

Reduced child care fees bring more babies

by

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Abstract

We study the effect of child care fees on the fertility behavior of Swedish families. Exploiting the exogenous variation in child care costs caused by the 2002 Swedish Child Care reform, we are able to identify the causal effect of child care costs on fertility in a context where child care enrolment is almost universal and the labor force participation of mothers very high. Our findings suggest that child care fees, also when they are initially highly subsidized, do influence the fertility decisions of families. The average reduction in child care costs for a typical family caused by the reform was SEK 56,000 (USD 9,500). This reduction resulted in 3–5 more child births per 1,000 families during an 18 months period, corresponding to a 4–6 per cent increase in the birth rate.

Keywords: Child Care, Cost of Children, Fertility, Natural experiment, Differences-in-differences

JEL-codes: H31, J13

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1 Introduction

Low fertility rates, aging populations, and the concern for long run labor supply have inspired a growing interest in how the availability and price of child care services influence birth rates. Yet conclusive evidence on the effect of child care prices on fertility is hard to find. Cross country comparisons show that birth rates are higher in countries with wide access to child care (D'Addio and Mira d'Ercole, 2005). However, the direction of causality is difficult to assess. Also, previous microstudies (see Blau and Robins, 1989; Del Boca, 2002; Schlosser, 2006) have found mixed support for the hypothesis that lower child care prices increase fertility. There are several reasons for this lack of conclusive evidence. First, studies of child care costs and fertility decisions are plagued with endogeneity, since the prices actually paid by families are largely a matter of choice of quality and quantity of child care. Second, it is difficult to separate whether it is the price of child care that differs or availability per se.

In this paper, our aim is to establish the causal effect of child care costs on fertility. To this end, we exploit the natural experiment created by the Swedish 2001 Child Care Reform, which put a cap on the child care fees charged by Swedish municipalities. The reform thereby induced exogenous variation in child care costs such that similar households experienced quite different cost changes depending on where they lived. Since we analyze a setting where child care is already widely available, we can isolate the effect of child care costs. Our findings suggest that child care costs do matter for fertility decisions. An average reduction in the child care fees due to the reform for families with children in child care age increased fertility rates with about 5 percent.

Economic models of fertility and maternal labor supply suggest that child care costs may matter for both labor supply and fertility (Ermish, 1989a, b; Apps and Rees, 2004). The price of child care influences the cost of having children, in particular by influencing the mother's net return to market work. Hence, lower child care costs make it more attractive for mothers to work. This may cause mothers to enter the labor market, which increases household income at the same time as the alternative cost of having more children increases. The resulting effect on fertility is then not clear. However, for mothers who already work lower child care costs reduce the cost of having children which ought to make them want more children. Thus, we would

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expect that fertility is affected when child care costs are reduced in a setting where women already work, which is indeed the case in the Swedish context studied here.

Contrary to the theoretical predictions, Blau and Robins (1989) showed early on, using American data, 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. More consistent with theory, they also found that reduced child care costs increased mothers' entry rate into employment and reduced the exit rate. Del Boca (2002), on the other hand, shows, in a study of Italian data, that both fertility and labor force participation are positively correlated with better access to 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 prices on Arab mothers' labor supply and fertility. She finds no effect on fertility but a positive effect on labor supply.

Many earlier studies, including Blau and Robins (1989) and Del Boca (2002), suffer from the problem that they have not been able to separate effects of child care prices from effects of other factors, such as family income. In order to identify causal effect of child care costs, it is necessary to have access to a source of exogenous variation in costs, i.e. variation which does not depend on the family's own choices. The study by Schlosser uses such exogenous variation in child care prices created by the introduction of free preschool. A special feature with her study is that she studies a group of women for which both maternal labor force participation and the use of out-of-family child care were extremely low before the reform. Hence, it is likely that Schlosser's study captures a combination effect of availability and costs of child care. Also, given the low initial labor force participation and large families of the studied mothers it is possible that entering the labor force, rather than having more children, is a more likely margin of adaptation to lower child care prices.

Compared to the Israeli context studied in Schlosser, female labor supply, fertility behavior and the market for child care in Sweden are rather different. The labor supply of Swedish mothers is high by international standards and child care enrolment for toddlers is close to universal. In such a context, it is likely that a child care costs reduction affects families' fertility choices, rather than increasing the already high labor supply of mothers. In support of the first part of this hypothesis, Lundin et al. (2008) find that the reduction in child care fees due to the Swedish 2001 Child Care Reform had no effect on the labor

supply of mothers. This paper investigates whether the second part of the hypothesis is true, namely, that the reduction in child care fees lead to higher fertility rates.

