Cheaper childcare, more children *

By

Eva Mörk[a], Anna Sjögren[b] and Helena Svaleryd[c]

October 2009

Abstract

We study the effect of childcare costs on the fertility behavior of Swedish women and find that reductions in childcare charges influence fertility decisions, even when costs are initially highly subsidized. Exploiting the exogenous variation in childcare costs caused by a Swedish childcare reform in 2002, we are able to identify the causal effect of childcare costs on fertility in a context in which childcare enrollment is almost universal and the labor force participation of mothers is very high. We also provide some evidence suggesting that long-run fertility rates are affected.

Keywords: Child Care, Cost of children, Fertility, Quasi-experiment, Difference-in-differences

JEL-codes: H31, J13

* We are grateful for comments by Matz Dahlberg, Peter Fredriksson, Christian Holzner, 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, SOLE 2009, the ELE Summer Institute, Bergen 2009, the Econometric Society's 2009 North American Summer Meeting in Boston, the 2009 NBER Summer Institute and the 2009 IIPF Congress in Cape Town.
[a] IFAU, IZA, IEB, UCFS and Department of Economics, Uppsala University, PO Box 513, SE-751 20 Uppsala, Sweden.
[b] IFAU and IFN, PO Box 513, SE-751 20 Uppsala, Sweden.
[c] IFN, Box 55665, SE-102 15 Stockholm, Sweden.

1 Introduction

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

We aim to establish if, and how, childcare costs affect fertility. To this end, we use the quasi-experiment initiated by the Swedish Child Care Reform in 2001. This reform standardized the fee schedules across Swedish municipalities and imposed a cap on childcare charges. Consequently, households with similar 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, conditional on household characteristics, the reform introduced exogenous variation in childcare costs.

We estimate that the reform, which induced an average reduction of just over 50 per cent (a reduction of SEK 107,000 or USD 17,800) in total childcare costs per household or a slightly larger percentage reduction in average cost per child, increased fertility during an 18-month period by 3-5 births per 1000 women, or by about 4–6 per cent. This implies an elasticity of fertility to childcare costs of about 0.1. If we relate these figures to estimations of the cost of a child from age 0-18 (around SEK 800 thousand[1]), the reform implies a reduction of about SEK 60 thousand, or 7.5 per cent, in the average cost of a child. The elasticity of fertility to the average cost of a child would then be 0.7.

Theoretical models of fertility and maternal labor supply (e.g., Ermisch, 1989a, b; Apps and Rees, 2004) predict that reductions in childcare costs may affect both the fertility and the labor supply of mothers. By increasing mothers' take-home wages, lower childcare costs make it more attractive to enter the labor market or to work longer hours. However, for working mothers, lower childcare costs imply a direct reduction in the cost of having children, which in turn should increase the demand for children. Hence, the effects of childcare costs on fertility are likely to depend on women's labor supply decisions. A study by Lundin et al. (2008) of this particular reform's influence on the labor supply of mothers find no effects suggesting that fertility may be the margin of adjustment.[2]

Previous micro studies have found mixed support for the hypothesis that lower childcare charges increase fertility. Using American survey data, Blau and Robins (1989) conclude that higher childcare costs decreased the birth rates of unemployed women but had 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 childcare. These studies, however, suffer from endogeneity problems. Both the availability of childcare and the charges actually paid by families vary according to local governments' response to demand or families' individual choices about the quality and quantity of care.

In a more recent study, Schlosser (2006) examines the introduction of free public pre-school for children aged 3 and 4 in Israel to estimate the effects of a reduction in childcare costs on Arab mothers' labor supply and fertility. She finds no effect on fertility but a positive effect on labor supply. Schlosser uses quasi-experimental data and is therefore more likely to capture

[1] A figure produced by banks and discussed in the popular media (see e.g., Dagens Industri, 2006).

[2] Note that even though maternal labor force participation is high in Sweden, many mothers with small children work part-time, so that there was the potential for an increased labor supply. The argument that there are no labor supply effects is strengthened by Wikström (2007), who shows that hours of care for children already enrolled increased only marginally as a result of the reform.

causal effects rather than correlations. However, the context she studies is specific: fertility was initially high, while maternal labor supply was very low. In such a situation, we would hardly expect to see further increases in fertility.

Two recent studies on US data examine the effects on labor supply and fertility using changes in household service sector wages caused by low-wage immigration. Cortes and Tessada (2009) find positive effects on the labor supply of women, and especially on highly educated mothers who worked longer hours. Furtado and Hock (2008) show that lower wages in the childcare sector resulted in higher fertility for these highly educated women.[3]

The US context is similar to that studied here: most Swedish women work, have children and use childcare. However, important differences exist, in particular regarding which groups were affected by the studied price changes. While low-skill immigration primarily lowered the price of flexible nanny services, making it easier for high-earning women to combine career and family, the present study examines changes in the cost of publicly subsidized childcare during regular work hours, which is used by the majority of Swedish families. In 2004, the attendance rate for children aged 3–6 was 90 percent.

Hence, an important advantage of the present study is that we can estimate the effect of cost changes on a majority of households as opposed to reviewing only on a small part of the population—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 childcare reform studied in this paper affected most families, we are able to investigate the presence of heterogeneous responses to changes in childcare cost.

[3] A related study investigates the impact of other financial incentives, such as child allowances and tax incentives, on fertility decisions (see e.g., Cohen et al, 2009, Kearney, 2004, Laroque and Salanié, 2004 and Milligan, 2005).

We find that younger women (34 or younger) are more likely to respond to changes in cost. For this group, we also find strong effects on first births, while we find significant effects on third births for both younger and older women. In light of the prevalent two-child norm in Sweden, the effect on third births suggests that the reform also had an effect on completed fertility rates instead of exclusively reducing spacing between children. We also find that the largest impact on fertility is found for part-time working women. This may explain why Lundin et al (2008) did not find any effects on the labor supply; this group of women decided to have more children instead.

Before we present the data, discuss our identification strategy in some detail, and arrive at estimation results, we provide background information on Swedish childcare institutions and the design of the childcare reform of 2002. We also describe recent developments regarding birth rates for Swedish women.

2 Institutional background

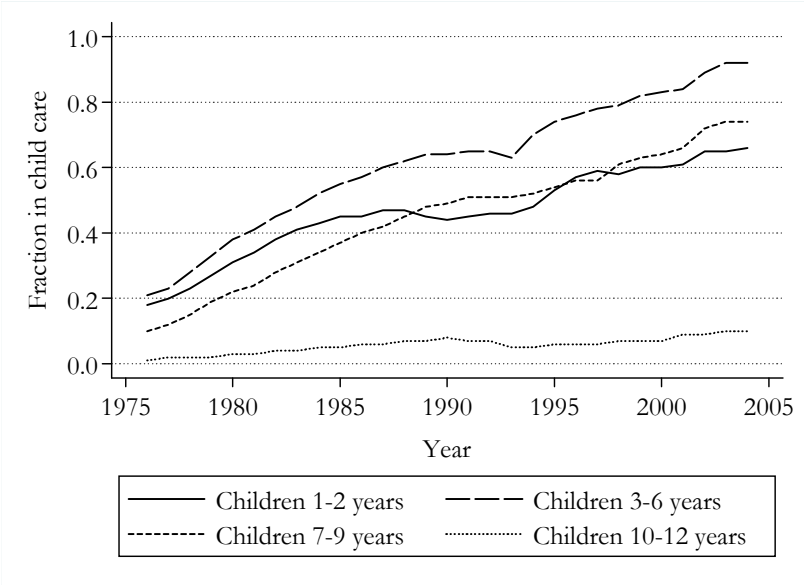
2.1 Childcare in Sweden

Sweden has a long tradition of publicly subsidized childcare for pre-school children and after-school care for young school-age children. Figure 1 shows the proportions of children attending some form of publicly subsidized childcare over time, by age. Enrollment rates have increased dramatically, and in 2004, 90 percent of all children in the 3–6 age group attended childcare.[4] The enrollment rate is also high for very young children (aged 1–2). One explanation for these

