DISCUSSION PAPER SERIES

IZA DP No. 3942

Cheaper Child Care, More Children

Eva Mörk
Anna Sjögren
Helena Svaleryd

January 2009

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Cheaper Child Care, More Children

Eva Mörk
IFAU, Uppsala University
and IZA

Anna Sjögren
IFAU

Helena Svaleryd
IFN

Discussion Paper No. 3942
January 2009

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 3942
January 2009

ABSTRACT

Cheaper Child Care, More Children*

We study the effect of child care costs on the fertility behavior of Swedish women and find that reductions in child care charges influence fertility decisions, even when costs are initially highly subsidized. Exploiting the exogenous variation in child care costs caused by a Swedish child care reform, we are able to identify the causal effect of child care costs on fertility in a context in which child care enrolment is almost universal and the labor force participation of mothers is very high. A typical household planning another child experienced a reduction in expected future child care costs of SEK 106,000 (USD 17,800). This reduction resulted in 3-5 more child births per 1,000 women during an 18 month period, which corresponds to a 4-6 per cent increase in the birth rate.

JEL Classification: H31, J13

Keywords: child care, cost of children, fertility, quasi-experiment, difference-in-differences

Corresponding author:

Eva Mörk
Uppsala University
PO Box 513
SE-751 20 Uppsala
Sweden
E-mail: eva.mork@ifau.uu.se

* We are grateful for comments by Matz Dahlberg, Peter Fredriksson, Rafael Lalive, Imran Rasul and participants at seminars at IFN, IFAU, SOFI, Stockholm University, Växjö University, the IFN Stockholm Conference on Family, Children and Work and the 23rd Annual Congress of EEA in Milan.

1 Introduction

Low fertility rates, aging populations, and the concern for long run labor supply have inspired policy interest in how the availability and price of child care services influence maternal labor supply and birth rates. Cross country comparisons show that birth rates are indeed higher in OECD countries with high female labor force participation and wide access to child care (D'Addio and Mira d'Ercole, 2005). Yet, the direction of causality is not well understood.

We aim to establish if there is a causal effect of child care costs on fertility. To this end, we exploit the quasi-experiment created by the Swedish Child Care Reform in 2001. This reform imposed a cap on child care charges and standardized fee schedules across Swedish municipalities. As a consequence of the reform, households, similar in characteristics, experienced different cost changes depending on where they lived, and households in a given municipality experienced different cost changes depending on characteristics such as household income, and the number and age of the children. Hence, depending on the household characteristics that determine child care charges, the reform introduced exogenous variation in child care costs.

Our estimates imply that the reform, which induced an average reduction in total child care costs of SEK 106,000 (just over 50 per cent), increased fertility rates by about 4–6 per cent. Stated differently, a USD 10,000 reduction in child care costs increased fertility by 2–3 children per 1,000 women.

Theoretical models of fertility and maternal labor supply (e.g. Ermish, 1989a, b; Apps and Rees, 2004) predict that reductions in child care costs ought to affect labor supply, rather than fertility, when child care enrollment and labor supply are initially low. The reason for this is that cost reductions make it more attractive to enter the labor market or to work longer hours. Yet, in the Swedish context, in which labor supply and child care enrollment are high but fertility is relatively low, fertility may be the more likely margin of adjustment to cost changes. A reason is that Swedish child care is supplied during regular and rather short work hours, leaving little scope for increasing labor supply on the intensive margin. Indeed, Lundin et al. (2008) find that the

reduction in child care charges after the reform had no effect on the labor supply of Swedish mothers. There is also evidence that hours in care for children already enrolled increased only marginally as a result of lower child care costs (Wikstrom, 1997).

Previous microstudies have found mixed support for the hypothesis that lower child care charges increase fertility. Blau and Robins (1989) use American survey data and find that a higher cost for child care had a negative impact on the birth rates of women who were *not* employed, but no effect on employed women. In a study of Italian data, Del Boca (2002) finds that both fertility and labor force participation are positively correlated with better access to child care. These studies, however, suffer from endogeneity problems. Both the availability of child care and the charges actually paid by families are largely a matter of choice on the part of local governments in response to demand, or families making choices over both quality and quantity of child care.

In a more recent study, Schlosser (2006) uses the introduction of free public preschool for children aged 3 and 4 in Israel to estimate the effects of a reduction in child care costs on Arab mothers' labor supply and fertility. She finds no effect on fertility but a positive impact on labor supply. Schlosser uses quasi-experimental data and is therefore more likely to capture causal effects rather than correlations. However, the context she studies is specific in the sense that maternal labor supply was initially very low, while fertility was high and no subsidized child care existed prior to the reform. In such a situation we would hardly expect to see further increases in fertility.

Two recent studies on US data use changes in household service sector wages, caused by low wage immigration, to study the effects on labor supply and fertility. Cortes and Tessada (2008) find positive effects on the labor supply of women, and, in particular, that well educated mothers worked longer hours when low skilled immigration increased the supply of cheap and flexible child care. Furtado and Hock (2008) show that lower wages in the child care sector resulted in higher fertility for these well educated women.

The US context is more similar to the Swedish context studied here; most women work, have children and use child care. However, there are important differences. Immigration may primarily lower the price of flexible nanny services making it possible to combine career and family for high earning women, but this kind of child care may

still be out of reach for women with less education and lower earnings. The present study, instead examines changes in costs for already highly subsidized child care during regular work hours. We should hence expect to see effects for a different group of women. Our results also show that it is primarily households where the women work part-time that respond to the changes in child care charges. Women working fulltime do not respond.

An important advantage in analyzing the Swedish setting is that most Swedish households with young children use some form of subsidized child care. In 2004, 90 percent of all children aged 3–6 attended publicly subsidized child care. The choice of whether to use subsidized child care or not is thus less of an issue than in many other child care markets. As a consequence, we can study the effect of cost changes on the entire population of households, as opposed to only on a small part of the population, which is a common weakness of studies using quasi-experiments. This significantly strengthens the external validity of our results (see discussion in Moffitt, 2005; and Angrist et al., 2008). Furthermore, because the child care reform studied in this paper affected most families, it is possible to study heterogeneous responses to changes in child care cost.

The effects of child care cost changes are not the same for all women. As mentioned above we find larger effects of child care cost changes on the fertility decisions of women working part-time. We also find that younger women (34 or younger) are more likely to respond. We further find that the effects of reduced child care charges are particularly strong for households with no earlier children and for third births. Since there is a clear two-child norm in Sweden, the fact that the effect is largest for third births suggests that the reform has affected completed fertility rates. Thus, our findings are not only a matter of reduced spacing between children.

Before presenting the data, discussing our identification strategy in some detail and arriving at estimation results, we will next provide a background on Swedish fertility, the child care market and the design of the child care reform of 2001.

2 Institutional background

2.1 Child care in Sweden

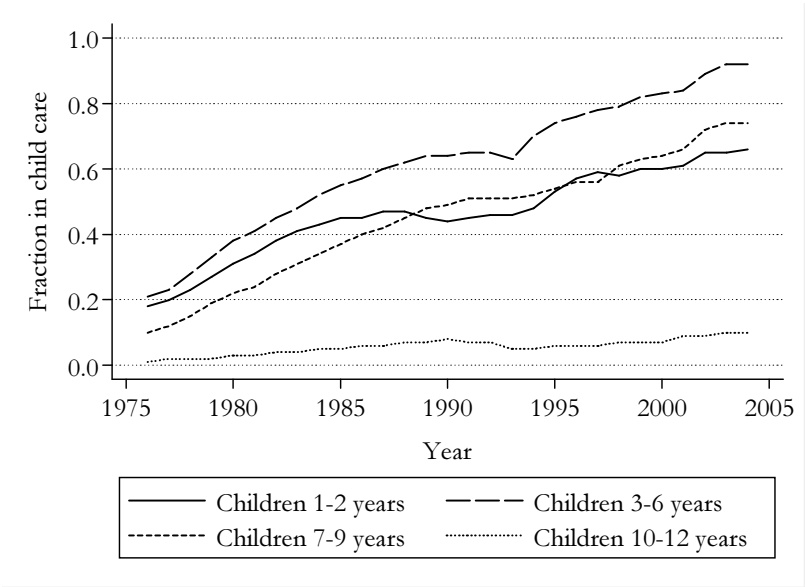
Sweden has a long tradition of publicly subsidized child care for pre-school children, and after-school care for young school children. Until the early 1990s, child care was publicly provided, but since then, a growing proportion of municipalities have introduced voucher systems, paving the way for private provision of services. Figure 1 shows the proportions of children attending some form of publicly subsidized child care over time, by age. The enrolment rates have increased dramatically over time, and in 2004 as many as 90 percent of all children aged 3–6 attended child care.[1] The enrolment rate is also high for very young children (aged 1–2). One explanation for these high enrolment rates is that the local governments in Sweden are obliged by law to provide child care for children aged 1–12 whose parents either work or are full-time students, within three to four months from the parents' request.[2] Subsidies for child care for infants are, however, restricted to families and children with special needs, and hence enrolment for infants is negligible.[3]

[1] Publicly subsidized child care comes in different forms, the most common being center-based care. Different forms of family day care, in a publicly-paid carer's home or in the child's home also exist. Although financing of child care is public, care providers can be public, cooperative or private.