Apart from the above mentioned studies that estimate the effects of child care fees on fertility, there are a number of other studies that investigate the effect of other economic incentives on fertility that are relevant for our study. 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 a strong effect of child care allowances on fertility rates. Kearney (2002) investigates the effect of family caps (i.e. instituting a cap on maternal cash allowances beyond a certain number of births) on fertility among welfare prone groups in the US 1989–98. Taking advantage of the variation across states in the timing of family caps, she does not find that this reform lead to reductions in child births. On the contrary, for some groups, she finds an increased number of births rather than the expected decrease. Cohen et al. (2007) investigate the effects of child allowances on fertility in Israel. Using a non-anticipated reduction in child allowances and assuming that high income households are less likely to react to financial incentives (an assumption that is supported by Israeli panel data evidence) they find that child allowances increase fertility rates. There is hence some evidence of positive income-effects on fertility, at least for those households that are not too poor.

In this study we study both changes in fees for children already born and changes in fees for a new child. In line with the above studies we find an income effect since fee changes for existing children has a positive effect on fertility rates. Changes in the fees for an additional child, i.e. changes in the marginal price, only affect some groups.

The paper proceeds as follows. First, we present background information on Swedish fertility, child care attendance and, importantly the child care fee reform of 2001. In section 3, we discuss our identification strategy and present our data sources. Empirical results are presents in section 4 and Section 5 concludes.

2 Institutional background

2.1 Child care in Sweden

Sweden has a long tradition of subsidized, publicly provided, child care for pre-school children as well as after school care for young school age children. *Figure 1* shows the fractions of children attending publicly subsidized child care over time by age. As can be seen, the enrolment rate has increased dramatically over time, and in 2004 as much as 90 percent of all children aged 3–6 attended some form of publicly subsidized child care.¹ The enrolment rate is also high for very young children (ages 1–2). One explanation for high enrolment rates is that the local governments in Sweden are obliged by law to provide child care to children aged 1–12 whose parents either work or are full-time students, within three to four months from the parents' request.² Subsidies to child care for infants is however restricted to families and children with special needs.

¹ Publicly subsidized child care comes in different forms, the most common being centre based care. Day care in a publicly salaried care takers home and family day care 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. Besides child care, they are responsible for primary and secondary education, care for the elderly and handicapped, welfare, as well as local infrastructure. Local governments finance their activities by a proportional local income tax, grants from the central government and user fees.

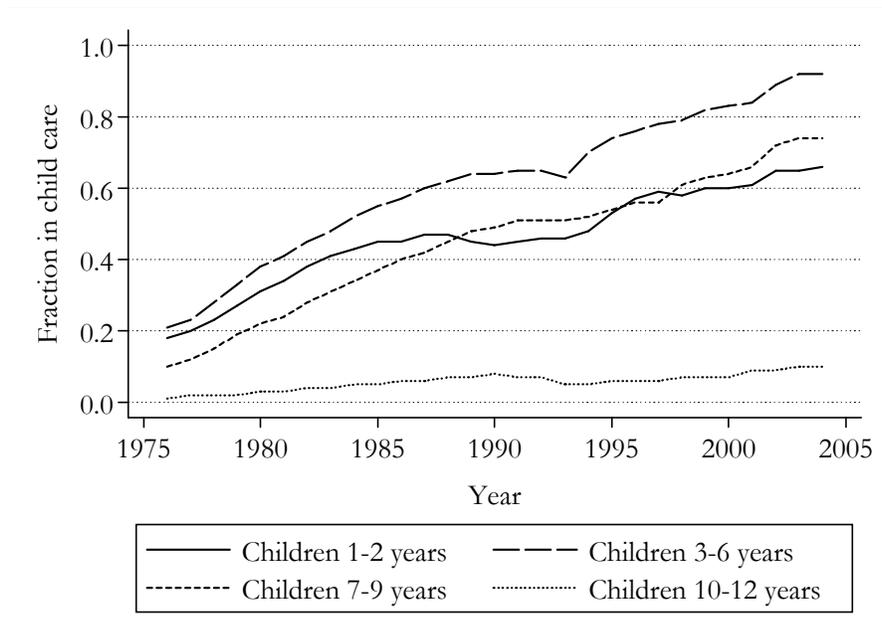


Figure 1 The fraction of children enrolled in subsidized childcare by age

Until 2002, the municipalities were free to set their own child care fees, as long as the fees were "reasonable". According to Government bill 93/94:11, "fees 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 wide interpretations, and consequently child care fee schedules differed considerably between municipalities, both with respect to levels and construction.

