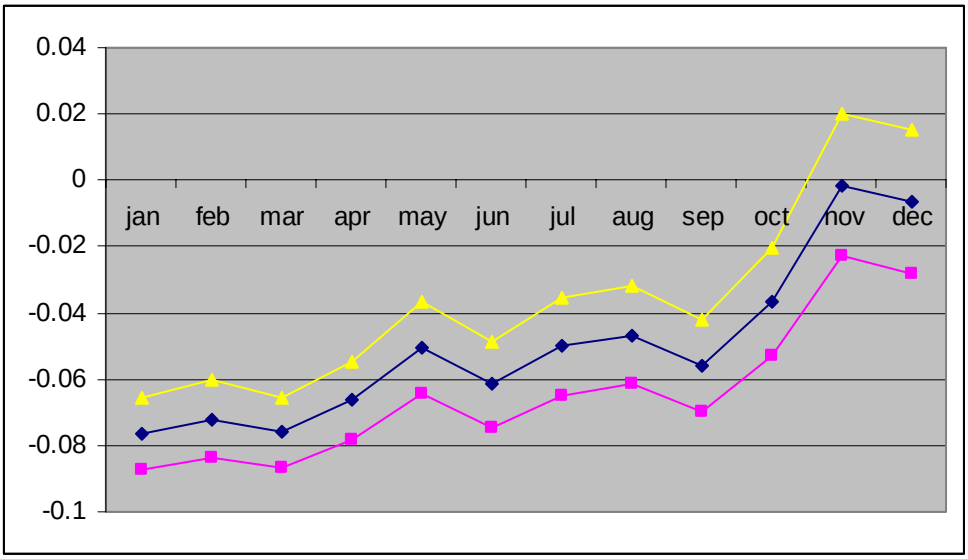

Figure 7 Probability of paying state tax in current year by month of newborn child (with 95 percent confidence intervals)

Included as an instrument in the equation system above is also the event of paying state tax in the previous period, $STATE_{it-1}$. Also this variable should serve as a good instrument for the event that state tax is paid in *t*. It is correlated, of course so it predicts the event of paying state tax, but it is independent of whether there is a new child.

Further strengthening our empirical analysis is the quality of data. The micro data that we use are longitudinal which implies that there is a potential to remove time constant unobserved individual effects. For this subsample we do not use a panel estimate where the influence of fixed effects is removed. The reason is that we really do not trust data to have enough longitudinal variability in this subsample.

Data and variable construction

Income is the gross income. It includes, besides labor earnings and capital income, non-taxable and taxable transfers. Taxes include taxes paid (not including the social insurance contributions paid by the employer or payroll taxes on consumption).

In the case of parental leave, the public parental leave insurance system has been described above.[2]

Usually it is the mother that stays at home with the baby child the first year or so.[3] Unless common-law or cohabiting couples have a common child they are not registered in our data. As a substantial fraction of couples live together as cohabitants without getting married we will not be able to identify the spouse and potential father in many cases. For these reasons we will consider subsidies for the women only, but we might like to examine the impact on the (potentially common-law) spouse as well, at least for those that we can identify, which is in general the case at the birth of a second child.

Some facts tell us, furthermore, that there are only small direct effects on the father's disposable income of the mother's leave from work because of a child birth. For instance, in Sweden the tax and most of the transfer systems are fully individualized. [4]

At our disposal is a rich micro panel data set covering administrative data for about 3 percent of the Swedish population (LINDA). For a more detailed description of LINDA see Edin and Fredriksson (2000). In this study we will use the waves 1993-2003. It is important to note that in the empirical analysis transfers, tax and income are measured on the annual level. The original sample includes observations from all 11 years for about 65 percent of the women. In some cases there are exits by death and emigration and entry by immigration and replacements for exits.

To identify potential mothers in data we assume that they are at least 16 years old and are labeled as a partner, a lone mother or another single living female. Only biological or adopted children to the mother or to both parents are considered. We study women until age 46. A little more than 5 percent have had a child during the three years we observe.