[4] Publicly subsidized childcare comes in different forms, the most common being center-based care. Different forms of family daycare—e.g., care provided in a publicly-paid caretaker's home or in the child's home—also exist, although to a rather small extent (in 2001, only 5 percent of all enrolled children had this type of care). Although the financing of childcare is public, care providers can be public, cooperative or private. Until the early 1990s, childcare was almost exclusively publicly provided; since then, a growing proportion of

high enrollment rates is that the local governments in Sweden are obliged by law to provide low-cost, high-quality childcare for children aged 1–12 whose parents either work or are full-time students; care is to be arranged within three to four months of the parents' request.[5] Subsidized childcare for infants is, however, restricted to families and children with special needs, and hence, enrollment for infants is negligible.[6]

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



Source: National Board of Education (Skolverket)

Daycare centers offer services during regular work hours. Enrolled children spend on average 32 hours per week at daycare. Although mothers who work full-time have their children in

municipalities have introduced voucher systems, paving the way for the private provision of services. These private child care centers still have to follow the nationally set curriculum.

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

[6] Infants are instead cared for by their parents. Parents are entitled to a year's paid parental leave with an income replacement rate of 80 per cent up to a cap.

daycare for longer hours than mothers working half-time (34 vs. 21 hours per week in 2005), very few children, even those with both parents working full-time, attend daycare more than 40 hours per week.[7] Anecdotal evidence also suggests that strong social norms regulate what parents view as adequate staying time. It is therefore interesting to note that attendance times did not change during the period of study (Skolverket, 2007), although childcare became cheaper.

Until 2002, the municipalities were free to set their own childcare 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 childcare activity that the child would benefit from". This definition clearly left room for different interpretations, and consequently, childcare fee schedules differed considerably between municipalities with respect to both levels and construction. In particular, charges varied with family income and the age and number of the children. Some municipalities applied a flat charge per child, but most municipalities used elaborate fee schedules such that families with high incomes and few children, all young, paid the highest charges per child. However, childcare was heavily subsidized in all municipalities, and only about 15–20 percent of the municipalities' childcare costs were covered by user charges.

Quality of daycare, both before and after the reform, has remained relatively homogenous both within and across municipalities. In particular, there is no reason to expect wealthier families have access to higher-quality daycare either within a particular municipality or between municipalities. For example, the correlation between the average child/teacher ratio and the average income across municipalities in 1999 was -0.0—i.e., almost zero. A reason for this absence of relationship is that childcare subsidies are financed through the municipal budget along with several other municipal responsibilities such as care for the elderly, education and

[7] The father's worktime has a much smaller impact on attendance time. Men are also much less likely to work

social welfare.[8] Moreover, user fees are strictly regulated, and hence, childcare services can only be adapted to meet parental preferences for quality within a given budget. There is therefore no connection between fees paid by a particular parent and the quality of the daycare center that the child attends.

2.2 The childcare reform

In the last months of the election campaign before the 1998 elections, the incumbent (Social Democratic) party proposed a large childcare reform designed to reduce user fees and further increase the accessibility of childcare.[9] Although the Social Democrats won the election, the reform bill was not passed by parliament until three years into the election term, in November 2000. The motivation for the reform was i) to give all children equal access to early education ii) to improve economic conditions for families with young children, and iii) to promote parental labor force participation.

The reform was implemented gradually and consisted of several parts. The most important component, and the one studied here, was an option for municipalities to impose a cap (set by the central government) on user fees for childcare beginning in January 2002.[10] 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. The decision to adopt the capped fee schedule was in most cases made in the fall of 2001. Hence, it was not until

---

part-time (Skolverket, 2007).

[8] Differences in income due to differences in the tax base are in principal equalized across municipalities.

[9] Elinder, et al. (2008) analyze the reform's impact on voter behavior and find that families with young children increased their propensity to vote for the incumbent government.

[10] The reform also introduced a right for children whose parents were unemployed or on parental leave to attend childcare for a minimum of 15 hours per week.

then that families knew whether they would enjoy lower childcare costs. We will return to this issue when we define households as treated or not.

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. The rate varies with the age and birth order of the children, such that care for younger children and children with few siblings in childcare costs more.[11] Secondly, per-child fees are capped and are thus constant beyond a monthly income ceiling, which was SEK 38,000 (6,430 USD) in 2002. The maximum amount paid by any household was SEK 2,280 (385 USD) per household and per month in 2002.

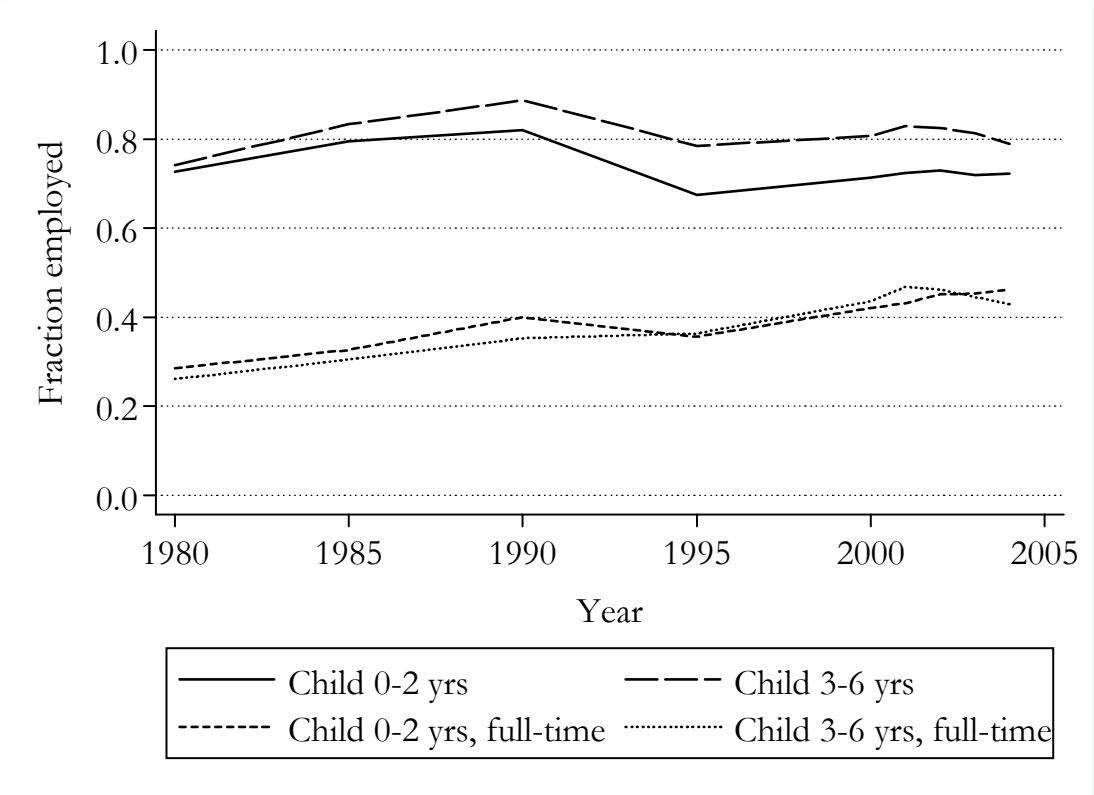
Prior to the reform, there was substantial variation in childcare fees across household types and municipalities. Since the reform, comparable households have faced similar childcare charges regardless of where they lived. Overall, childcare became cheaper as a result of the reform. In 1999, the median middle-income family with two adults and two children in pre-school paid SEK 2,660 (380 USD) per month, and childcare charges ranged from SEK 1,560 (260 USD) to 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) on average for the care of their two children, and charges ranged between SEK 1,040 (175 USD) and SEK 1,900 (320 USD) (Skolverket, 2003). Hence, there was also some variation after the reform because municipalities were allowed to charge lower fees than indicated in the national schedule.