2.2 The child care fee reform

In the last months of the election campaign of the September 1998 elections, the Social Democrats proposed a large child care reform designed to reduce user fees and thereby increase accessibility of child care. The Social Democrats won the election, but the reform bill was not passed by the parliament until two years into the election term, in November 2000. The main purpose of the reform was to give all children equal access to the pedagogic activities

provided, improve the economic conditions for families with children, and facilitate parental labor force participation. The reform was implemented gradually and consisted of several parts, where the most important component was an option for the municipalities to, beginning in 2002, impose a cap (stipulated by the government) on user fees for child care. Municipalities that chose to do so were granted compensation (at least partial) for lost revenues. Most municipalities took the decision to implement the reform as late as in the fall of 2001. Hence, it was not until then that families could be sure that they would benefit from lower child care costs or not.

The cap was twofold. First, fees per child were to be determined as a fixed percentage rate of the household income. The percentage rates differed with respect to the number and age of the children, with higher per-child rates the fewer the number of children in the household in public child care and the younger the child. Second, fees were capped such that municipalities could only charge parents the fixed percentage of household income up to an income ceiling of SEK 38,000 (6,430 USD). For household incomes above this level, per child fees were to be constant. Although it was voluntary for the municipalities to impose the cap, all but two municipalities implemented the capped fee schedule in January 2002. The remaining two municipalities implemented the reform the next year.

Prior to the reform there was thus substantial variation in child care fees across household types and municipalities, whereas after the reform the fee structure was much more compressed and comparable households faced similar child care fees regardless of where they lived. In 1999, a middle-income family with two adults and two pre-school aged children paid SEK 2,660 (380 USD) per month (median). However, the cost 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 2001 Child care fee reform, a similar family paid SEK 1,900 (320 USD) for the care of their two children (fees varied from SEK 1,040 (175 USD) and SEK 1,900 (320 USD)).

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 completed fertility rates were 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 rates³ of Swedish women have, however, varied substantially over time, and so has the spacing between children. Similar to 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 shows substantial time variation in total fertility rates with a recession in the late 70s and early 80s, followed by a boom in the late 80s and early 90s and lower levels again in the end of the 90s. Total fertility rates have picked up in recent years, from an all time low in 1999 of 1.5. 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.⁴

Interestingly, these aggregate numbers do show a slight increase in the in the number of children born after the Swedish child care reform. But, given the magnitude of the cyclical fluctuations in fertility, this increase can, however, not readily be interpreted as a causal effect of decreased child care fees due to the reform. To establish such a causal link we have 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. The next section presents the empirical methodology in detail as well as the data used to try to establish this link.

³ Total fertility of a given year shows how many children a hypothetical woman would have in her life time if she at each age had as many children as women of a given age has in that particular year.

⁴ See Adsera (2004, 2005) for discussions of the link between unemployment and fertility in explaining cross country differences in fertility.

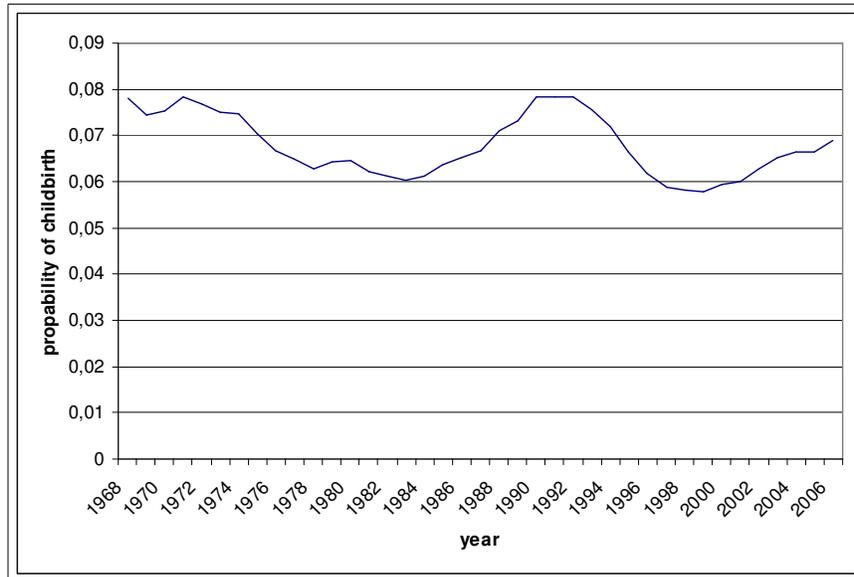


Figure 2 The average number of children born per woman aged 20–45 in Sweden over the period 1968-2006. Source: Statistic Sweden

3 Methodology and data

3.1 Econometric challenge

The problem typically arising when estimating the effect of child care costs on fertility is that observed child care costs of a given household are determined by household characteristics that are also likely to have direct effects on fertility decisions. Had the 2001 Child Care Reform implied that changes in child care fees were truly random, such that fee changes were independent of household characteristics, it would be straight forward to estimate the effect of the fee change on fertility. This was, however, not the case. Instead, the fee changes induced by the reform varied with household characteristics that are likely to influence fertility directly. In particular, the fee cap implied that high

income households experienced larger cost reductions. In order to get unbiased estimates of the causal effect of child care costs on fertility we therefore need to hold constant all the household characteristics that determine both child care prices and fertility decisions, and thus only identify the effect of child care costs on an *exogenous* change in fees.