[2] There are 290 local governments in Sweden. In addition to child care, they are responsible for primary and secondary education, care of the elderly and disabled, welfare and local infrastructure. Local governments finance their activities by, in order of their importance, a proportional local income tax, grants from the central government, and user fees.

[3] Infants are instead cared for by their mothers and to a much smaller extent by their fathers. Parents are entitled to a year's paid parental leave with an income replacement rate of 80 per cent up to a cap.

Figure 1 The proportion of children enrolled in subsidized child care by age, 1976–2004



Source: National Board of Education (Skolverket)

Until 2002, the municipalities were free to set their own child care charges, as long as these were "reasonable". According to Government Bill 93/94:11, "child care charges must not be so high that parents, for economic reasons, refrain from letting their child attend a child care activity that the child would benefit from". This definition clearly gives room for different interpretations, and consequently child care fee schedules differed considerably between municipalities, both with respect to levels and construction. In particular, charges varied with family income and age and number of children. Some municipalities applied a flat charge per child, but most municipalities used elaborate fee schedules which implied that families with high incomes and few young children paid the highest charges per child. Child care was, however, heavily subsidized in all municipalities, and only about 15–20 percent of the municipalities' child care costs were covered by user charges.

2.2 The child care reform

In the last months of the election campaign in the 1998 elections, the incumbent Social Democratic Party proposed a large child care reform designed to reduce user fees and

further increase accessibility of child care.[4] Although the Social Democrats won the election, the reform bill was not passed by the Swedish Parliament until three years into the election term, in November 2000. The government justified the reform in terms of a wish to i) give all children equal access to educational activities ii) improve economic conditions for families with children, and iii) facilitate parental labor force participation.

The reform was implemented gradually and consisted of several parts. The most important component was an option for the municipalities, as of 2002, to impose a cap stipulated by central government on user fees for child care. Municipalities that chose to do so were granted compensation (at least partially) for lost revenues. As it turned out, all but two municipalities implemented the capped fee schedule in January 2002. The remaining two municipalities implemented the reform in the following year. Most municipalities took the decision to implement the capped fee schedule as late as in the fall of 2001. Hence, it was not until then that families knew whether they would benefit from lower child care costs or not. We return to this issue when defining our pre- and post-reform periods.

The capped fee schedule, which has been in place since the reform, has two components. First, the charge per child is determined as a fixed percentage of household income. This percentage rate varies with the age and order of the child in the household, so that the younger the child, the higher the rate, but the more younger siblings the child has that are also enrolled in public child care, the lower the rate.[5] Secondly, fees are capped so that municipalities can only charge parents the fixed percentage of household income up to a monthly income ceiling which was SEK 38,000 (6,430 USD) in 2002. Per-child charges are constant for household income above this level.

Prior to the reform there was substantial variation in child care fees across household types and municipalities. After the reform, comparable households faced similar child care charges regardless of where they lived. Moreover, child care became much cheaper as a result of the reform. In 1999, the median middle-income family with two adults and

[4] Elinder, et al. (2008) analyze the reform's impact on voter behavior and find that families with young children were affected by the promise.

[5] The percentage rate for the first child in preschool is 3 percent, 2 percent for the second child, and 1 percent for the third child. The corresponding figures for after school care are 2, 1 and 1 percent. The household does not pay

two pre-school aged children paid SEK 2,660 (380 USD) per month, and child care charges varied between SEK 1,560 (260 USD) and SEK 3,940 (670 USD) depending on where the family lived (Skolverket, 1999). In 2002, after the implementation of the reform, a similar family paid SEK 1,900 (320 USD) for the care of their two children where charges varied between SEK 1,040 (175 USD) and SEK 1,900 (320 USD) (Skolverket, 2003).

2.3 Fertility in Sweden

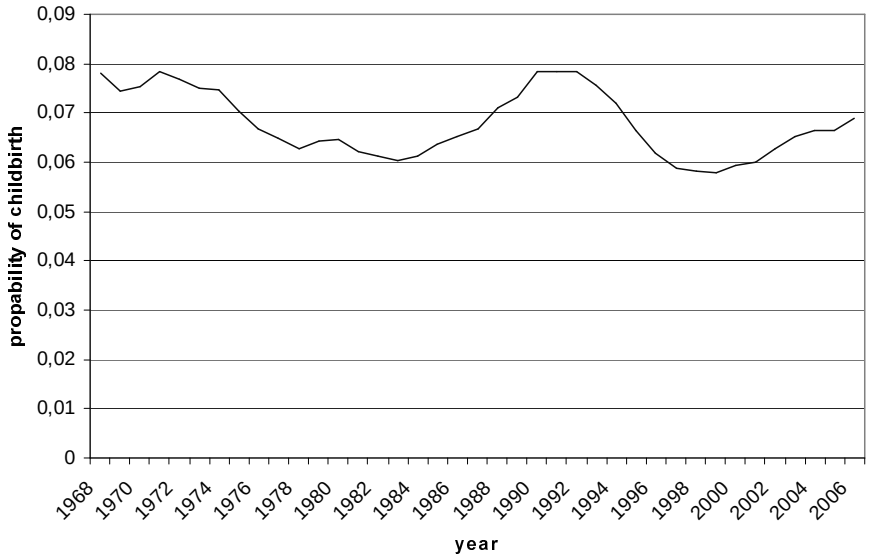
In contrast to most OECD countries, where completed fertility rates have fallen considerable over the past few decades, completed fertility in Sweden has remained rather stable (see Björklund, 2006). The cohorts of women born 1926–59 had completed fertility rates around 2.0, with the highest rate (2.11) for the cohort born in 1943 and lowest rate (1.96) for the cohort born in 1945.

Total fertility rates[6] of Swedish women have, however, varied substantially over time, and so has the spacing between children. As is the case in other OECD countries, first-time mothers are getting older. Figure 2 shows the average number of children born per woman aged 20–45 in Sweden over the period 1968–2006. The Figure demonstrates substantial time variation in total fertility rates, with a recession in the late 1970s and early 1980s, followed by a boom in the late 1980s and early 1990s, and lower levels again in the late 1990s. Total fertility rates have, however, picked up in recent years, from an all time low of 1.5 in 1999.

anything for child number four and after. The youngest child is defined as child number 1. Hence families with one child in preschool and one in after school care pay 4 percent of household income.

[6] Total fertility in a given year shows how many children a hypothetical woman would have in her lifetime if she had as many children at each age as women of a given age in that particular year.

Figure 2 The average number of children born per woman aged 20–45 in Sweden during the period 1968–2006.



Source: Statistics Sweden

The fluctuations in total fertility largely mirror the development of the labor market with a few years lag, suggesting a link between the two. The correlation between total fertility and labor market opportunities is likely to depend on the design of the Swedish parental benefit system. For example, only parents who have been employed prior to pregnancy and birth qualify for income-related benefits up to a relatively high ceiling. The qualifying rules provide a strong incentive for women to postpone having children until they are established in the labor market (Björklund, 2006).[7]

Interestingly, these aggregate numbers show a slight increase in the number of children born after the Swedish child care reform. But, given the magnitude of the cyclical fluctuations in fertility, we cannot readily interpret this increase as a causal effect of decreased child care costs due to the reform. In order to establish a causal link, we need to show that the changes in fertility behavior across different types of households are, in fact, related to how these household types were affected by the

[7] See Adsera (2004, 2005) for discussions of the link between unemployment and fertility in explaining cross-country differences in fertility.

reform. In the next section, we discuss the empirical methodology in detail and present the data used to establish this link.