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[2] The complementary transfers collectively agreed by unions and employers' confederations may be very important, especially for high income earners, as they generally supplement the public transfer above the cap. Therefore we include controls for labor market affiliation.

[3] According to the latest statistic about 75 percent of fathers take some parental leave (SCB, 2006). Of these one third take more than the so-called "daddy-months" (60 days are reserved for one parent). The median for the father's share of total parental leave was 10 percent (or 35 days).

[4] An exception is the child allowance which habitually is paid out to the mother and the housing allowance which is mainly paid to lone mothers. The housing allowance acts as an insurance for the mother in case of a break with the father that lowers the risk she takes. Pension benefits entitlements for leave in connection to birth are also awarded to the mother unless otherwise agreed.

In the analysis we will, besides the income and tax variables described above, use age, year, month of birth of the new baby, the type of education, length of education (in three categories; basic, high school, and university), sector of employment. After having generated the lags required in the analysis we drop all periods except those in which a women gives birth.

In data there are 660938 time-person observations to start with. Table 1 shows the resulting sample size when all necessary corrections and data generations were complete.

Table 1

Remark	*Size*
Orginal sample	660938
Had a new child	35418
Education is non-missing	34329
State(t-1) is non-missing	30491
Birth month of baby non-missing	30476
Disposible income is zero	30402
Resulting sample	30402

Results

In **Table 2** descriptive statistics for the variables we use are reported. The number of children is on average only 1.7 since women are here still in fertile age and the distribution is fairly concentrated below 3 children.

Mid education is defined as including upper secondary school (which is voluntary but with enrollment well above 90 percent) but no completed tertiary education. Note that tertiary education here includes vocational education for nurses for example.

Table 2 Descriptive statistics (only women, 16-46, that had a child) for the sample of 30402 observations

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Number of children	1.740412	1.045294	1	11
ln(DISP)	11.61812	0.558411	1.139622	14.79399
STATE(t)*ln(DISP)	2.505818	4.81526	0	14.79399
STATE(t)	0.213506	0.409788	0	1
STATE(t-1)	0.228965	0.420174	0	1
ln(CC)	9.428877	1.904899	7.389144	12.67499
ln(CC)*STATE(t)	2.010219	3.957169	0	12.67499
age	29.83817	5.034769	17	46
Low education	0.137754	0.344647	0	1
Mid education	0.545787	0.497907	0	1
High education	0.316459	0.465102	0	1
Central gov	0.03855	0.192523	0	1
Local gov	0.328334	0.469615	0	1
Private	0.39231	0.488273	0	1
self_employed	0.00819	0.09013	0	1
Other sector	0.023156	0.150403	0	1
Sector is missing	0.20946	0.40693	0	1

The birth month

As can be seen from Figure 8 there are more babies born in the months March-May. In later years in the data there sweem to have been a shift towards more births in the months September-October and less during March and May.