The child care fee survey conducted by IFAU suggests that the fee schedules, both before and after the reform, are fully determined by a subset of household characteristics that we denote by Z . Moreover, because all the household characteristics in Z are available in Swedish Register data, it is possible to compute each household's exact child care fee both before and after the reform under the assumption that all children of child care eligible age are enrolled in full time child care.

Let us further define a household type j as all households sharing the same characteristics Z_j such that in a given municipality m at a given period in time, t , all households of type j have identical child care costs. Stated differently, for households of type j , the household's child care costs are a function $P_m(Z_j)$. 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 by including fixed effects for each municipality-household type Z_{jm} . More formally, we estimate the following relationship:

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

where $Child_{ijmt}$ is the probability that a household i of type j , in municipality m , in period t , has a new child, and τ_t is a time-fixed effect controlling for a common time trend in fertility.⁵ 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 . Including such controls may, however, increase efficiency. See discussion in Smith and Todd (2005).

⁵ The same strategy is applied by Lundin et al. (2008) when investigating the effect of child care prices on parental labor supply

Our estimation strategy is thus to compare the probability that a household of a particular type in a particular municipality has a child during a time window prior to the reform to 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. We then relate the changes in fertility behavior 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 differences-in-differences estimator where households are matched at the household type \times municipality level. The resulting estimate of β is the weighted-sum over all household types of the differences-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 . As discussed above, a crucial condition for using this approach is that we are able to control for all variables simultaneously affecting both child care fees and fertility.

An issue of concern is whether the effects of the child care fee reform can be isolated from 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 fee reform, we must take this into account, otherwise our estimations will be biased. There were indeed other nationwide reforms to family policy during the period of investigation, and, in particular, an additional allowance for large families was introduced. However, since there was no variation across municipalities in the implementation of other reform packages, it is possible to account for the effect of such reforms by allowing for nationwide fertility trends common to the household types that are likely to have been affected by these other reforms.

During this time period there were also a number of changes made to tax-rules that are likely to have had differential effects on families in different income brackets, just as we know that families in different income brackets were affected differently by the Child Care Reform. However, once again, since changes in tax rules apply to all municipalities equally, allowing for different trends in fertility for households depending on income brackets capture changes in fertility that were due to tax changes rather than child care cost changes.

Finally, it is possible that municipalities that implemented the largest fee cuts also introduced other child related policies at the same time. In that case the change in child care fees could pick up fertility effects that were not the

result of the fee change per se. Under 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.

Another question of concern is whether the child care fee reform also had effects on the quality of the care provided and/or the access to care as a result of increased demand. Such effects could potentially confound the results found when investigating the effects of fertility of the reduction of fees. As regards provision, 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 already in 1993. This obligation was not altered. In follow ups of the child care fee reform conducted by the National Board of Education, there is furthermore no evidence of increased group sizes or other adverse effects of quality (see Wikström, 2007).

3.2 Data

We use data from two sources. First the information on households and fertility is taken from register data from Statistics Sweden. Second, the information on fee schedules is based on survey data on municipal child care fee schedules collected by IFAU.⁶ All variable definitions can be found in Appendix *Table A:1*

For the years around the reform, 1997–2002, we sample all couples where the woman is 20–45 years old. Because Swedish register data does not code cohabiting couples without common children as household units, this sampling implies that the women without children in our sample are all married, but that couples with children in common need not be married. Hence, excluded from our sample are unmarried women without children, single mothers and unmarried mothers whose partner is not the father of her children. The main reason for excluding these households is that the measure of household income, and hence the measure of the household's child care cost, are likely to have

⁶ IFAU collected child care fees via an email-request sent to all Swedish municipalities asking for exact formulas on how they calculated prices in 2001–04. They received information about the exact fee structure from 220 of Sweden's 290 municipalities.

large measurement errors. For the households of the sampled women we obtain register based information on a number of household characteristics, i.e. the woman's age, education, country of origin, annual income for the woman and her partner, as well as the number and ages of the of children living in the household.

As mentioned in section 2.2, it was not until late fall of 2001 that municipalities decided whether to implement the child care fee reform or not. Given a nine months gestation period, July 2002 is when fertility rates may first respond to the expected fee changes. However, allowing for certain randomness in conception and delayed responses we register births during an 18 months time window after the reform could have an impact. We use register data on all child births in Sweden to define a dependent variable that takes the value 1 if a woman bares a child during an 18-month period. The period affected by the reform is set to July 2002 through December 2003. Our data allows us to construct two pre-reform periods as comparisons to this post-period with: the first one being July 1998 to December 1999 and the second one being July 2000 to December 2001. Thus, children conceived earlier than Mars 2001 are assumed to be unaffected by the reform and children conceived between October 2001 and Mars 2003 are potentially affected by the reform.