3 Methodology and data

3.1 Econometric challenge

The problem arising when estimating the effect of child care costs on fertility is that observed child care costs for a given household are typically determined by household characteristics that are also likely to directly influence fertility decisions. If the Swedish child care reform had implied that changes in child care charges were truly random, and thereby independent of household characteristics, it would be straightforward to estimate the effect of the cost changes on fertility. However, this was not the case. In particular, the fee cap implied that high-income households experienced larger cost reductions than low-income households. In order to get unbiased estimates of the causal effect of child care costs on fertility we therefore need to hold constant all household characteristics that determine both child care charges and fertility decisions, and thus only identify the effect of child care costs through the exogenous change in child care charges.

The child care fee survey conducted by IFAU (for details, see Section 3.2) shows that the fee schedules, both before and after the reform, are fully determined by a subset of observable household characteristics. We denote this subset by Z.[8] We can thereafter define a household type *j* as all households sharing the same characteristics Z_j so that in a given municipality *m* at a given period in time, *t*, all households of type *j* have identical child care costs. In other words, for households of type *j*, the household's child care costs are a function $P_{mt}(Z_j)$. It follows that, any variation in child care costs within household type *j* in a given municipality is a result of exogenous changes in the fee schedule *P* over time. All possible direct effects of Z_j on fertility can be accounted for

[8] The variables that determine child care charges are household income, the number of children and the age of each child. These are all available in Swedish register data, and it is therefore possible to compute each household's exact child care fee both before and after the reform, on the assumption that all children of child-care eligible age are enrolled in full-time child care. We will return to this issue in Section 3.4.

by including fixed effects for each municipality-household type Z_{jm}. More formally, we estimate the following relationship:

$$Child_{ijmt}=\alpha+\beta P_{jmt}(Z_j)+Z_{jm}+\tau_t+\varepsilon_{ijmt}, \qquad (1)$$

where $Child_{ijmt}$ is the probability that the woman in household i of type j, in municipality m, in period t, bears a child, and τ_t is a time-fixed effect, controlling for a common time trend in fertility.[9] Including controls for household characteristics that influence fertility, but do not influence child care costs (e.g. maternal age and education) is not necessary for unbiased estimates of β , conditional on an assumption of homogenous responses to the price change. Including such controls may, however, increase efficiency. See discussion in Smith and Todd (2005).

Our estimation strategy is to compare the probability that the woman in a household of a particular type in a particular municipality bears a child during a time window of a given length prior to the reform with the probability that a household of that same type in the same municipality has a child in a time window of the same length after the reform. The changes in fertility behavior are then related to the changes in child care costs induced by the reform for the same household type across different municipalities, and other types of households in the same municipality. This strategy produces a difference-in-differences estimator, where households are matched at the household type×municipality level. The resulting estimate of β, is the weighted-sum over all household types of the difference-in-differences estimates of fertility changes across municipalities and time within a given household type, where the weights are determined by the number of households grouped together in each household type j.

One issue of concern is whether the effects of the child care reform can be isolated from the effects of other general or local reforms that took place at the same time? To the extent that such other reforms affected the same household types that were particularly affected by the child care reform, we must take this into account, otherwise

[9] The same strategy is applied by Lundin et al. (2008) when investigating the effect of child care prices on parental labor supply

our estimations will be biased. There were indeed other nationwide reforms in family policy during this time period. For example, an additional allowance for large families was introduced, and there were a number of changes made to tax-rules that are likely to have had differential effects on families in different income brackets. However, since there was no variation across municipalities in the implementation of these other reform packages, it is possible to account for the effect of such reforms by allowing for nationwide fertility trends for each household type.

It is also possible that municipalities that implemented the largest fee cuts also introduced other child-related policies at the same time. In that case, changes in child care fees could pick up fertility effects that were not the result of the fee changes per se, but rather the effects of other policy changes. On the assumption that such local policies affected all the families in a municipality in the same way, we can control for this possibility by estimating the model with municipality-specific time trends in fertility.

Allowing for both household type-specific time trends and municipality-specific time trends, equation (1) is modified

$$Child_{ijmt}=\alpha+\beta P_{jmt}(Z_j)+Z_{jm}+\tau_t+trend_j+trend_m+\varepsilon_{ijmt}. \qquad (2)$$

Due to computational restrictions, we estimate both equation (1) and (2) in first differences, i.e. netting out the fixed effects.[10] This results in some loss of efficiency in comparison to the within-estimator.

Another issue of concern is whether the child care reform also had effects on the quality of the care provided and/or that access to care was affected as a result of increased demand. Such effects could, potentially, confound the effects on fertility of a reduction in fees. As regards provision of care services, the reform is not likely to have had any major impact on the access to child care, since municipalities were obliged by law to provide a child with child care within 3 months of parental demand as early as 1993. This obligation did not change. The reform, however, implied guaranteed access to child care for a minimum of 15 hours per week for the children of unemployed

persons and parents on parental leave with younger siblings. These are the reason for the increase in enrolment seen in Figure 1, above. However, the number of enrolled children per child care employee, as well as the share of child care employees with training in pedagogics, remained constant between 2001 and 2003. Furthermore, if anything, the total cost per enrolled child increased slightly between 2001 and 2003.[11] There is hence no evidence that the reform implied lower child care quality.

Our identification strategy assumes that the cost changes for each household-municipality type are exogenous and do not depend on any other characteristics affecting fertility decisions and fees. One concern may be that families that are insensitive to the cost of child care are more likely to reside in municipalities with high fees. In this case, households receiving the largest reductions will be the least responsive to changes in child care costs. This selection problem might lead us to underestimate the impact of the reform on fertility, and bias our results against finding any effects.

3.2 Data

We use data from two sources. Firstly, the information on fee schedules comes from survey data on municipal child care charge tariffs conducted by IFAU.[12] Secondly, information on household characteristics and fertility comes from register data from Statistics Sweden. All variable definitions can be found in Appendix Table A.2.

Our sample consists of all couples in which the woman was 20–45 years old in the period 1997–2002. Since Swedish register data does not code cohabiting couples without common children as household units, we exclude from the analysis unmarried women without children, single mothers, and cohabiting unmarried mothers whose partner was not the father of her children. The reason for doing this is that we are unable

[10] Thus, when estimating eq. (1) we estimate: $\Delta Child_{jm}=Child_{jmt}-Child_{jmt-1} = \alpha + \beta(P_{mt}(Z_j) - (P_{mt-1}(Z_j)) + \varepsilon_{jm}$, and when estimating eq. (2) we estimate: $\Delta Child_{jm} = \alpha + \beta(P_{mt}(Z_j) - (P_{mt-1}(Z_j)) + Z_j + m_m + \varepsilon_{jm}$.

[11] See Table A.1 for some descriptive statistics. http://www.skolverket.se/sb/d/1663 for statistics.

[12] IFAU collected child care fee data via an email-request sent to all Swedish municipalities asking for exact formulas on how they calculated prices in 2001–04. Information about the exact fee structure from 220 of Sweden's 290 municipalities was received. Comparing the pre-reform child care costs for a number of type families in the municipalities that responded with those of the municipalities that did not respond (available in Skolverket, 1999) we conclude that they are very similar, which implies that we need not worry about a selection of a specific type of municipality..

to identify a potential father for the child, and therefore cannot obtain a correct measure of household income for these groups. This sampling implies that women without children in our sample are all married, but that couples with children in common need not be married. Because most Swedish first-born children are born out of wedlock, this necessity to exclude unmarried childless women is somewhat unfortunate. The estimates obtained for childless women may not reflect the effects of changes in child care fees in the whole population of childless women, since married couples are likely to differ from unmarried couples in several respects. It is, however, not clear if they should be expected to be more or less sensitive to changes in child care fees compared to unmarried couples.