[11] The percentage rate for the first child in preschool is 3 percent; the rate is 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 anything for child number four or for any children thereafter. 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.

2.3 Fertility and maternal labor supply in Sweden

From a European perspective, the labor force participation of Swedish women is high; it is about 88 percent of the male participation rate. Women are, however, more likely to work part-time than are men. Part-time work is especially prominent among women with small children. One reason is that parents with small children have a legal right to work shorter hours (75 percent of full-time or less). As is shown in Figure 2, about 80 percent of women with small children are employed, and half of them work part-time. A closer examination of the work hours of women with small children shows that there are peaks at 100 and 75 percent, respectively (Oecd, 2005).

Figure 2 Fraction of women employed and working full-time for different ages of youngest child.



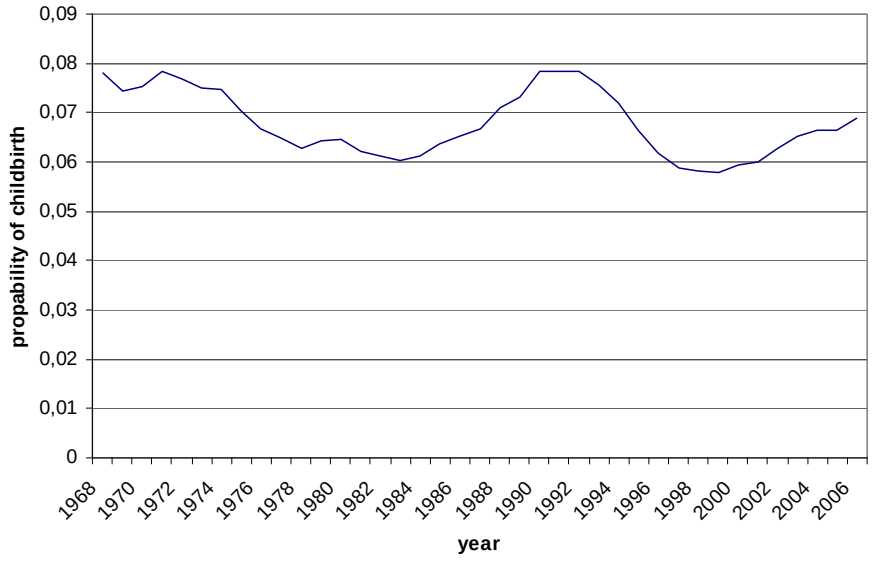
Source: OECD (2005)

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[12] of Swedish women have, however, fluctuated substantially over time. Figure 3 shows the average number of children born per woman aged 20–45 in Sweden over the period 1968–2006. The figure demonstrates 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.

Figure 3 The average number of children born per woman aged 20–45 in Sweden during the period 1968–2006.



Source: Statistics Sweden

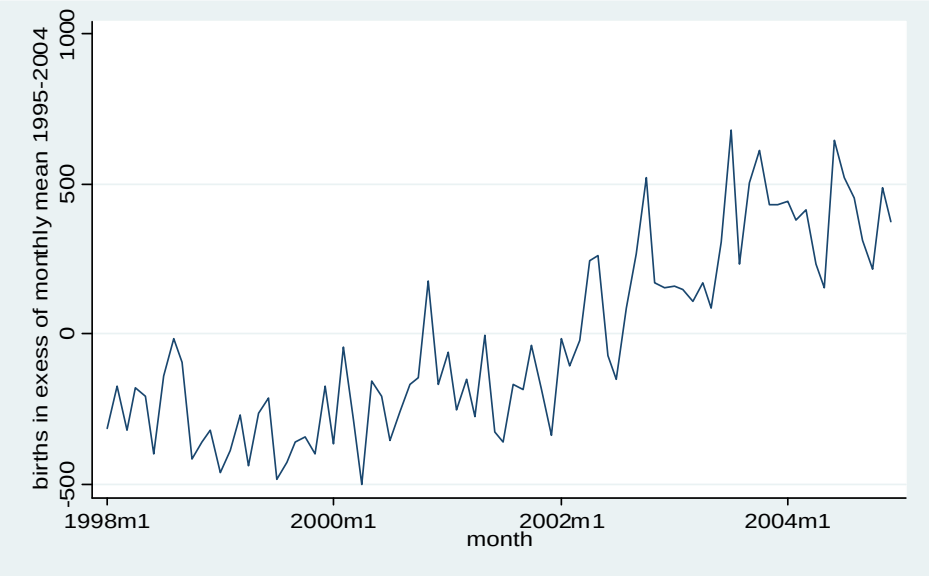
[12] Total fertility in a given year shows how many children a hypothetical woman would have in her lifetime if she had as many children at each age as women of a given age in that particular year.

The fluctuations in total fertility largely mirror the development of the labor market with a lag of a few years, 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, which requires parents to qualify for income-related benefits by working prior to pregnancy and birth. The qualifying rules provide a strong incentive for women to postpone having children until they are established in the labor market (Björklund, 2006).[13]

Interestingly, these aggregate numbers show a slight increase in the number of children born after the Swedish childcare reform. Taking a closer look at the monthly number of births for the years around the reform, we see that the raw numbers do suggest that the increase in the birth rate is rather well timed in relation to the reform. Figure 4 shows the number of births in excess of the monthly average for the 1995–2004 time period by month from January 1998 through December 2004. The figure suggests that there is a take-off in births in spring of 2002. However, given the magnitude of the long-run cyclical fluctuations in fertility, we cannot readily interpret this increase as a causal effect of decreased childcare 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 reform. In the next section, we discuss the empirical methodology in detail and present the data used to establish this link.

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

Figure 4 The monthly birth rate 1998–2004.



Source: Statistics Sweden.

3 Methodology and data

3.1 Econometric challenge

The problem that arises when one estimates the effect of childcare costs on fertility is that observed childcare costs for a given household are typically determined by household characteristics that are also likely to directly influence fertility decisions. If the Swedish childcare reform had implied that changes in childcare 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 order to achieve unbiased estimates indicating the causal effect of childcare costs on fertility, we therefore need to hold constant all household characteristics that determine both childcare charges and fertility decisions, and thus only to identify the effect of childcare costs through the exogenous change in childcare charges.