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 sample of households used in the empirical study. Comparing pre- and post-reform periods, fertility rates were higher after the reform both for families with children in child care age and for the sample of households that do not have children in child care age.

Table 1 Pre-and post-reform number of child births per 1000 women (during an 18 months spell) for different household types

	All families	Families with children in child care age	Families without children in child care age
Pre-reform	83.25 (186.75)	92.31 (202.68)	57.90 (128.95)
Post-reform	95.19 (202.21)	104.71 (217.41)	68.61 (148.72)

Note: Average values. Standard deviations in parenthesis

Next, we compute the households' child care costs. From the survey data on child care fee schedules before the reform, we concluded that fees were based on a few household characteristics that can all be observed in the register data, namely year, municipality of residence, household income, number of children aged 1-9⁷, and the age of each child. The information collected by IFAU pertains to the fee schedules as they were in 2001.⁸ After the reform, the central government stipulated a fee schedule and maximum fees that were identical across the country. The new fee schedule was however still based on the same set of household characteristics as the municipalities has used prior to the reform.⁹

Given the information on the number and age of each household's children as well as household income, we use the survey data on fee structure to compute i) the present value of the household's total fees for having the already born children enrolled in full-time care until they turn ten years old, and ii) the present value of household's additional fees if it had another child enrolled in full-time care between age one and age ten.¹⁰ We denote the first cost *Fees existing children* and the second *Fees additional child*.¹¹ Couples without children and families with children too old to be in child care are only affected

⁷ Since the share of children older than nine attending child care is very low, we assume that children attend child care (or after school care) only until they are ten.

⁸ Information on price scheduled prior to 2001 is not available, but the survey information suggests that there were not 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 also 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.

⁹ Some municipalities chose to charge low-income households even lower prices. Since parents could not observe actual prices until 2002, we have chosen to use the stipulated maximum prices as basis for the price-calculations for all municipalities

¹⁰ 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 builds on the assumption that everyone attends child care and after school care full time. The sensitivity to this assumption will be tested in the empirical application where we will estimate the model only for parents that we know work full time, and thereby are more likely to use child care full time.

¹¹ When summing child care costs over time, we assume that the families discount future costs exponentially with the discount rate 0.03. In the empirical analysis, we have investigated whether the results are sensitive to the choice of discount rate.

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by the reduction in cost of having an additional child, whereas families with young children may react to both cost measures.

Table 2 Present value of total child care costs before and after the reform, thousands SEK

	Families with children in child care age		Families without children in child care age	
	PRE	POST	PRE	POST
Fees existing children	105.34 (69.72)	49.48 (31.91)		
Fees additional child	100.69 (52.13)	48.60 (17.80)	150.20 (49.05)	64.46 (14.98)

Note: Average values. Standard deviations in parenthesis

Table 2 shows the present value of the household total child care fees for the remainder of the children's time in child care for the pre- and post-reform sample in SEK thousands. As is clear from the table, comparing the pre- and post-reform sample of families, the fees of child care decreased dramatically due to the reform. On average, in our sample, the fees for existing children decreased from SEK 105,340 to SEK 49,480 for families that had children in child care age. The fees associated with having an additional child in enrolled in child care decreased from SEK 100,690 to 48,600 on average for families with children in day care. Since families get a sibling rebate if they have several children in child care, the price for an additional child is higher for families that do not have any previous children attending child care.

3.3 Defining household types

As discussed in above, the household types to be matched across time periods should be defined so narrowly that all factors affecting both child care fees and fertility are the same within each household type. A major strength of this paper is that we have access to all the information necessary to construct such matches. Child care fees both before and after the reform are functions of: municipality of residence, household income, the number of children in the household under the age of 10 and the ages of the children. Using these same characteristics, we define household types and look for matches both within municipalities across time and across municipalities.

When creating matches there is, however, a trade-off. The more narrowly we search for matches, the more precise are our cost measures and the smaller is the within match variance in characteristics that determine child care fees. The more truly random is then the within match variation in child care fees. The draw back to too narrowly defined matches is however that we find matches for fewer household types. The problem is highlighted by household income. Since household income is a continuous variable, it is not possible to perform an unconstrained match since this would prevent us to find matches for most of our households. Instead, we use monthly income spans, of SEK 1,000 in 2002 prices.¹² When matching on the exact age of each child the same problem occurs. We have chosen to define household types by their number of children under age 10, the exact age of the youngest child and the age category of the next three youngest children, as well as by the household monthly income span. We only consider the four youngest children in the household since only a few municipalities before and none after the reform charged additional fees beyond the fourth child. The age categories are defined in line with the typical age categories defining child care fees, 1–3, 4–5 and 6–9.