For the households in our sample, we obtain register-based information on the woman's age, education, country of origin, annual income for the woman and her partner, as well as the number of children living in the household and their respective ages. We also obtain register information on whether the woman has given birth to a child in the pre-reform and post-reform periods.

3.3 Defining pre- and post-reform periods

We assume that the fertility decisions of households were first affected by the reform when they knew that it would be implemented in their municipality.[13] As mentioned in Section 2.2, municipalities did not decide until the late fall of 2001 whether or not to implement the child care reform. Taking the nine months gestation period into account, July 2002 is when we can expect the first births in response to reduced costs. Allowing for some randomness in conception and delayed responses, we define a post-reform sample consisting of all women meeting our sample criteria in 2001, and register their births during an 18 month time window after the reform (i.e. July 2002–December 2003).

Our data allows us to construct two pre-reform samples as comparisons for the post-reform sample. The first pre-reform sample consists of women meeting the sampling criteria in 1997, and their births in the period July 1998 through December 1999. The

[13] This assumption will be tested in the empirical analysis.

second pre-reform sample consists of women meeting the sampling criteria in 1999 and measures births in July 2000 through December 2001. Children conceived earlier than March 2001 are hence assumed to be unaffected by the reform, while children conceived between October 2001 and March 2003 are potentially affected by the reform.

3.4 Computing child care costs and birth rates

Since child care charges depend on a number of observable household characteristics, we can compute the households' remaining child care costs, assuming that the household's children plus an additional child are enrolled in full-time care until each child reaches the age of ten.[14] Column (1) of Table 1 presents the present value of the remaining child care costs for the pre- and post-reform samples. When computing pre-reform costs, we apply the pre-reform fee schedules collected in the survey[15]. Post-reform costs are computed using the reform fee schedule as it was stipulated by central government, thus assuming that the capped fees were implemented in the same way across the country. As is clear from the table, comparing the pre-reform and post-reform sample of households, the costs of child care decreased dramatically due to the reform. On average, the net present value of remaining child care costs decreased by 106,000 or more than 50 percent, from SEK 194,980 to SEK 89,220. The drop in the standard deviation of child care costs also shows that the variation in fees across households decreased radically when the reformed national fee schedule replaced local fee schedules.

[14] Note that we do not observe whether children are actually attending child care, and if so, for how many hours. The cost-measure we calculate is based on the assumption that everyone attends child care and after-school care full time. When totaling child care costs over time, we have further assumed that the families discount future costs exponentially with the discount rate 0.03. Within reasonable limits, results are not sensitive to the choice of discount factor.

[15] The information collected by IFAU pertains to the fee schedules as they were in 2001. Information on prices scheduled prior to 2001 is not available, but the survey information suggests that there were no major changes in local fee schedules in the years prior to the reform. As a result, we use the fee schedule for 2001 to compute what the household pre-reform fee was in the years prior to 2001. Although inflation was minor during these years, we have, however, denominated household incomes in 2001 prices using a consumer price index, in order to achieve comparability across years.

Table 1 Pre-reform and post-reform remaining child care costs in SEK 000s and the number of child births per 1,000 women (during an 18 month spell).

	Sample Year	Child Care Cost	Births
Pre-reform	1997	187.75	81.40
		(69.32)	(273.45)
	1999	194.98	85.13
		(70.79)	(279.08)
Post-reform	2001	89.22	95.19
		(31.00)	(293.48)

Note: Average values. Standard deviations in parenthesis

Ignoring twin births and very closely spaced siblings, we count one birth if the woman bears at least one child during the defined 18-month period, and zero otherwise. The last column in Table 1 reports the average number of births per 1,000 women during an 18 month time window before and after the reform for the households sampled. A comparison of the number of births for the 1997, 1999 and 2001 samples shows an increase over time, with a sharper increase after the reform.[16]

The capping of child care charges implied that the largest cost cuts accrued to households that initially had high costs. In order to get a better understanding of which type of households experienced the largest cost reductions, Table 2 shows changes in remaining child care costs at different parity and levels of household income. Note that the largest cost changes accrued to well- off families that already had two children, while low income households without children received a much smaller reduction in child care cost. Although the within- family type variation in child care cost changes was smaller for families with low incomes or few children, Table 2 also illustrates that the reform also introduced substantial variations in costs for households with similar incomes and the same number of children.

[16] Table A3a-c contains child care costs and birthrates for all sub groups of households that are analyzed later on in this paper.

Table 2 Change in present value of remaining child care cost 1999–2001 for a household giving birth to one additional child, SEK

Parity	Household income, quantiles		
	Low	medium	high
No children	-57.84	-88.64	-108.52
	(20.10)	(23.77)	(33.52)
One child	-82.95	-115.07	-130.28
	(33.41)	(34.81)	(41.84)
Two children	-89.85	-125.11	-146.45
	(37.34)	(40.30)	(50.89)
Three or more children	-92.34	-129.97	-143.53
	(38.69)	(41.33)	(54.03)

Note: Average values. Standard deviations in parenthesis

3.5 Defining household types

The estimation strategy discussed in section 3.1 relies on comparisons of households that are identical with respect to all factors affecting both child care fees and fertility, but that experience different changes in child care costs because they live in different municipalities. To achieve such a comparison, we need to a) define household types based on income, the number of children and the age of the children, and b) observe each household type in at least two municipalities, both before and after the reform. In defining household types we therefore face a trade-off. The more narrowly we define household types, the more precise is our measure of child care costs, the smaller the within-household type variance in characteristics that determine child care charges and, hence, the more truly random is the within-household type variation in child care costs. The drawback of too narrowly defined household types is that we are less likely find matches over time for the same household type in at least two municipalities. Hence, the more precise our household types, the less representative is the sample used for estimation. This problem is fruitfully illustrated by household income. Household income is a continuous variable, and it is therefore not possible to perform an unconstrained match. Doing so would prevent us from finding matches for most of our

household types. Instead, we use monthly income spans of SEK 1,000 in 2002 prices. When matching the exact age of each child, a similar problem arises. Instead, we choose to define household types by their number of children under the age of 10, the exact age of the youngest child and the age category of each of the next three youngest children, and the household's monthly income span. We only consider the four youngest children in the household, since only a few municipalities before the reform, and none after, charged beyond the fourth child. The age categories are defined in line with the typical age categories determining child care charges, 1–3, 4–5 and 6–9.

The success rate of the chosen matching strategy is presented in Table 3. The number of municipality-household types (Z_{jm}) for 1997 and 1999 is 393,670. Of these, 56 percent or 110,712 (221424/2) municipality-household types are present in both years and are hence included in the estimations. Note that the municipality-household types that are dropped, for lack of comparable households in a specific municipality in the next period, are rare municipality-household types in the sense that they represent few households. As a result, the fraction of households included in the estimations is 78 percent, which is much larger than the fraction of municipality-household types that are included. Turning to the years 1999 and 2001, we see that the fraction of municipality-household types that find a matching household type is similar to the previous period, 55 percent, accounting for 77 percent of all households.