A survey of childcare fees conducted by IFAU (for details, see Section 3.2) shows that fee schedules, both before and after the reform, are fully determined by a subset of observable household characteristics. We denote this subset by Z[14] and define J household types as households sharing the same characteristics Z_j where $j \in \{1,J\}$, so that in a given municipality *m* at a given period in time, *t*, all households of type *j* have identical childcare costs. In other words, for households of type *j*, the household's childcare costs are a function $P_{mt}(Z_j)$. It follows that any variation in childcare costs within household type *j* in a given municipality is a result of changes in the fee schedule *P* over time. All possible direct effects of Z_j on fertility can be accounted for by including a fixed effect for each municipality-household type Z_{jm}. More formally, we estimate the following relationship:

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

where $Child_{ijmt}$ is the probability that the woman in household *i* of type *j*, in municipality *m* and in period *t*, bears a child, and where τ_t is a time-fixed effect controlling for a common time variation in fertility. Including controls for household characteristics that influence fertility but do not influence childcare 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 women in households of a particular type in a particular municipality bear children during a time window of a given length

[14] The variables that determine childcare 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

prior to the reform to the probability that women in household of that same type in the same municipality have children in a time window of the same length after the reform. The changes in fertility behavior are then related to the changes in childcare costs induced by the reform for the same household type across different municipalities and for other types of households in the same municipality. This strategy produces a difference-in-differences estimator, where households are matched and compared 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 for each household type j.

One issue of concern is whether the effects of the childcare reform can be isolated from different trends in fertility. Households with certain characteristics or households in some municipalities may be exhibiting specific trends that are unrelated to the reform. This may be due to underlying trends or unobserved changes in general policy or local reforms.

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

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

A further issue of concern is whether the childcare reform also had effects on the quality of the care provided and/or whether 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

household's exact childcare fee both before and after the reform, on the assumption that all children of childcare-eligible age are enrolled in full-time childcare. We will return to this issue in Section 3.4.

regards the provision of care services, the reform is not likely to have had any major impact on access to childcare because municipalities had been obliged by law to provide a child with childcare within 3 months of parental demand as early as 1993. This obligation did not change. The reform, however, implied guaranteed access to childcare for a minimum of 15 hours per week for the children of unemployed persons and parents on parental leave caring for new siblings of their older children. These are the reason for the increase in enrollment seen in Figure 1 above. However, the number of enrolled children per childcare employee, as well as the share of childcare 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.[15] Hence, there is e no evidence that the reform implied lower-quality childcare.

Our identification strategy assumes that the reform induces cost changes for each household-municipality type that were exogenous and did not depend on other characteristics affecting fertility decisions and fees. It is therefore problematic if families that were insensitive to the cost of childcare were more likely to reside in municipalities with high fees prior to the reform. In this case, the households receiving the largest reductions would be the least responsive to changes in childcare costs. Such a selection problem might lead us to underestimate the impact of the reform on fertility and might bias our results against finding any effects. A related concern is that the reform may have encouraged families planning more children to move to locations where they would receive large fee cuts. We therefore determine household childcare fees and register fertility in the municipality of residence just prior to the reform. As a result, we are if anything likely to underestimate the magnitude of the effects.

[15] See Table A1 in the Appendix for some summary statistics.

3.2 Data

We use data from two sources. Information on fee schedules comes from a survey of municipal childcare charge tariffs conducted by IFAU.[16] Information on household characteristics and fertility comes from register data from Statistics Sweden.

We sample all couples in which the woman was 20–45 years old in the period 1997–2002. Because Swedish register data does not code cohabiting couples without common children as household units, our sample excludes unmarried women without children, single mothers, and cohabiting unmarried mothers whose partners are not the fathers of their children. For these women, we are unable to obtain a correct measure of household income because we cannot identify the potential father.[17] As a result, our analysis of first births is restricted to married couples. This is unfortunate because a high fraction of Swedish first-borns, more than two thirds, are born out of wedlock (www.SCB.se). The results we present for childless women are therefore not representative of the population of childless women because 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 childcare fees than unmarried couples.

For the households in our sample, we obtain register-based information on the woman's age and education, the annual income for the woman and her partner, and 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 or post-reform periods.

[16] IFAU collected childcare fee data via an email request sent to all Swedish municipalities asking for exact formulas used to calculate prices in 2001–04. Information about the exact fee structure from 220 of Sweden's 290 municipalities was received. Comparing the pre-reform childcare 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 the costs are very similar, which implies that we need not worry about selection based on a specific type of municipality.

3.3. Who was affected by the reform?

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

Our data allow us to construct two analogous pre-reform samples for comparison with the post-reform sample. In principle, we could extend the analysis further back in time, but the data on the pre-reform fee schedules are limited to the period just before the reform. Hence, extending back in time would increase problems with measurement errors in fees. In order to estimate equation (1) above, we would in principle only need one post-reform period. However, in order to credibly estimate equation (2), where we allow for household type-specific and municipality-specific trends, we need at least two pre-reform periods. Also, using two pre-periods enables us to run a placebo experiment testing the exogeneity of the reform.

The first pre-reform sample consists of women who met the sampling criteria in 1997 and their births in the period from July 1998 through December 1999. The second pre-reform sample consists of women who met the sampling criteria in 1999 and measures births in July 2000

[17] We have tried to impute household income for these unmarried childless women using predictions from the sample for which we observe both parents. Because we were unable to replicate our results for the married women using predicted household income, we judge that the results for unmarried childless women as too speculative and uncertain.

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 through of as being potentially affected by the reform.

3.3 Computing childcare costs and birth rates

Because childcare charges depend on a limited number of observable household characteristics, we can compute the households' exact childcare costs. We compute two measures of childcare costs. First we compute a measure of the present value of total remaining cost of childcare, assuming that the household's children plus an additional child, born 9 months ahead and enrolled at age one, are enrolled in full-time care[19] until each child reaches the age of ten (*Total cost*). The second measure captures the present value of costs for the additional child alone (*Marginal cost*).[20] Note that for couples without children, these two cost measures are the same, but that for families with children, they differ.

It is not clear to which of these measures families with children actually react. A change in the total cost measure is made up of two components: a change in the marginal cost of an additional child (a price effect) and a change in the cost of placing the children already born in childcare (an income effect). In his seminal work on fertility, Becker (1960) argued that fertility ought to react to the marginal cost of children and indicated why children might be normal goods even though the number of children does necessarily increase in wealth. More recently, Liebeman and Zeckhauser (2004) have presented arguments for why people may actually react

[18] This assumption will be tested in the empirical analysis.
[19] Hence, for the post-reform sample, we calculate the cost of childcare for all children plus one additional child from 2002 until the children reach the age of ten and use a corresponding technique for the pre-reform samples.
[20] Note that we do not observe whether children attend childcare or for how many hours they do so. The cost measure we calculate is based on the assumption that everyone attends childcare and after-school care full-time. We have further assumed that the families discount future costs exponentially with the discount rate 0.05. Within reasonable limits, the results are not sensitive to the choice of discount factor.

to average costs changes (or total costs) rather than to marginal cost changes. The explanation put forth is that marginal cost changes are often hard to observe and disentangle when price schedules are complicated and non-linear, as is indeed the case with childcare costs in Sweden.

The Swedish childcare fee reform changed both the total and the marginal cost simultaneously. We should expect the reform to have had both income and price effects on fertility. However, for any given household, there is only one source of exogenous variation, and the changes in the two cost-measures are negatively correlated. We are thus unable to disentangle a true price effect from an income effect in a meaningful way.

Column (1) and (2) of Table 1 presents the present value of the remaining childcare costs for the pre- and post-reform samples. When computing pre-reform costs, we apply the pre-reform fee schedules indicated in the survey responses[21]. 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 samples of households, one sees that the costs of childcare decreased dramatically due to the reform. On average, the net present value of remaining childcare costs decreased by more than 50 percent. The drop in the standard deviation of childcare costs also shows that the variation in fees across households decreased radically when the reformed national fee schedule replaced local fee schedules.