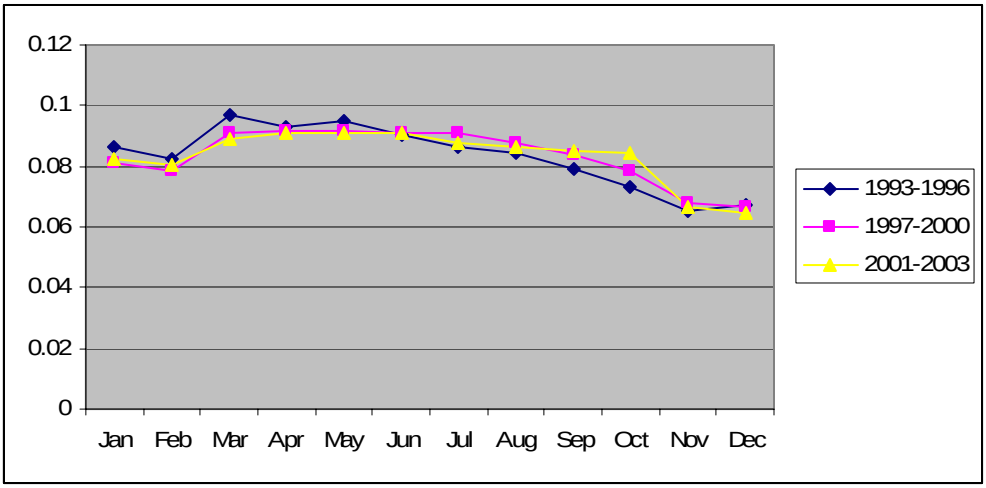

Figure 8 The distribution of birth month, over years

According to Figure 9 there is a difference in the baby's birth month depending on whether the mother was a state tax payer in the year before the baby was born. For high income mothers the distribution of birth month are more accentuated towards April and May compared to other mothers. One hypothesis is that high income mother with an important career path is more aware that the child's month of birth will matter for her and her partner's

planning ahead. If the child is born in this time of the year then it will be at a right age to start of child care in the autum when it is about one and a half years old. It will also be that the fathers' favour parental leave during the summer months in connection to ordinary vaccation.

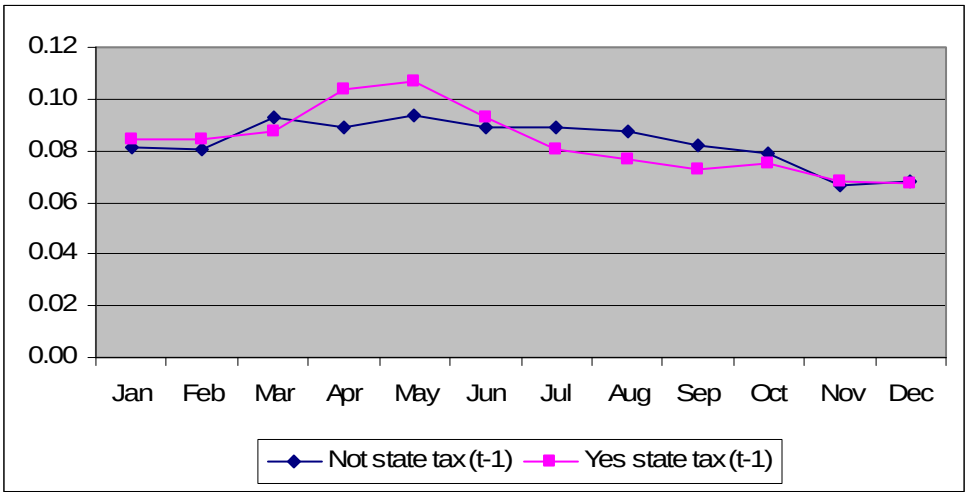

Figure 9 The birth month of new baby, by state tax payer (t-1)

Instrumental variables (IV) regression results

The instrumental variables (IV) regressions, presented in Table 3, confirm our prior. An increase in disposable income is linked to more children, conditional on mother's age, educational level, the year of study, and the sector of occupation, but the effect of being above the income limit for state tax when on parental leave will dampen the effect to some extent. The size of the counter acting effect is, in all specifications, smaller than the main effect but never the less strongly significant.

Table 3 IV estimates of number of kids for the subsample of mothers on parental leave (has a new-born in current year)