Table 3 Descriptive statistics on the matching

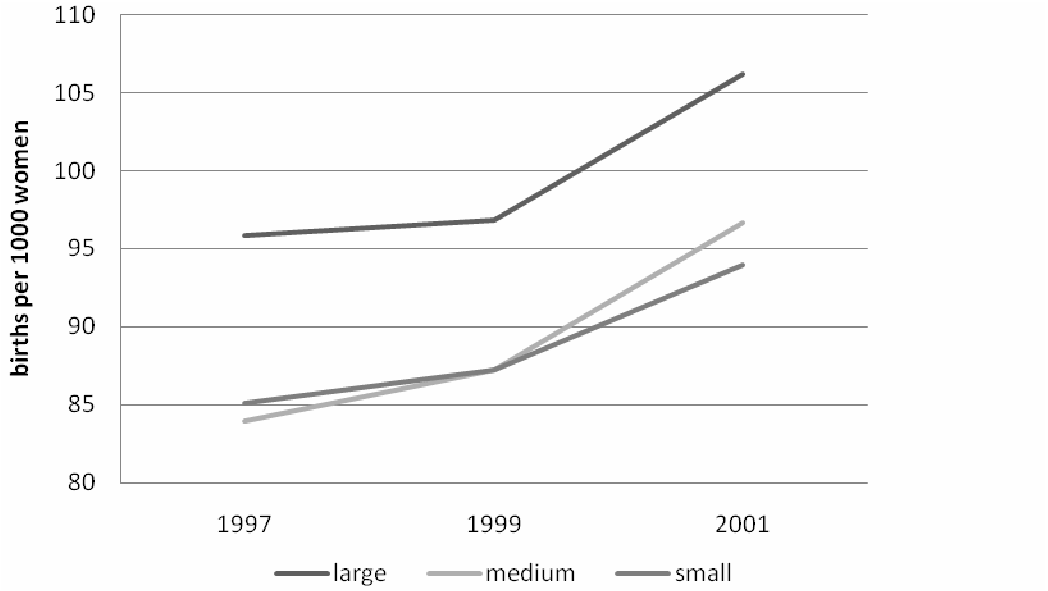
	1997 & 1999			1999 & 2001		
	No. of obs. in total sample	No. of obs. in matched sample	Percent matched sample of total	No. of obs. in total sample	No. of obs. in matched sample	Percent matched sample of total
Municipality-household type	393,670	221,424	56%	402,336	222,696	55%
Households	1,035,835	810,497	78%	1,031,356	797,789	77%

3.6 Graphical analysis

Before turning to the econometric estimations, we present a graphical analysis to provide an initial indication of whether reduced child care costs affected birth rates. In

Figure 3 we plot the birth rate per 1,000 women in 1997, 1999 and 2001 for three categories of household types that came to experience large, medium or small reductions in child care charges. We can see that there is a positive trend in fertility rates for all three categories of household types already before the reform. Between the 1999 and 2001 samples, the increase in the number of births, however, appears to be greatest for households that received the largest reductions in costs, and the smallest for the households that encountered the least changes.

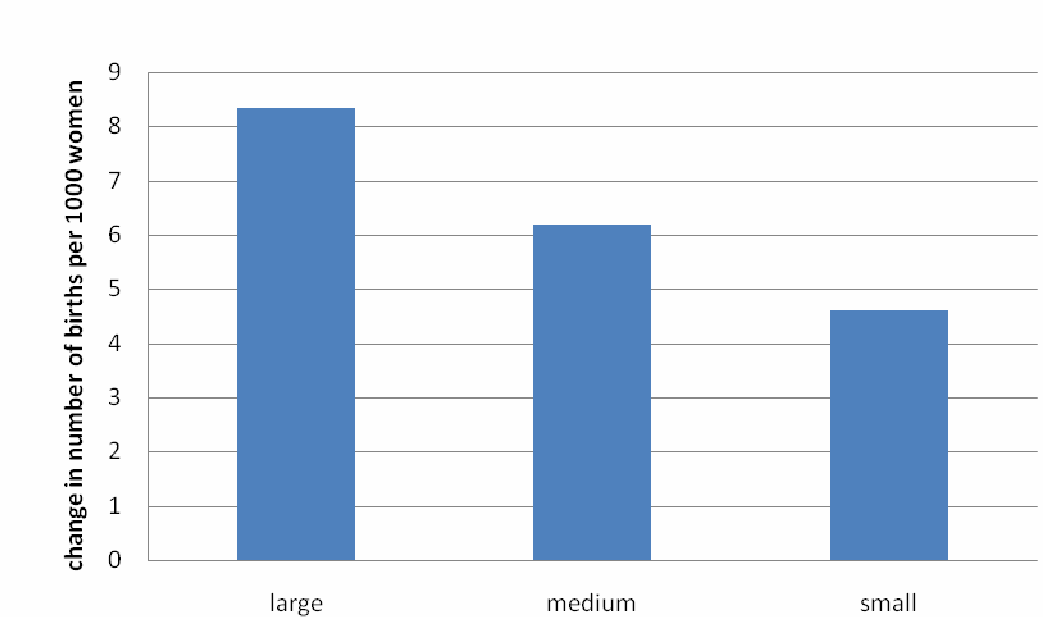
Figure 3 Births per 1,000 women by magnitude of cost reductions



To further illustrate the different effects for the three categories, we present the detrended changes in birth rates between 1999 and 2001 in Figure 4.[17] It is clear from the Figure that the detrended increase in birth rates between 1999 and 2001 is larger for households that received larger cost reductions.

[17] We have extrapolated the fertility trend between the 1997 and 1999 sample.

Figure 4 Detrended change in births per 1,000 women by magnitude of cost reductions.



4 Results: Effects of child care costs on fertility

The graphical analysis in the previous Section indicated a positive relationship between reduced child care costs and increased fertility. In order to determine if there is, in fact, a causal effect of child care costs on birth rates, we turn to a formal analysis of the data, as outlined in Section 3.1.

4.1 Baseline estimates

Table 4 reports the baseline estimates obtained when reductions in child care costs are regressed on changes in fertility. In column (1) we present the estimates of the model given by equation (1) in Section 3. The coefficient for child care costs is -0.03, which implies that a SEK 1,000 reduction in child care costs increases the number of births by 0.03 children per 1,000 women.[18]

[18] Due restrictions in computational capacity, we estimate the model in first differences, as mentioned above. Estimating on first differences entails a cost in terms of efficiency. If we instead estimate the model in column (1)

Table 4 Child care costs and fertility

	Child births per 1,000 women, 1997–2001		
	(1)	(2)	(3)
Child care cost	-0.031*	-0.048***	-0.040**
	(0.016)	(0.016)	(0.019)
Age		-11.242***	-11.224***
		(0.162)	(0.165)
University		33.492***	33.656***
		(1.417)	(1.440)
Municipal×household type FE	Yes	Yes	Yes
Municipal trend			Yes
Household type trend			Yes
Observations (household types)	222,060	222,060	222,060
R-squared	0.00	0.03	0.05

Note: Robust standard errors in parenthesis. * indicates significant at the 10%-level, ** at the 5% and *** at the 1% level. Household types are defined by number of children under the age of 10, exact age of youngest child, age category (ages 0–3, 4–5, 6–9) of next three youngest children and household monthly income span of 1,000 SEK.

In column 2, we introduce controls for the average age of women and proportion of women with a university degree in each municipality × household-type cell. This causes the estimated coefficient for child care costs to increase somewhat in magnitude to 0.048. Since child care fee schedules do not depend on maternal age or education, one possible explanation of the change in the point estimate is that the responses to cost changes differ across women depending on their age and education. Closer examination reveals that the coefficient for child care costs is sensitive to including a control for age, but not to controlling for education.[19] We further explore the presence of heterogeneous effects by age in Section 4.3.

In column 3 we investigate whether the estimates are robust to taking differential time trends at the municipal level and household type level into account. The coefficient for child care costs diminishes slightly, but is still negative and significant. Thus, we can conclude that lowering the costs of child care does indeed have a positive impact on fertility. The estimated effect, ranging between -0.03 and -0.048, implies that the average reduction in child care costs, which amounted to some SEK 106,000, increased the number of child births per 1,000 women during an 18-month period by 3–5 children.

using the within- estimator, the point estimate remains the same, but the standard deviation decreases considerably, and the effect is now significant at the 1-percent level.

Compared to the average of 85 children born to 1,000 women in an 18-month period prior to the reform, this implies that the birth rate increased by 4–6 percent, and that the child care reform accounted for about 30–50 per cent of the increase in fertility that took place during this period.

4.2 Placebo results

As a further robustness check, we examine whether the reform was exogenous to fertility behavior prior to the reform. This includes testing whether households anticipated the reform and reacted early, or if household types that experienced large reductions in child care costs already had an increasing trend in fertility before the reform. We test the exogeneity of the reform by performing a placebo test in which we predate the reform to 1999 and attempt to explain changes in fertility behavior of household types between the 1997 and 1999 samples in terms of changes in the child care charges that these household types did not experience until after the period studied. To this end, we compute each household's costs in 1999, using the post-reform fee schedule, and compare the fertility behavior of the 1997 and 1999 samples.