When all households are assigned a household type and a municipality we can construct our regression sample by matching a household type in a particular municipality prior to the reform with the same household type in the same municipality after the reform. Using this definition of household type we find a match for 76% of our sample of households.

4 Results

This section presents the results of estimating the effect of child care fees on the fertility behavior of Swedish households. As mentioned before, families with children in child care and families without children in child care will be affected differently by the reform. For the first group, two things will happen, first, it will be cheaper to have the already born children in child care. We expect this change in fees (*Fees for existing children*) to have similar effects on

¹² We also explore how the fraction of households for which we find matches depends on the size of the income span used. See appendix

fertility behavior as any other increase in household income. It is possible that the effect is larger since the increase in income is associated with children and because of framing the elasticity when it comes to children may be larger than other goods. Second, the fee of having an additional child (*Fees additional child*) decreases thanks to the reform. This can be interpreted as a change in the marginal cost of having children, and we expect this to have a negative effect on the fertility. For families without children in child care (this group consists of childless families as well as families with children older than 9) only the second fee measure is relevant.

What we have done when estimating the model is to collapse data at the household type-municipal level, and thereafter taking first difference in order to get rid of the household type-specific fixed effect. Appendix Table A:2 displays summary statistics for the first-differences used in the empirical study.

4.1 Effect of child care fees on fertility

Table 3 reports the results from the baseline specification given by equation (1) in section 3 for households divided into two groups, depending on whether they have children in child care age or not.

Table 3 Child care fees and fertility

	(1) <i>Families with children in child care age</i>	(2) <i>Families without children in child care age</i>	(3) <i>Childless couples</i>	(4) <i>Families with children beyond child care age</i>
Fees existing children	-0.063*** (0.022)			
Fees additional child	0.004 (0.023)	-0.039 (0.026)	-0.262** (0.104)	0.004 (0.008)
Observations	187,834	34,226	13,208	21,018
R-squared	0.00	0.00	0.00	0.00

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

The first column shows, as expected, that when the fees for the already born children increase, fertility decreases. An increase of fees with 1,000 SEK

reduces the number of child births per 1,000 women with 0.06 or, decreases the probability that a woman will have a child with 0.06 per mille. This effect is statistically significant at the 1%-level. There is however, no effect on fertility of an increase in the marginal cost of having an additional child.

The second column shows that there is, on average, no effects on the fertility of households without children in child care of child care fee increase. However this group is rather heterogeneous, since it consists of married childless couples as well as of families with children no longer in child care. In particular, families where the youngest child is 10 years or older is perhaps not likely to react to changes in fees, since these families to larger extent have finished their family forming period. We therefore divide the sample into two groups, couples without children in column (3) and couples with children older than 9 in column (4). Doing this, we find that there is in fact a negative effect on fertility of increased child care fees for the married couples without children; increased fees with 1,000 SEK implies almost 0.3 more child births per 1,000 women. For families with older children on the other hand, we find no effect; the parameter estimate is both statistically and economically insignificant.

Before interpreting the estimated effects as the causal effect of child care fees on fertility, we need to consider the possibility that there, during this time period, were time trends in fertility caused by some other policy changes at the municipal or national level. We will do this by allowing for different trends in fertility, both between different municipalities and between different family-types. We start by investigating families with children in child-care age in *Table 4*. In column (1), we allow for differential municipal time trends in fertility. The coefficient on child care fees for existing children is now somewhat larger in magnitude and still negative and significant, and coefficient for marginal cost is still statistically insignificant. Column (2) allows for differential time trends in fertility for families with similar household income and for families with the same number of children. Again, the results are largely unaffected.

To improve efficiency in our estimation we in column (3) control for woman's age and woman's education, two characteristics that are likely to be of importance for fertility behavior, but that do not matter for child care fees. The results reveal that that fertility declines with age of the mother and that educated mothers are more likely to have another child. Including these controls, however, renders the estimated coefficient on child care fees for

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existing children somewhat larger in magnitude, 1,000 SEK in increased fees for the already born children implies a decrease in the number of birth per 1,000 women with 0.10. The coefficient on child care fees for an additional child is still close to zero and it seems fair to conclude that the marginal price of child care is, at least on average, not relevant for these households.