Variable	*(1)* *IV*	*(2)* *IV*	*(3)* *IV*	*(4)* *IV*	*(5)* *IV*	*(6)* *IV*	*(7)* *OLS (all exogenous)*
STATE(t)*ln(DISP)	-0.050***	-0.087***	-0.107***	-0.045***	-0.071***	-0.091***	-0.028***
ln(DISP)	0.094***	0.175***	0.340***	0.155***	0.213***	0.388***	0.288***
Low educ	0.507***	0.503***	0.316***	0.470***	0.468***	0.270***	0.280***
Mid educ (ref)							
High educ	-0.241***	-0.217***	-0.187***	-0.260***	-0.239***	-0.204***	-0.249***
Central gov				-0.048	-0.065**	-0.096***	-0.066**
Local gov				0.217***	0.194***	0.182***	0.227***
Private (ref)							
Self-employed				0.206*	0.215*	0.219*	0.246**
Other				0.147***	0.130**	0.095*	0.132***
Sector is missing				0.286***	0.268***	0.285***	0.308***
Age dummies	No	No	Yes	No	No	Yes	Yes
Year dummies	No	Yes	Yes	No	Yes	Yes	Yes
N	30402	30402	30402	30402	30402	30402	30402
R^2	0.028	0.042	0.096	0.049	0.063	0.118	0.139
Hansen J statistic	5.56	9.02	4.42	8.06	11.34	5.31	
p-value	0.9013	0.6197	0.9559	0.7080	0.4153	0.9155	
Anderson[$]	4953.37	5203.15	5057.82	4849.28	4877.09	4745.98	
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Note. Instrumented: STATE(t)*ln(DISP). Excluded instruments: D^m , m=1,…,11, and STATE(t-1). Robust standard errors. *p<0.05; ** p<0.01; *** p<0.001. [$]) Refers to Anderson canonical correlations LR statistic.

We perform the usual diagnostic tests to find out whether these empirical results are trustworthy. These tests[5] show that instruments are both valid and relevant. Further, a comparison with the OLS estimator where all variables are assumed exogenous shows that there seems to be endogeneity bias towards zero effects for both state tax payers and others.

In our most elaborated specification (6) the counteracting effect of being state tax payer is about one fourth of the disposable income effect. The results suggest, if these results can be given a causal interpretation, that mothers that do not pay state tax in the year of having a baby and experience a 100 percent increase in their disposable income will have 0.39 more children. State tax payers must experience a 130 percent increase to have the same number of kids.

[5] Hansen J statistic is a test of overidentifying restrictions (a rejection casts doubt on the validity of instruments), and Anderson canonical correlations LR statistic is a test of the excluded instruments are relevant (rejection of the null indicates that the model is identified).

Does child care then compensate high educated or high earners more? The child care institution in Sweden should, as argued above, be of greater economic importance to high income earners than to mid and low income earners. The implicit subsidy of having very cheap and good publicly provided child care is greater for every hour for the well paid, as their alternative cost of not having this option for child care is higher. The effect of the tax and transfer system might then be of secondary importance.

Here we have only very crude estimates of the child care subsidy. It is defined as follows. The household's child care benefit, CC_{it}, is the per capita public consumption of child care for children aged between 0 and 12, weighted by the number of children in each age in the household, N_{ait}:

$$CC_{it} = \sum_{a=0}^{12} cc_a N_{ait} \ .$$

In this analysis cc_a is the estimated per capita age profile of public consumption of child care (taken from Forsell et al. (2007)) reported in SEK in Table 4.

Table 4 NTA estimates of child care subsidy received for children at different ages.

age	*0*	*1*	*2*	*3*	*4*	*5*	*6*
SEK	1618	38161	72878	76310	80319	80919	23549
age	*7*	*8*	*9*	*10*	*11*	*12*	
SEK	21900	20423	16623	5893	2493	1326	

In the following set of estimates in Table 5 we explore the possibility that child care subsidy matters more for state tax payers than others. For comparison the specification *(6)* from Table 3 is included unchanged.

In specification (8) we include the new variable. There is an effect on the results by including this additional information. Controlling for the level of public child care (in (8)) will reduce the effect of disposable income changes somewhat, both for state and non-state tax payers. We find that child care is positively related to family size, but the effect is smaller than that of disposable income. There seem not to be any difference in effects for state tax payers compared to others (see specification (9)). In fact when we assume that state tax payers will be differently affected by more child care subsidy we no longer find that the effect of

disposable income changes will be smaller for this group. A tentative interpretation could be that state tax payers indeed are compensated by child care subsidies when we condition on this control.