Our identification strategy depends on the assumption that the reform-induced child care costs would have no effects on changes in fertility behavior between these years. Significant estimates would indicate that the analysis suffers from identification problems, generating spurious correlations between child care cost reductions caused by the reform and the fertility behavior of households. Table 5 shows that the changes in child care charges introduced in 2002 cannot explain behavior in 1999. The coefficients for child care cost are small and not statistically significant in either specification.[20] The effects of the woman's age and education are, however, stable for both the "true" and the placebo specifications.

[19] These results are available on request.
[20] The lack of statistical significance is not an effect of low efficiency of the first-difference-estimator. Estimating the model in column (1) using the within-estimator also produces statistical insignificant estimates.

Table 5 Placebo-test

	Child births per 1,000 women, 1997–99	
	(1)	(2)
Child care cost	0.009	0.025
	(0.015)	(0.030)
Age		-11.051***
		(0.231)
University		31.951***
		(2.014)
Municipal-Household type FE	Yes	Yes
Municipal trend		Yes
Household type trend		Yes
Observations (household types)	110,712	110,712
R-squared	0.00	0.07

Note: Robust standard errors in parenthesis. * indicates significant at the 10%-level, ** at the 5% and *** at the 1% level. Household types are defined as in Table 5.

In sum, there seems like the reduction in child care charges increased fertility. The lack of significant results in the placebo regressions strengthens the interpretation that the effect is causal. In the following Sections, we will investigate the presence of heterogeneous responses to child care costs.

4.3 Women's age

The instability of the baseline estimates in Table 4 to inclusion of the average age of the women in the household type × municipal cell suggested a presence of heterogeneous responses to the child care cost changes by women of different ages. In this Section we explore this possibility further.

When estimating heterogeneous effects, we need to re-define our household types, also taking the age of the woman into account.[21] The median age in our sample of women is 34. We have therefore categorized women as old or young if they are older or younger that the median age. Defining these different age categories implies splitting many household × municipal cells in two, which causes us to lose out on some

[21] Since the number of children is already taken into account when defining household types, investigating heterogeneous effects for couples with and without children does not mean that we need to re-define the household types.

households for which we no longer find matches.[22] However, we still find matches for almost 70 percent of the households. Average child care costs and birth rates before and after the reform for young and old women are presented in Table A3a in the Appendix.

Table 6 displays the results of the analysis on a sample matched at the age × household type × municipal level. The results show that it is only the young women who respond to the changes in child care costs. The coefficient for older women is close to zero. For women aged 34 or younger, a cost increase with 1,000 SEK leads to approximately 0.05 fewer births per 1,000 women.

Table 6 Heterogeneous effects with respect to women's age

Child births per 1,000 women		
	(1)	(2)
Child care cost		
Young women (<35)	-0.041*	-0.049**
	(0.024)	(0.024)
Older women (>35)	0.005	-0.001
	(0.021)	(0.021)
Municipal-household type FE	Yes	Yes
Household characteristics		Yes
Municipal trend	Yes	Yes
Household type trend	Yes	Yes
Observations (household types)	227,161	227,161
R-squared	0.02	0.02

Note: Robust standard errors in parenthesis. * indicates significant at the 10%-level, ** at the 5% and *** at the 1% level. Household types are defined by number of children under the age of 10, exact age of youngest child, age category (ages 0–3, 4–5, 6–9) of next three youngest children, household monthly income span of 1,000 SEK and women older or younger than 35. Household characteristics include average age of women and fraction of women with a university degree in each household type × municipal cell.

4.4 Women's labor supply

Swedish parents with small children have the right by law to shorten their work hours down to 75 percent of full-time. A large fraction of mothers exercises this right. A closer look at the work hours of the women in our sample shows that women with more children are more likely to work part-time. This tendency to work part-time may indicate that the Swedish child care system, which provides subsidized child care during

[22] This is the reason to why we restrict the number of age categories to two.

regular work-hours, makes it difficult to combine children with long work-hours. In this section we investigate whether the response to child care charges depends on the initial labor supply of the woman in the household.

In columns (1) and (2) in Table 7 we have not taken into consideration the finding that households reacted differently to changes in child care costs depending on the age of the woman in the household, but only investigated whether the effect is heterogeneous with respect to the woman's labor supply. We find that it is only women who work part time (i.e. less than 80 percent of full time) who react to changes in child care costs. In columns (3) and (4) we let the effects vary both with respect to age and labor supply and find that it is only for part-time working women younger than 35 that the effect is statistically significant. Although the coefficients for all interactions are negative the standard errors are relatively noisy. An increase in child care costs with 1,000 SEK leads to a decrease in child births with 0.185 children per 1,000 women. These figures should be compared to the average number of births per 1000 women prior to the reform for subgroup of women that was below 35 years old and worked part time which was 139 (see Table A3c in the Appendix). Hence the average childcare reduction which for this group was 110,000 SEK implies an increase in the birth rate of almost 15 percent.

One interpretation of this finding is that Swedish child care, which is supplied during regular work hours, is not flexible enough for full time working women to respond to reductions in child care charges with increased fertility. For these women, having another child is likely to require them to reduce work hours when they return to work after a year's parental leave. The loss in earnings associated with having another child is therefore larger than for women who are already working part time. An alternative explanation to the heterogeneous response with respect to work-time may be that women working part-time are more likely to have small children and that women with small children were more likely to react to the change in child-care charges. Perhaps, women working full time, do so precisely because their children are older and because they do not plan to have more children. However, the correlation between work-time and age of the youngest child is only 0.03. Moreover, results from estimations that are

not presented here, show that the age of the youngest child does not influence the response to the reform.[23]

Table 7 Heterogeneous effects with respect to women's labor supply and age

		Child births per 1,000 women			
		(1)	(2)	(3)	(4)
Child care cost					
Part time		-0.061	-0.068		
		(0.051)	(0.049)		
Full time		-0.014	-0.024		
		(0.051)	(0.049)		
Part time	Young women (<35)			-0.183**	-0.185**
				(0.080)	(0.080)
Part time	Older women (>35)			-0.048	-0.045
				(0.050)	(0.050)
Full time	Young women (<35)			-0.027	-0.032
				(0.068)	(0.067)
Full time	Older women (>35)			-0.043	-0.044
				(0.048)	(0.047)
Municipal-household type FE		Yes	Yes	Yes	Yes
Household characteristics			Yes		Yes
Municipal trend		Yes	Yes	Yes	Yes
Household type trend		Yes	Yes	Yes	Yes
Observations (household types)		129,066	129,066	117,602	117,602
R-squared		0.06	0.10	0.07	0.07

Note: Robust standard errors in parenthesis. * indicates significant at the 10%-level, ** at the 5% and *** at the 1% level. In column 1 and 2 household types are based on the same characteristics as in Table 4. In column 3 and 4 household types are based on the same characteristics as in Table 6. Household characteristics include average age of women and fraction of women with a university degree in each household type × municipal cell

4.5 The number of children

Finally, we investigate whether the effects differ depending on how many children the households initially have. This analysis can give us a hint as to whether the effects on birth rates that we have found so far are the result of anticipation of children already planned, or whether the completed fertility of the women affected by the reform is likely to have increased.

Table 8 displays the results of estimating our model when we have included interaction terms for child care costs with dummy variables that capture parity. We start

[23] . These results are available upon request.

by investigating whether the effects differ for couples with or without children. We do so by including an interaction term for child care costs, with a dummy variable indicating that the household has no children[24]. The result in the first column shows an effect both for households with children and for childless couples, although the response of the latter group is larger. In the second column, we study whether the effect differs depending on the woman's age. In line with previous results, it is the younger women who have children in response to the reductions in child care charges, and this is true both for households with and without children. A 100,000 SEK decrease in child care charges increased fertility with three percent for families with children and 5.5 percent for families without children.

Table 8 Heterogeneous effects with respect to family size and age – childless couples and families with children in daycare-age

		Child births per 1,000 women 1997–2001			
		(1)	(2)	(3)	(4)
			All households	Household with children in daycare-age	
All women	Women with children	-0.041**			
		(0.019)			
	Childless couples	-0.111**			
		(0.053)			
Young women (<35)	Women with children		-0.047*		
			(0.024)		
	Childless couples		-0.180**		
			(0.073)		
Old women (>35)	Women with children		-0.008		
			(0.021)		
	Childless couples		-0.079		
			(0.051)		
All women	One child			-0.003	
				(0.034)	
	Two children			-0.044*	
				(0.026)	
	Three or more children			0.079	
				(0.049)	
Young women (<35)	One child				-0.026
					(0.043)
	Two children				-0.053*
					(0.029)
	Three or more children				0.039
					(0.063)
Old women (>35)	One child				0.019
					(0.032)
	Two children				-0.028

[24] The fixed effect of being a household with no children is included in the household-type fixed effect since the number of children is one of the variables defining the household type.