[21] 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 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 childcare costs for all children in SEK 000s and the number of childbirths per 1,000 women (during an 18-month spell).

	Observation periods	Total cost	Marginal cost	Births
Pre-reform	1998–	187.75	110.80	81.40
		(69.32)	(54.24)	(273.45)
	2000–	194.98	118.57	85.13
		(70.79)	(54.03)	(279.08)
Post-reform	2002–	89.22	54.08	95.19
		(31.00)	(18.11)	(293.48)

Note: Average values. Standard deviations in parenthesis

The last column in Table 1 reports the average number of births per 1,000 women during 18-month time windows before and after the reform for the sampled households. Ignoring twin births and very closely spaced siblings[22], we count a birth if the woman bears at least one child during the defined 18-month period and assign a value of zero otherwise. A comparison of the number of births for the 1998, 2000 and 2002 samples shows an increase over time, with a sharper increase after the reform.

The capping of childcare charges implied that the largest cost cuts occurred for households that initially had high childcare costs. In order to encourage a better understanding of which type of households experienced the largest cost reductions, Table 2 shows changes in remaining childcare costs at different parity and household income levels. Note that the largest cost changes occurred for well-off families that already had two children, while low-income households without children received a much smaller reduction in childcare cost. Although the

within-family variation in childcare cost changes was smaller for families with low incomes or few children, Table 2 also illustrates that the reform introduced substantial variations in costs for households with similar incomes and the same number of children.

Table 2 Change in present value of remaining childcare cost (*total cost*) 2000-2002 for a household experiencing the birth of 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

3.4 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 childcare fees and fertility but that experience different changes in childcare costs because they live in different municipalities. To achieve such a comparison, we need a) to define household types based on income, the number of children and the age of the children; and b) to observe each household type in at least two municipalities, both before and after the reform. In defining household types, we therefore face a

[22] Very few women have two births within the 18-month spell. Less than one in 100 women giving birth during

trade-off. The more narrowly we define household types, the more precisely is our measure of childcare costs, the smaller is the within-household variance in characteristics that determine childcare charges and, hence, the more truly random is the within-household variation in childcare costs. The drawback of defining household types too narrowly is that we are less likely find matches over time for the same household type in at least two municipalities. Hence, the more precise are our household types, the less representative is the sample used for estimation.

This problem is fruitfully illustrated by the example of 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 attempting to match the exact age of each child, a similar problem arises. Instead, we choose to define household types by the 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 because only a few municipalities before the reform (and none after) charged fees for the fifth child or any thereafter. The age categories are defined in line with the typical age categories determining childcare 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 was 393,670. Of these, 56 percent or 110,712 (221424/2) municipality-household types are present during 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

a spell had two consecutive births.

households included in the estimations is 78 percent, which is much larger than the fraction of municipality-household types 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 that of the previous period, 55 percent; this accounts for 77 percent of all households in the sample. (See Appendix A4 for descriptive statistics for both the full and matched 1999 and 2001 samples.)

Table 3 Descriptive matching statistics

	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%

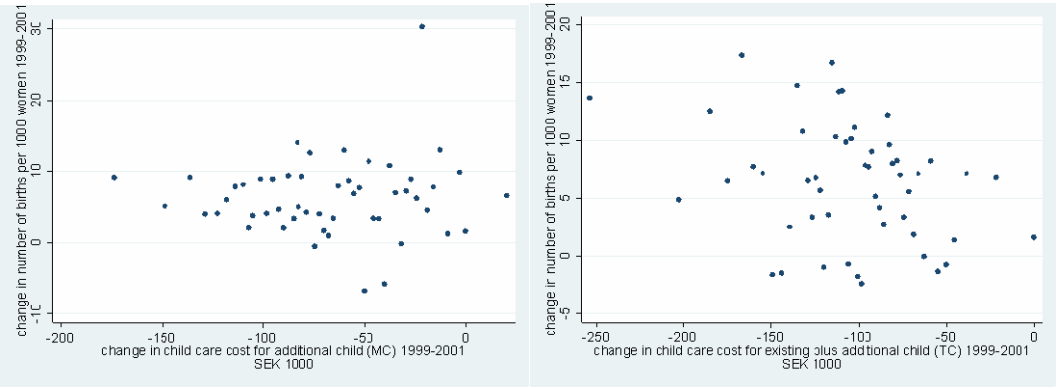
3.6 Graphical analysis

Before turning to econometric estimations, we present a graphical analysis to provide an initial indication of whether reduced childcare costs have affected birth rates. Figure 2 relates the changes in childcare costs to changes in birth rates between the 2000 sample and the 2002 sample.[23] The first panel shows that there is no evident relation between the change in childcare cost for an additional child and changes in birth rates. In panel two, the cost change measure also includes changes in childcare costs for already existing children. Although this is a noisy

[23] We have computed averages, grouping households by their percentile position in the distribution of reform-induced childcare cost reductions.

relationship, there is evidence of a negative correlation between childcare cost reductions and increases in fertility.

Figure 2 Change in births per 1,000 women by magnitude of cost reductions.



4 Results: Effects of childcare costs on fertility

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

4.1 Baseline estimates

We start by estimating the difference-in-differences specification given by equation (1) using one pre- and one post-reform period. [24] Initially, we focus on the effect of changes in the total remaining childcare costs for current children plus an additional child. The resulting estimate, presented in column (1) in Table 4, shows a negative effect of total childcare costs on fertility of

[24] Due restrictions in computational capacity, we estimate the model in first differences netting out the fixed effects. 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: $\Delta Child_{jm}= \alpha + \beta(P_{mt}(Z_j) - (P_{mt-1}(Z_j)) + Z_j + m_m + \varepsilon_{jm.}$ Estimating on first differences entails a cost in terms of efficiency.

-0.034, suggesting that an increase in total childcare costs of SEK 1,000 causes a decrease in the number of births by 0.034 children per 1,000 women. In column (2), we include 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 to increase somewhat in magnitude to 0.049. Because childcare 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 childcare costs is sensitive to including a control for age but not to controlling for education.[25] We further explore the presence of heterogeneous effects by age in Section 4.3.

A causal interpretation of the estimate presented in column one rests on the assumption that pre-reform trends in fertility at the household type and municipal level were uncorrelated with the price changes caused by the reform. In order to verify this, we include a second pre-reform period, which allows us to explicitly account for differential pre-reform trends in fertility among households in the same municipality and among households of the same type. Column (3) re-estimates the model from column (2) using three periods instead of two. The parameter estimate remains close to identical when adding one additional pre-reform period, which is reassuring. In column (4), we therefore continue the analysis using three periods and controlling for different time-trends. As can be seen from the table, the parameter estimate remains negative and statistically significant but decreases somewhat in magnitude. Finally, in the last column, we allow for household type-specific trends that differ across municipalities. As a result, much of the identifying variation disappears, causing the standard errors to increase. However, even though the estimate is no longer statistically significant, the point estimate is well within the range of the earlier estimates. Our reading of column (5) is therefore that this specification is too

[25] These results are available on request.

strict, leaving too little identifying variation. This leaves the estimate in column 4 as our preferred specification.