Table 4 Child care fees and fertility with time trends and additional controls: Families with children in child care age

	(1)	(2)	(3)
Fees existing children	-0.085*** (0.024)	-0.073*** (0.025)	-0.100*** (0.025)
Fees additional child	-0.015 (0.026)	0.013 (0.029)	0.006 (0.029)
Woman's age			-9.659*** (0.178)
Woman's education			30.031*** (1.569)
<i>Municipal time trend</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Family size time trend</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
<i>Household income time trend</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Observations	187,834	187,834	187,834
R-squared	0.00	0.00	0.02

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Woman's age is the difference between the average age in the household type and the average age in the whole sample. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Hence, the results for families with children in child care age suggest that there is indeed a positive effect on fertility of lowering the fee of child care for the existing children. The estimated effect, ranging between -0.06 and -0.10, implies that the average reduction in the child care fees of existing children, which amounted to some SEK 56,000, increased the number of child births per 1,000 women during a 18 month period by 3.4 – 5.6 children. Compared to the average number of children born to 1,000 women in an 18 month period prior to the reform (92.3) this implies that the birth rate increased by 4–6 percent and that the child care reform accounted for about half of the increase in fertility that took place during this period.

Next, we turn to the childless couples. *Table 5* shows the results allowing for municipality specific time trend (column 1), household income time trend (column 2) and controls for the woman's age and education. When allowing for household income time trends, the coefficient becomes smaller and is no longer statistically significant. Notice, however that for this sample of households the child care fees only depends on municipality of residence and income, and thus controlling for trends in income implies that the only variation left is between municipalities. One explanation to the lack of statistically significant results could be that there is not enough variation when only using the differences between municipalities. Controlling for maternal age and education, in column 3, makes the estimate slightly larger in magnitude, but it is still insignificant. We can therefore not say anything about the effect of child care fees on the fertility of childless couples.

Table 5 Child care fees and fertility with time trends and additional controls: Families without children

	(1)	(2)	(3)
Fees additional child	-0.322*** (0.114)	-0.186 (0.130)	-0.198 (0.122)
Woman's age			-19.977*** (0.477)
Woman's education			58.374*** (7.905)
<i>Municipal time trend</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Household income time trend</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Observations	13,208	13,208	13,208
R-squared	0.01	0.03	0.17

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Woman's age is the difference between the average age in the household type and the average age in the whole sample. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Finally, when we include time trends and additional controls in the estimation of the effects of child care fees on the fertility behavior of families with children beyond child care age, our previous result of no effect is intact, see *Table 6* below.

Table 6 Child care fees and fertility with time trends and additional controls: Families with children beyond child care age

	(1)	(2)	(3)
Fees additional child	0.004 (0.009)	0.001 (0.010)	0.001 (0.010)
Woman's age			-2.279*** (0.198)
Woman's education			-0.277 (0.881)
<i>Municipal time trend</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Household income time trend</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
Observations	21,018	21,018	21,018
R-squared	0.01	0.01	0.02

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Woman's age is the difference between the average age in the household type and the average age in the whole sample. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

So far we have found that there seems to be a positive effect on the fertility of families with young children of reducing child care fees for existing children, but that reducing the child care fee for additional children had no effect on these families. For the childless couples we found a rather large positive, effect of lower child care fees on fertility, which was however rendered insignificant once household income specific fertility trends were included. For families with children beyond child care age, we have as yet found no effects on fertility of child care fees.

4.2 Do the effects differ for young and old women?

In this section, we investigate the presence of heterogeneous effects by woman's age. It is possible that our identification strategy which captures the average effect of child care fees misses out on effects on certain households because they are grouped together with households that do not react. It is likely that age matters for how sensitive a household is to child care fee changes. On the one hand, women who already have children may become less willing to have additional children as they get older. For some childless women who plan to have children, age may, on the other hand, have the opposite effect at least up to menopause. In *Table 7* below we present results for the three different

types of families that we have studied above. In the model, the two fees-measures are interacted with a variable called “mother’s age” that is measured as deviations in years from 34, which is the mean age of women in our entire sample.

Table 7 Heterogeneous effects with respect to woman’s age.

	(1) <i>Families with children in child care age</i>	(2) <i>Families without children</i>	(3) <i>Families with children beyond child care age</i>
Fees existing children	-0.095*** (0.025)		
Fees existing children×woman’s age	-0.009*** (0.003)		
Fees additional child	-0.006 (0.031)	-0.146 (0.123)	-0.072** (0.028)
Fees additional child×woman’s age	0.008*** (0.003)	-0.037*** (0.008)	0.009*** (0.003)
<i>Woman’s age and education</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Municipal time trend</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Family size time trend</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
<i>Household income time trend</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
Observations	187,834	13,208	21,018
R-squared	0.02	0.02	0.03

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Woman’s age is the difference between the average age in the household type and the average age in the whole sample. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

Columns 1, 2 and 3 present the results from interacting maternal age with child care fees for families with children in child care age, childless couples and families with children beyond child care age. Column (1) shows an interesting pattern. While the negative coefficient on fee for existing children becomes increasingly negative with age, the opposite is true for the coefficient on fees for an additional child. Previously we found no effect on families’ fertility behavior of the fee for an additional child. In column 2 we study the sample of childless households and here the effect of reduced fees increases with age. Column 3 reveals that the interaction of fees with maternal age for the families

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with older children similar fashion to the one for families with younger children. *Table 8* shows more in detail how the estimates change with age.