		Child births per 1,000 women 1997–2001		
	(1)	(2)	(3)	(4)
		All households	Household with children in daycare-age	
				(0.026)
Three or more children				0.136**
				(0.055)
Municipal×household type FE	Yes	Yes	Yes	Yes
Household variables	Yes	Yes	Yes	Yes
Municipal trend	Yes	Yes	Yes	Yes
Household type trend	Yes	Yes	Yes	Yes
Observations (household types)	222,060	227,161	188,159	188,159
R-squared	0.05	0.02	0.03	0.03

Note: Robust standard errors in parenthesis. * indicate significant on the 10%-level, ** on the 5% and *** on the 1% level. Household characteristics include average age and fraction of women with a university degree in the household type × municipal × age cell.

Next, we turn to study the possible differential effects depending on parity. We estimate a separate effect of child care fees on families with one, two and three or more children. The results in the third column show that families with one child do not respond. The point estimate of -0.003 is insignificantly different from zero. Also, for higher order parities – families with three or more children – is there no response to the change in child care charges. The results show that it is families with two children that respond positively to cost reductions.

Since our previous investigations suggest different responses depending on the mother's age, we interact the dummies capturing parity with dummies indicating whether the mother is younger or older than the median age (34). In line with previous results, the results in the last column show that it is younger mothers with two children who respond to the cost reductions. Actually, this group seems to be the type of family for which the reform induced the largest response. A 100,000 SEK decrease in child care charges increased fertility rates with 7,4 percent.

We have no clear-cut explanation as to why older mothers of three or more children react by having fewer children when costs decline. It should be noted, however, that families with 4 or more children are very rare in Sweden, especially families satisfying the restriction that all children have to be of an age eligible for subsidized child care, i.e. 1–10 years old. In our sample, the average probability of having another child for households with three children and a mother categorized as old is only around 25

children per 1,000 women during an 18 month period. As a result, a few births may have substantial effects on our outcome variable.

Are the effects on birth rates that we have found so far the result of anticipation of children already planned, or can we expect the completed fertility of the women affected by the reform to have increased? A thorough analysis of this issue would require data on completed fertility rates. Since these will not be available for many years to come, we are restricted to alternative ways of exploring this issue.

One approach to differentiating effects on timing from long-run fertility that is commonly employed by demographers (see e.g. Hoem, 1993) is to study third or higher order births. If the number of higher order births increases, while there is no reduction in first or second births, the net effect is likely to be an increase in long-run fertility. Also, since historically most families in Sweden choose to have two children, increases in third births should be more informative about long-term increases in fertility. Our results hence suggest that there is indeed a possibility that long-run fertility was positively affected by the reform.[25]

5 Conclusions

We have explored the effect of introducing a cap on child care charges on the fertility behavior of Swedish families. Exploiting the exogenous changes in child care costs introduced by the Swedish child care reform of 2001, we can conclude that child care charges have an effect on fertility. In particular, we find that fertility over an 18-month period increased by about five per cent when total child care cost for the average family was reduced by SEK 106,000 (USD 17,800), or that a USD 10,000 reduction in child care costs would have led to 2–3 more child births per thousand women. This implies that the reform can account for as much as half of the total post-reform increase in fertility.

We find that it is young women working part-time who account for most of the effect of child care charge reductions on fertility in the Swedish context. Moreover, Lundin et

[25] In this analysis, we focus on families with children of child care age.

al. (2008) show that labor supply was not affected by the change in child care costs. These results contrast with recent findings on U.S. data. Cortes and Tessada (2008) have found that increased immigration reduced the cost of child care services, which, in turn, increased the share of professional mothers with small children who worked very long hours. Furtado and Hock (2008) also find a positive effect on the fertility of highly educated women. A possible explanation for the different results is that while the Swedish child care cost change concerned costs for care during regular work hours, the US cost change concerned also more flexible nanny services. The high incidence of part time work for Swedish mothers and the rather short child care hours of Swedish children suggest that, while it is straightforward to be a working mother, it is hard to combine a full time career with motherhood. One interpretation of the absence of an effect of child care charge reductions on the fertility on full time working women is that for these women the income forgone during a year's parental leave and possibly a reduction in hours when returning to work may be too high in relation to the child care cost change induced by the reform.

One key question is whether the Swedish child care reform led to increased completed fertility rates, or whether the reduction in the child care charges only influenced the spacing between child births. We argue that there is some evidence that long-run fertility rates were affected. The strongest argument in favor of this conclusion is that the reform increased the number of third births without negative effects on first and second births.

Is the magnitude of the effects we find reasonable? We can compare the magnitude of the estimated effect with the findings of other studies that investigate the effect of other economic incentives on fertility. Milligan (2002) investigates the effects of a pro-natalist transfer policy implemented in Quebec, by which mothers received a cash bonus for giving birth. Using the exogenous variation created by the reform, he finds that there is a substantial impact of child care allowances on fertility rates.[26] Milligan finds that a cash bonus of 1,000 Canadian Dollars (USD 950) increased fertility by 16 percent.

[26] Kearney (2004), on the other hand, finds no negative effects from a decrease in cash allowances beyond a certain number of births on fertility among welfare-prone groups in the US in 1989–98. On the contrary, for some groups, she finds an increased number of births.

Laroque and Salanié (2004), instead, apply a structural model of maternal labor supply and fertility to French data and family policies (although ignoring the effects of child care). In simulations, they find that increasing mothers' earnings reduces fertility, but that increasing child support during the first three years, corresponding to a present value cash transfer in of some USD 20,000 would increase fertility by a quarter.

The effects found in this study are comparatively small. Hence, although we find that child care costs do affect fertility, general child care subsidies appear to be an expensive way of stimulating overall fertility, at least when compared to the international evidence on other types of policies presented here. However, we need to bear in mind that the Swedish child care reform managed to increase fertility without any negative effects on female labor supply (Lundin et al., 2008). Whereas cash transfers or other policy instruments are likely to increase fertility at the cost of lower female labor supply, low child care charges may be an efficient way of combining high labor supply with high fertility rates.

References

Adsera, A. (2004), “Changing fertility rates in developed countries. The impact of labor market institutions.” *Journal of Population Economics* vol. 17, pp. 17–43.

Adsera, A. (2005), “Vanishing children: From high unemployment to low fertility in developed countries”, *American Economic Review, Papers and Proceedings* vol. 95, pp.189–193.

Angrist, J., V. Lavy and A. Schlosser (2007), “Multiple experiments for the causal link between the quantity and quality of children”, mimeo.

Apps, P. and R. Rees (2004) “Fertility, female labor supply and public policy”, *Scandinavian Journal of Economics* vol. 106, pp. 745–763.

Björklund, A. (2006), “Does family policy affect fertility?”, *Journal of Population Economics* vol. 19, pp. 3–24.

Blau, D. M. and P. K. Robins (1989), ”Fertility, employment, and child-care costs”, *Demography* vol 26, pp 287–299.

Cortes, P. och J. Tessada (2008), “Cheap maids and nannies: How low-skilled immigration is changing the labor supply of high-skilled American women”, manuscript University of Chicago- GSB.

D'Addio and M. d'Ercole (2005), “Trends and determinants of fertility rates in OECD countries: The role of policies”, DELSA OECD.

Del Boca, D. (2002), “The Effect of Child Care and Part Time Opportunities on Participation and Fertility Decisions in Italy”, *Journal of Population Economics* vol. 15, pp. 549–573.

Elinder, M., H. Jordahl and P. Poutvara (2008), “Selfish and prospective: Theory and evidence of pocketbook voting”, Working Paper No. 770.

Ermisch, J. F. (1989a), “Fertility employment and child-care costs”, *Demography* vol. 26, pp. 287–299.