Table 4 Total childcare costs and fertility

	Childbirths per 1,000 women				
	(1) Two periods	(2) Two periods	(3) Three periods	(4) Three periods	(5) Three periods
Total cost	-0.034**	-0.049***	-0.048***	-0.040**	-0.055
	(0.016)	(0.016)	(0.016)	(0.019)	(0.035)
Age		-11.532***	-11.242***	-11.224***	-11.427***
		(0.233)	(0.162)	(0.165)	(0.312)
University		35.703***	33.492***	33.656***	35.329***
			(1.417)	(1.440)	(2.692)
Municipal× household type FE	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes
Municipal trend	No	No	No	Yes	No
Household type trend	No	No	No	Yes	No
Municipal × household type trend	No	No	No	No	Yes
Observations (household types)	111,348	11,1348	222,060	222,060	222,060
R-squared	0.00	0.03	0.03	0.05	0.50

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

The estimated effect of total childcare costs, ranging between -0.034 and -0.049, implies that a reduction in childcare costs of SEK 100,000 increased the number of childbirths per 1,000 women during an 18-month period by 3–5 children. When this figure is 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 has increased by 4–6 percent and that the childcare reform has accounted for about 30–50 percent of the increase in fertility that took place during this period.

The cost measure used above is the sum of two components. First of all, the reform encouraged childcare costs for children already in childcare to decrease, which in turn entailed an income effect for households with pre-school-aged children. Secondly, the marginal cost for having one additional child decreased. Ideally, we would like to separate these two effects. However, our identifying variation comes from the childcare reform, which affected both measures at the same time, implying that it is not possible to separately identify both effects. Furthermore, inspection of the data shows that the two measures are negatively correlated, making matters even more complicated. However, even though we cannot estimate both the income and the price effect, it is of interest to investigate the effects on fertility of the marginal cost of childcare. Table 5 below shows the estimates from three different model specifications. Column (1) shows basic difference-in-differences-estimates using only two periods, and column (2) shows the same estimate, but when three periods are used. As can be seen from the table, the point estimates are positive and statistically significant, which is at odds with economic theory. Taking differential time-trends into account, the statistical significance disappears and the point estimate becomes very close to zero, indicating that households reacted not to the marginal cost but rather to the total cost.

Table 5 Marginal childcare costs and fertility

Childbirths per 1,000 women			
	(1)	(2)	(3)
	Two periods	Three periods	Three periods
Marginal cost	0.043***	0.041**	-0.001
	(0.017)	(0.017)	(0.021)
Age	-11.547***	-11.248***	-11.221***
	(0.233)	(0.162)	(0.165)
University	35.422***	33.353***	33.623***
	(2.053)	(1.417)	(1.440)
Municipal×household type FE	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Municipal trend	No	No	Yes
Household type trend	No	No	Yes
Obs. (household types)	111,348	222,060	222,060
R-squared	0.03	0.03	0.05

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

While families with children faced changes in the costs of childcare for their existing children as well as in the cost of care for a marginal child, families without children faced changes only in the marginal childcare cost. We re-estimate the models from Table 5 including only households without children. The estimates are presented in Table 6. As is clear from the table, childless couples react to the marginal cost of childcare, and the effect is considerably larger than the effect found in Table 4 above. An increase in marginal childcare costs with SEK 1,000 yields

approximately 0.2 fewer births per 1,000 women. The point estimate remains stable but is no longer statistically significant when controlling for a municipal and a household-type trend.[26]

Table 6 Marginal childcare costs and fertility – Households without children

Childbirths per 1,000 women			
	(1)	(2)	(3)
	Two periods	Three periods	Three periods
Marginal cost	-0.215**	-0.218**	-0.198
	(0.098)	(0.098)	(0.122)
Age	-20.489***	-20.068***	-19.977***
	(0.684)	(0.473)	(0.477)
University	52.753***	56.931***	58.374***
	(11.286)	(7.899)	(7.905)
Municipal×household type FE	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Municipal trend	No	No	Yes
Household type trend	No	No	Yes
Obs. (household types)	6,656	13,208	13,208
R-squared	0.15	0.15	0.17

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

Table 6 shows dramatic effects on first births compared to what was found in Table 4. To obtain a complete picture, we have therefore estimated a number of models for a sample of households *with* children. These results are presented in Table 7. Columns (1) and (2) show the effects of the marginal cost, and columns (3) and (4) show the effects of total costs. Comparing the first two columns of table 7 with columns (2) and (3) in Table 5, we see clearly that the results for

[26] Remember that our sample of households without children only includes married couples. It is not clear if we should have expected a larger or smaller effect had our sample of households been representative for first births.

the whole sample (all households) are driven by the effects for households with children (which make up the majority of all households in the sample). When controlling for flexible time trends, marginal costs have no effects on the fertility decisions of households with children, whereas total cost has a negative effect on fertility, although this effect is imprecisely estimated.

Table 7 Marginal and total childcare costs and fertility – Households with children

Childbirths per 1,000 women				
	(1) Three periods	(2) Three periods	(3) Three periods	(4) Three periods
Marginal cost	0.056***	0.003		
	(0.020)	(0.027)		
Total cost			-0.045**	-0.039
			(0.019)	(0.024)
Age	-9.648***	-9.647***	-9.641***	-9.650***
	(0.178)	(0.181)	(0.178)	(0.181)
University	29.784***	30.137***	29.914***	30.169***
	(1.566)	(1.593)	(1.566)	(1.593)
Municipal×household type FE	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Municipal trend	No	Yes	No	Yes
Household type trend	No	Yes	No	Yes
Obs. (household types)	187,834	187,834	187,834	187,834
R-squared	0.02	0.04	0.02	0.04

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

4.2 Placebo results

As a further robustness check, we examine whether the reform was exogenous to changes in fertility behavior prior to the reform. This involves testing whether households anticipated the reform and reacted early, or whether household types that experienced large reductions in childcare costs were already exhibiting a decreasing trend in fertility before the reform. We perform a placebo test in which we predate the reform to 2000 and attempt to explain changes in the fertility behavior of household types for the 1997 and 1999 samples considering the changes in the childcare charges that took place in 2002—i.e., the period after. We compute each household's childcare cost from the year 2000 onward using the post-reform fee schedule, and we compare the fertility behavior of the 1997 and 1999 samples. Because we only have two pre-reform samples, we are only able to estimate the basic difference-in-differences-specification corresponding to column (2) in Table 4. We estimate the model for the full sample households and for childless couples and families with children separately.

Our identification strategy rests on the assumption that the reform-induced childcare costs had no impact on fertility changes prior to the reform. Hence, significant estimates would indicate that the analysis suffers from identification problems and that the estimated coefficients so far are picking up something other than a causal effect of childcare costs. Table 8 shows that the changes in childcare charges introduced in 2002 cannot explain pre-reform fertility behavior. The coefficients for childcare cost are small and not statistically significant in either specification. The coefficients of woman's age and education are reassuringly similar in the placebo specifications to what was found when estimating reform effects. This suggests that the samples used are similar and that basic relations are stable.

Table 8 Placebo-test

Childbirths per 1,000 women			
	(1)	(2)	(3)
	All households	Households without children	Households with children
	Two periods	Two periods	Two periods
Total cost	0.009	-0.010	0.017
	(0.015)	(0.095)	(0.019)
Age	-10.940***	-19.658***	-9.289***
	(0.225)	(0.656)	(0.245)
University	31.186***	60.986***	26.695***
	(1.953)	(11.063)	(2.138)
Municipal×household type FE	Yes	Yes	Yes
Year effects	Yes	Yes	Yes
Municipal trend	No	No	No
Household type trend	No	No	No
Obs. (household types)	110,712	6,552	93,868
R-squared	0.03	0.16	0.02

Note: Robust standard errors in parenthesis. * indicates significance at the 10%-level, ** at the 5% level and *** at the 1% level. Household types are defined as in Table 8.