Table 5 Additional IV estimates of number of kids with proxy for child care subsidy included.

Variable	*(6) (repeated)* *IV*	*(8)* *IV*	*(9)* *IV*
STATE(t)*ln(DISP)	-0.091***	-0.065***	0.022
ln(DISP)	0.388***	0.305***	0.294***
STATE(t)*ln(CC)			-0.118
ln(CC)		0.127***	0.152**
Low educ	0.270***	0.233***	0.227***
Mid educ (ref)			
High educ	-0.204***	-0.177***	-0.179***
Central gov	-0.096***	-0.084***	-0.082***
Local gov	0.182***	0.155***	0.156***
Private (ref)			
Self-employed	0.219*	0.224*	0.222*
Other	0.095*	0.078*	0.081*
Sector is missing	0.285***	0.197***	0.193***
Age dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
N	30402	30402	30402
R^2	0.118	0.179	0.172
Hansen J statistic	5.31	6.37	6.15
p-value	0.9155	0.8479	0.8023
Anderson	4745.98	4630.99	25.40
p-value	0.0000	0.0000	0.0080

Note. Instrumented: STATE(t)*ln(DISP) and STATE(t)*ln(CC).
See Table 3 for additional notes.

Note that we in this case have one additional endogenous variable (the interaction term between the logarithm of CC and the event of being a state tax payer), but the same set of instrument variables. However the diagnostic tests give us no reason to be cautious about the interpretation since again they show that instruments are both valid and relevant.

However, the CC variable has been constructed using the number of children and their age composition so even if we instrument and diagnostics look good, our interpretation must be tentative. This crude measure could also pick up other variation dependent on the number of children, liked scale economies in households or quantity-quality trade-offs. A good

measurement of this is, however, hard to construct due to local variation in the degree of subsidies as well as the way that the fee relates to income.

Finally, one should note that we have not performed all required sensitivity analysis to check the robustness of these results. The stability of parameter estimates in Table 3 is however at least to some extent quite reasuring.

Preliminary Conclusions

We find evidence that the decision to have a new child is indeed influenced by the subsidy system. We make use of instrumental variable techniques to reduce some of the endogeniety bias introduced. For the subgroup that had a new child, the month in which that birth occurred is a valid instrument for the event of being a state tax payer in that year. With reservation for our inability to control for all possible endogeneity biases and sometimes overly crude proxy measures, it is apparent that high educated women in Sweden at a given age are, relatively speaking, compensated for their on average higher opportunity costs although there is a remaining negative effect of high education per se, in addition to the income related effects. For very high income earners paying higher marginal taxes (state tax) there is a counter-acting effect suggesting they are not fully compensated through the transfer system. Using a crude measure for child care subsidies as a control this effect disappears, however, which we very tentatively interpret as evidence that child care subsidies provide an offsetting effect on long run opportunity costs.

Although further research on this is certainly needed it appears that the Swedish subsidy system can explain a substantial part of the fact that TFR is higher in Sweden than the European average.

More tentatively there are indications that child care subsidies may be especially important to high earning women's decision to have a new child. Although the potential for to use this as stimulus to births in Sweden seems rather exhausted by now child care subsidies could be a useful complement to increase female labor supply in many European countries.

With regard to completed fertility our study does not say much, however, since our estimates are cross-sectional. One conclusion can be drawn, however. If delayed fertility indeed carries

a risk that desired fertility cannot be achieved then our results indicate that this delay can be influenced by increasing the relative tax subsidy for younger women. Even if policies to increase fertility are not deemed desirable from a purely economic viewpoint the medical risks of later birth for both mothers and children could motivate such age related subsidies.

Results are so far preliminary since we need to test the sensitivity of our analysis to a number of restrictive and not validated assumptions. Causality may be questionable for some correlations we find and need to be confirmed by more specialized studies than this explorative study.

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