Ermisch, J. F. (1989b), ”Purchased child care, optimal family size and mother's employment“, Journal of Population Economics vol. 2, pp 79–102.

Furtado, D. och H. Hock (2008), “Immigrant labor, child-care services, and the work-fertility trade-off in the United States”, IZA Discussion Paper 3506.

Government Bill 1993/94:11 “Utvidgad lagreglering på barnomsorgsområdet, mm.”

Hoem, J. (1993), “Public policy as the fuel of fertility: effects of a policy reform on the space of childbearing in Sweden in the 1980s.” *Acta Sociologica* vol. 36, pp. 19–31.

Kearney, M. 2002, “Is there an effect of incremental welfare benefits on fertility behavior? A look at the family cap”, *Journal of Human Resources* vol. 392, pp. 295–325.

Laroque, G. and B. Salanié (2004), “Fertility and financial incentives in France”, CESifo Economic Studies, vol. 50, 3/2004.

Lundin, D., E. Mörk and B. Öckert (2008), ”How far can reduced childcare prices push female labour supply”, *Labour Economics* vol. 15, pp. 647–659.

Milligan, K. (2005) “Subsidizing the stork: New evidence on tax incentives and fertility”, *Review of Economics and Statistics* vol. 87, pp. 539–555.

Moffit, R. (2005), “Remarks on the analysis of causal relationships in population research,” *Demography* vol. 42, pp. 91–108.

Schlosser, A. (2006), “Public preschool and the labor supply of Arab mothers: Evidence from a natural experiment”, Mimeo Hebrew University, Jerusalem.

Skolverket (1999) ”Avgifter i förskola och fritidshem 1999”, Skolverkets rapport 174.

Skolverket (2003) “Avgifter i förskola och fritidshem”, Fördjupning av rapport 231, Skolverket.

Smith, J. and P. Todd (2005) ”Does matching overcome LaLonde's critique of nonexperimental estimators?” *Journal of Econometrics* vol. 125, pp. 305–335.

Wikstrom, M. (2007) “Kommunalekonomiska effekter av maxtaxa och ökad tillgänglighet inom förskola och skolbarnomsorg”, Umeå Economic Studies 704, Umeå Universitet.

Appendix

Table A.1 Descriptive statistics of child care quality

	1999	2000	2001	2002	2003	2004
Costs per enrolled child, SEK	83,000	86,900	90,200	93,700	95,900	96,600
Number of enrolled children per worker	5.3	5.4	5.3	5.3	5.4	5.4
Share of personnel with higher education	54 %	54 %	52 %	51 %	51 %	51%

Source: http://www.skolverket.se/sb/d/1663

Table A.2 Variable definitions

Child: Dummy that takes the value 1 if the household had a child in an 18-month period
Child care cost : The present value of the total child care costs associated with having the family's existing children plus an additional child enrolled in full-time child care until the age of 10.
Age: Age of the women in the households minus the median age (34)
University: Dummy that takes the value 1 if the woman in the household has some university education
The data is collapsed at the household-municipal level, and therefore one observation will be the household type × municipality average×year
age 35+: Dummy variable taking the value 1 if the woman in the household is 35 or older.
Childless couple: Dummy variable taking the value 1 if the household has no children
One child: Dummy variable taking the value 1 if the household has one child
Two children: Dummy variable taking the value 1 if the household has two children
Three or more children: Dummy variable taking the value 1 if the household has three or more children.

Table A.3a Pre-reform and post-reform total remaining child care costs in SEK 000s and the number of child births per 1,000 women (during an 18 month spell).

		Sample Year	Child Care Cost	Births
Young	Pre-reform	1999	205.02	176.09
			(73.16)	(273.72)
	Post-reform	2001	97.25	199.71
			(33.71)	(287.56)
Old	Pre-reform	1999	187.91	21.09
			(68.13)	(112.40)
	Post-reform	2001	83.86	25.52
			(28.54)	(123.34)
Childless				
	Pre-reform	1999	147.45	199.74
			(46.02)	(248.59)
	Post-reform	2001	62.42	226.13
			(16.33)	(261.11)
Families with children	Pre-reform	1999	198.92	75.65
			(71.01)	(203.88)
	Post-reform	2001	91.43	84.35
			(30.88)	(215.41)
1 child	Pre-reform	1999	192.93	148.52
			(63.93)	(262.03)
	Post-reform	2001	87.51	159.49
			(25.54)	(270.73)
2 children	Pre-reform	1999	222.16	49.85
			(73.19)	(167.70)
	Post-reform	2001	106.18	55.62
			(30.35)	(179.00)
More than 2 children	Pre-reform	1999	229.01	49.92
			(81.83)	(206.48)
	Post-reform	2001	114.09	55.47
			(34.73)	(220.12)
Part-time	Pre-reform	1999	196.23	65.19
			(69.62)	(210.36)
	Post-reform	2001	89.53	74.06
			(29.54)	(223.85)
Full-time	Pre-reform	1999	204.37	80.37
			(66.65)	(215.63)
	Post-reform	2001	91.55	88.38
			(28.04)	(225.08)

Note: Average values. Standard deviations in parenthesis

.

Table A.3b Pre-reform and post-reform total remaining child care costs in SEK 000s and the number of child births per 1,000 women (during an 18 month spell). Households with women 34 and younger

		Sample Year	Child Care Cost	Births
All	Pre-reform	1999	205.02	176.09
			(73.16)	(273.72)
	Post-reform	2001	97.25	199.71
			(33.71)	(287.56)
Childless	Pre-reform	1999	145.73	326.87
			(44.99)	(251.74)
	Post-reform	2001	62.29	346.14
			(16.55)	(257.63)
families with children	Pre-reform	1999	211.92	158.55
			(72.69)	(270.76)
	Post-reform	2001	101.74	180.91
			(31.55)	(285.80)
1 child	Pre-reform	1999	199.41	301.77
			(67.14)	(304.81)
	Post-reform	2001	93.46	317.30
			(28.00)	(308.78)
2 children	Pre-reform	1999	221.10	71.60
			(73.62)	(194.06)
	Post-reform	2001	108.37	82.13
			(31.57)	(210.66)
More than 2 children	Pre-reform	1999	219.87	65.88
			(78.41)	(233.81)
	Post-reform	2001	110.81	76.56
			(34.31)	(254.53)
Part-time	Pre-reform	1999	208.94	139.14
			(71.37)	(328.80)
	Post-reform	2001	99.23	156.71
			(31.11)	(346.54)
Full-time	Pre-reform	1999	224.63	170.156
			(73.91)	(351.14)
	Post-reform	2001	104.18	190.40
			(30.98)	(366.53)

Note: Average values. Standard deviations in parenthesis

Table A.3c Pre-reform and post-reform total remaining child care costs in SEK 000s and the number of child births per 1,000 women (during an 18 month spell). Households with women 35 and older

		Sample Year	Child Care Cost	Births
All	Pre-reform	1999	187.91	21.09
			(68.13)	(112.40)
	Post-reform	2001	83.86	25.52
			(28.54)	(123.34)
Childless		1999	149.66	35.65
	Pre-reform		(47.23)	(109.46)
	Post-reform	2001	62.86	49.69
			(15.99)	(136.09)
Families with children	Pre-reform	1999	190.22	20.20
			(68.50)	(112.51)
	Post-reform	2001	85.00	24.20
			(28.63)	(122.47)
1 child	Pre-reform	1999	188.05	33.12
			(60.94)	(139.27)
	Post-reform	2001	83.00	40.12
			(22.48)	(153.28)
2 children	Pre-reform	1999	223.46	23.27
			(72.63)	(123.20)
	Post-reform	2001	103.84	27.34
			(28.79)	(131.55)
More than 2 children	Pre-reform	1999	240.02	30.68
			(84.48)	(165.68)
	Post-reform	2001	117.61	32.85
			(34.83)	(173.01)
Part-time	Pre-reform	1999	197.23	19.81
			(72.22)	(133.72)
	Post-reform	2001	88.26	22.58
			(29.39)	(142.80)
Full-time	Pre-reform	1999	209.55	24.01
			(72.20)	(143.74)
	Post-reform	2001	92.43	29.99
			(28.37)	(160.71)

Note: Average values. Standard deviations in parenthesis