We can conclude that the reduction in childcare charges had an overall positive effect on fertility and that the lack of significant results in the placebo regressions strengthens the interpretation that the effect is causal. The instability of estimates to controls and the different effects on first births compared to effects on families with children suggest that the effects were not homogenous. In the following sections, we investigate this issue further. Toward this end, we focus on total childcare costs (for childless couples, this is the same as marginal costs) and only estimate the specification allowing for municipality-specific and household type-specific time trends.

4.3 Women's age

The instability of the baseline estimates in Table 4 to the inclusion of the average age of the women in the household type × municipal cell suggested the presence of heterogeneous responses to the childcare 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. 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 households for which we no longer find matches.[27] However, we still find matches for almost 70 percent of households. Table 9 displays the results of the analysis of a sample matched at the age × household type × municipal level. It is the young women who respond to the changes in childcare costs. However, the results are noisy, and the young-old difference is not statistically significant. For women aged 34 or younger, a cost reduction of 1,000 SEK leads to approximately 0.05 fewer births per 1,000 women—i.e., an increase of 2.8 percent.

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

Table 9 Heterogeneous effects with respect to women's age

	Childbirths per 1,000 women
Total cost	
Young women (<35)	-0.046*
	(0.026)
Older women (>35)	-0.010
	(0.021)
Municipal-household type FE	Yes
Year effects	Yes
Household characteristics	Yes
Municipal trend	Yes
Household type trend	Yes
Obs. (household types)	227,161
R-squared	0.04

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

4.4 The number of children

Next, we investigate whether the effects differ based on parity. We are particularly interested in effects on higher-parity births because fertility increases beyond the two-child norm would be suggestive of effects on completed fertility as well.

Table 7 presents the results of estimating our model, including interaction terms for childcare costs with dummy variables that capture parity.[28] The first column shows that the strongest fertility effect of childcare costs is found for households with two or more children. In the second column, we interact the effects of parity with age. In line with previous results, we find

the largest effects among younger women. There is a large effect on young women in households with no previous children; this difference between young and old women is also statistically significant. The effect on fertility at higher parity is statistically significant for households with both young and old mothers. The estimates suggest that a 100,000 SEK decrease in childcare charges increased fertility by 5 percent for young women with no children, by 7.2 percent for young women with at least two previous children, and by as much as 14.8 percent for older women with at least two previous children.

[28] The fixed effect of having a household with no children is included in the household-type fixed effect because the number of children is one of the variables defining the household type.

Table 7 Heterogeneous effects with respect to family size and age – childless couples and families with children at daycare-age

		Childbirths per 1,000 women 1997–2001	
		(1)	(2)
Total cost			
All women	Childless	-0.030	
	couples	(0.025)	
	One child	-0.024	
		(0.026)	
	Two or more children	-0.049***	
		(0.019)	
Young	Childless		-0.168**
women	couples		(0.085)
(<35)	One child		-0.021
			(0.043)
	Two or more children		-0.051**
			(0.025)
Old women	Childless		-0.013
(>35)	couples		(0.023)
	One child		0.004
			(0.024)
	Two or more children		-0.037*
			(0.021)
Municipal×household type FE		Yes	Yes
Year effects		Yes	Yes
Household variables		Yes	Yes
Municipal trend		Yes	Yes
Household type trend		Yes	Yes
Observations (household types)		222,060	227,161
R-squared		0.05	0.04

Note: Robust standard errors in parenthesis. * indicate significance on the 10%-level, ** on the 5% level and *** on the 1% level. Household types are defined by the number of children under the age of 10, the exact age of the youngest child, the age category (ages 0–3, 4–5, 6–9) of the next three youngest children, a household monthly income span of 1,000 SEK in column (1) and women as older or younger than 35 in column (2). Household characteristics include average age and the fraction of women with a university degree in the household type × municipal × age cell.

Are the effects on birth rates that we have found so far the result of the 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. Because these will not be available for many years, 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. Because 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 it is possible that the reform affected long-run fertility.[29]

4.5 Women's labor supply

The theory predicts that more affordable childcare may increase the female labor supply because take-home wages will increase. This was also one of the aims of the reform. However, Lundin et al. (2008) find that the Swedish childcare reform had no effect on labor participation rates or work hours. Is it possible that this group reacted to reduced childcare costs by increasing fertility instead?

We investigate whether the response to childcare charges depends on the initial labor supply of the woman in the household. Data on work-time is available for all women working in the public sector and for a sample of women working in the private sector. Table 8 shows median work-time by parity in our sample. As expected, the median work-time decreases monotonically with parity.

[29] In this analysis, we focus on families with children of childcare age.

Table 8 Median work time by parity

	Median work-time (percent of full-time)
Childless	100
One child	85
Two children	80
Three children	75
Four or more children	70

When estimating heterogenous effects with respect to work-time, we re-define our household types by taking the work hours of the woman into account. We categorized women as working full-time if they work more than 80 percent of full-time and otherwise as working part-time. Table 9 presents the effects on fertility of changes in childcare costs for part-time and full-time working women. Column (1) suggests that part-time women were more likely to respond to cost reduction. However, the difference between the two groups is not statistically significant.

Next, we let the effect differ with respect to both work-time and parity. The largest effect is found for part-time women without children: a SEK 100,000 reduction in childcare costs increased fertility with 28 percent. For parities higher than two, fertility increased 16 percent for part-time women and 12 percent for households with a full-time working mother.

These results offer an explanation as to why there was no effect of the reform on the female labor supply. Instead of working longer hours, women working part-time choose to have more children. However, not only did women's working part-time increase fertility, but their working full-time with many children also had an effect.

Table 9 Heterogeneous effects with respect to women's labor supply

		Childbirths per 1,000 women	
		(1)	(2)
Total cost			
	Part time	-0.072**	
		(0.034)	
	Full-time	-0.018	
		(0.032)	
Part time	Childless		-0.402**
	couples		(0.161)
	One child		-0.084*
			(0.044)
	Two or more		-0.076***
	children		(0.027)
Full-time	Childless		-0.073
	couples		(0.078)
	One child		0.022
			(0.034)
	Two or more		-0.052**
	children		(0.023)
Municipal-household type FE		Yes	Yes
Year effects		Yes	Yes
Household characteristics		Yes	Yes
Municipal trend		Yes	Yes
Household type trend		Yes	Yes
Obs. (household types)		129,066	129,066
R-squared		0.08	0.06

Note: Robust standard errors in parenthesis. * indicates significance at the 10%-level, ** at the 5% level and *** at the 1% level. Household types are defined by the number of children under the age of 10, the exact age of the youngest child, the age category (ages 0–3, 4–5, 6–9) of the next three youngest children, a household monthly income span of 1,000 SEK and women's working more or less than 80 percent of full-time. Household characteristics include average age and the fraction of women with a university degree in the household type × municipal × age cell.

5. Conclusions

We have explored the effect of introducing a cap on childcare charges on the fertility behavior of Swedish families. Examining he exogenous changes in childcare costs introduced by the Swedish childcare reform of 2001, we can conclude that childcare 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 childcare cost for the average family was reduced by SEK 106,000 (USD 17,800), or that a USD 10,000 reduction in childcare costs would have led to 2–3 more childbirths per thousand women. This implies that the reform can account for as much as half of the total post-reform increase in fertility. We have, however, only investigated the first births after the reform. It is possible that some households reacted by increasing their preferred number of children by two or more, in which case we have underestimated the effect of childcare costs on fertility.

The reform cut childcare costs in half; hence, the elasticity of fertility with respect to total childcare costs is estimated to be 0.1. If we relate the average per-child cost reduction of some SEK 60 thousand to the estimates of the total cost of having a child produced by consumer organizations and banks, which total around SEK 800 thousand, our estimates suggest that the elasticity of fertility to the cost of having a child is around 0.7.[30]

One key question is whether the Swedish childcare reform led to increased completed fertility rates, or whether the reduction in the childcare charges only influenced the spacing between childbirths. We argue that there is some evidence that long-run fertility rates may have been 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. The fact that we find

[30] See DI 2006, October 30, "Ditt barn kostar en million" (Your child costs a million).

effects on women older than 34 also suggests that the reform may have increased completed fertility.

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 (2005) investigates the effects of a pro-natalist transfer policy implemented in Quebec, in 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 childcare allowances on fertility rates. Milligan finds that a cash bonus of 1,000 Canadian Dollars (USD 950) increased fertility by 16 percent. 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 childcare). In simulations, they find that increasing mothers' earnings reduces fertility but that increasing child support during the first three years, with what would correspond to a present value cash transfer of some USD 20,000, would increase fertility by a quarter. Finally, Cohen et. al. (2009) find, investigating the effects of child subsidies, that a reduction of USD 34 in monthly subsidies for a marginal child decreases fertility by 8 percent.

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

Becker, G. S (1960) "An Economic Analysis of Fertilty" in *Demographic and Economic Change in Developed Countries*, Princeton: National Bureau of Economic Research, 1960, pp. 209-231.

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 (2009), "Low-skilled immigration and the labor supply of highly educated women", manuscript University of Chicago.

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.

Dagens Industri, (2006), “Ditt barn kostar en million” (Your child costs a million). October 30, 2006.

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.

Liebeman, J. and R. Zeckhauser (2004), “Schmeduling”, manuscript Harvard university.

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.

OECD (2005), *Babies and bosses: Reconciling work and family life? Canada, Finland, Sweden and the United Kingdom*.

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.

Skolverket (2007) Barns omsorg. Tillgång och efterfrågan på barnomsorg för barn 1-12 år med olika social bakgrund. Rapport 203.

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

Wikström, 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
Marginal cost: The present value of the cost of an additional child enrolled in full-time child care until the age of 10.
Total 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 childbirths per 1,000 women (during an 18 month spell).

		Sample Year	Total 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)
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 or more children	Pre-reform	1999	223.42	49.87
			(74.90)	(175.47)
	Post-reform	2001	107.56	55.60
			(31.30)	(186.82)

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 childbirths per 1,000 women (during an 18 month spell). Households with women 34 and younger and 35 and older.

		Sample Year	Total child care cost	Births
Younger women				
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)
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 or more children	Pre-reform	1999	220.88	70.56
			(74.52)	(201.93)
	Post-reform	2001	108.80	81.15
			(32.08)	(219.00)
Older women				
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)
1 child	Pre-reform	1999	188.05	33.12
			(60.94)	(139.27)
	Post-reform	2001	83.00	40.12
			(22.48)	(153.28)
More than 2 children	Pre-reform	1999	226.53	24.64
			(75.24)	(132.12)
	Post-reform	2001	106.24	28.30
			(30.39)	(139.67)

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 childbirths per 1,000 women (during an 18 month spell). Households with women working part-time and women working full-time

		Sample Year	Total child care cost	Births
Part-time				
All	Pre-reform	1999	196.11	65.68
			(68.22)	(212.54)
	Post-reform	2001	89.58	73.33
			(29.52)	(225.54)
Childless		1999	138.07	145.97
	Pre-reform		(44.76)	(271.79)
	Post-reform	2001	58.31	160.78
			(16.28)	(278.51)
1 child	Pre-reform	1999	188.72	116.14
			(59.02)	(274.29)
	Post-reform	2001	84.85	126.43
			(22.68)	(285.81)
More than 2 children	Pre-reform	1999	224.29	46.82
			(69.70)	(184.82)
	Post-reform	2001	107.30	52.18
			(28.36)	(198.09)
Full-time				
All	Pre-reform	1999	203.98	74.84
			(66.04)	(207.98)
	Post-reform	2001	91.24	85.29
			(27.87)	(221.25)
Childless		1999	162.24	225.90
	Pre-reform		(41.17)	(241.44)
	Post-reform	2001	68.74	257.65
			(12.22)	(258.69)
1 child	Pre-reform	1999	207.51	117.21
			(59.71)	(267.43)
	Post-reform	2001	92.61	130.17
			(22.43)	(276.57)
More than 2 children	Pre-reform	1999	241.45	43.83
			(69.84)	(174.02)
	Post-reform	2001	113.85	50.36
			(27.31)	(187.00)

Note: Average values. Standard deviations in parentheses

Table A4.1a Summary statistics for 1999 sample, all

Variable	*Obs*	*Weight*	*Mean*	*Std. Dev.*	*Min*	*Max*
Number of children	199627	513753	1.233643	.9401716	0	4
Woman's age	199627	513753	35.84876	4.825644	20	45
Household income	199627	513753	34330.36	18010.98	10001.37	2047932
Births	199627	513753	85.1343	190.8232	0	1000
Total Child care costs	199627	513753	194.9828	70.74416	0	1963.813
Marginal child care cost	199627	513753	116.5821	55.80809	-58.81377	1767.793
Average per child cost	199627	513753	100.6724	47.12796	0	981.9067

Table A4.1b Summary statistics for 1999 sample (only successfully matched households)

Variable	*Obs*	*Weight*	*Mean*	*Std. Dev.*	*Min*	*Max*
Number of children	110712	398229	1.048324	.8621588	0	4
Woman's age	110712	398229	36.01657	4.838712	20	45
Household income	110712	398229	32771.3	12682.34	10001.37	225985.2
Births	110712	398229	88.86093	178.3301	0	1000
Total Child care costs	110712	398229	187.3213	63.99705	0	671.3108
Marginal child care cost	110712	398229	118.5869	54.03101	-58.52023	413.0803
Average per child cost	110712	398229	104.9431	46.98368	0	413.0803

Table A4.1c Summary statistics for 2001 sample, all

Variable	*Obs*	*Weight*	*Mean*	*Std. Dev.*	*Min*	*Max*
Number of children	202709	517603	1.199891	.9233052	0	4
Woman's age	202709	517603	35.91784	4.772113	20	45
Household income	202709	517603	36704.81	22492.08	10002.83	2284689
Births	202709	517603	95.19265	202.2094	0	1000
Total Child care costs	202709	517603	89.21771	30.97446	20.3131	194.7681
Marginal child care cost	202709	517603	52.78537	18.47319	-9.4254	75.30709
Average per child cost	202709	517603	45.50036	17.37565	6.615995	75.30709

Table A4.1d Summary statistics for 2001 sample, only successfully matched households

Variable	*Obs*	*Weight*	*Mean*	*Std. Dev.*	*Min*	*Max*
Number of children	111348	398682	1.013093	.8399375	0	4
Woman's age	111348	398682	36.1031	4.777721	20	45
Household income	111348	398682	34847.64	13950.6	10002.83	306027
Births	111348	398682	98.44688	187.8638	0	1000
Total Child care costs	111348	398682	85.5819	28.7402	20.3131	193.6281
Marginal child care cost	111348	398682	54.07504	18.11092	-5.873856	75.30709
Average per child cost	111348	398682	47.43093	17.42257	8.061243	75.30709