Table 8 Estimates of effect of fees depending on woman's age.

<i>Age of woman</i>	<i>Families with children in child care age</i>		<i>Families without children</i>	<i>Families with children beyond child care age</i>
	<i>Fees existing children</i>	<i>Fees additional child</i>	<i>Fees additional child</i>	<i>Fees additional child</i>
20	0.027	-0.123 **	0.377 **	-0.195 ***
21	0.019	-0.114 *	0.340 **	-0.186 ***
22	0.010	-0.106 *	0.302 *	-0.177 ***
23	0.001	-0.098*	0.265	-0.168 ***
24	-0.008	-0.089 *	0.228	-0.159 ***
25	-0.016	-0.081 *	0.190	-0.151 ***
26	-0.025	-0.072	0.153	-0.142 ***
27	-0.034	-0.064	0.115	-0.133 ***
28	-0.042	-0.056	0.078	-0.124 ***
29	-0.051 *	-0.047	0.041	-0.115 ***
30	-0.060 **	-0.039	0.003	-0.107 ***
31	-0.069 ***	-0.031	-0.034	-0.098 ***
32	-0.077 ***	-0.022	-0.072	-0.089 ***
33	-0.086 ***	-0.014	-0.109	-0.080 **
34	-0.095 ***	-0.006	-0.146	-0.072 **
35	-0.103 ***	0.003	-0.184	-0.063 **
36	-0.112 ***	0.011	-0.221 *	-0.054 **
37	-0.121 ***	0.019	-0.259 **	-0.045 **
38	-0.130 ***	0.028	-0.296 **	-0.036 **
39	-0.138 ***	0.036	-0.333 ***	-0.028 **
40	-0.147 ***	0.044	-0.371 ***	-0.019
41	-0.156 ***	0.053 *	-0.408***	-0.010
42	-0.164 ***	0.061 **	-0.446***	-0.001
43	-0.173 ***	0.069**	-0.483 ***	0.008
44	-0.182 ***	0.078 **	-0.520 ***	0.016

45	-0.191 ***	0.086 **	-0.558 ***	0.025 *
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Notes: * significant at 10%; ** significant at 5%; *** significant at 1%

The first two columns investigate how the estimate on the two different fee measures changes with the woman's age for families with children in child care age. The effect of reducing the fees for existing children seems to affect households where the mother is 29 years old or older. We also find a predicted negative effect of child care fees on fertility for households with children where the mother is younger than 26. For mothers older than 42 we find an implausible positive effect of child care fees on fertility. Childless households, on the other hand, seem to react to larger extent the older the mother in the household is. According to the estimates presented in the third column, households with a woman older than 35 will increase fertility as a response to lower child care fees. The last column shows the estimates in the sample of households with older children. Also here is the effect stronger for younger women. Notice, however, that there are very few households where the youngest child is 10 years old or older and where the mother is 20 years old.¹³ Having said that, there is still a negative and significant effect of the fees on fertility of the youngest women in this category of households.

In sum, younger mothers in households with children seem to increase fertility when the fees for an additional child go down. At least for families where the youngest child is 10 years old or older, the declining sensitivity with age may indicate that these families have finished the family formation phase. Childless families, on the other hand, are more prone to react if the mother is older. An explanation could be that these families need to hurry up to have children before it is too late and therefore they are more likely to react to changes in fees.

A second reason for investigating the presence of heterogeneous effects is that it is relevant to ask whether the effects of child care fees found relate to changed timing and spacing of births or if the effects do in fact represent increases or reductions in long run fertility. To properly analyze this question we would need data over completed fertility rates. Since they are not, for

¹³ Note that the 10+ year old in these households is plausibly the man's child from a previous relation.

natural reasons, available yet we will explore this issue in other ways. First, we argue that for women approaching menopause, a decision to anticipate or postpone child birth, is in for biological reasons equivalent to the decision to have or not to have another child. Hence, finding positive effects on the fertility of older women would suggest that the effects are not only a matter of anticipating children these women would have anyway. What conclusion do we draw with regard to timing, based on the results in *Table 7* and *8*? Although the pattern is not entirely clear, it does suggest that the wealth effect is stronger for older women and that the marginal cost effect increases with age for childless women. Both these results speak against mere timing effects.

A second approach to differentiating effects on timing from long run fertility, commonly taken 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. We explore if the effects of child care fees is the same for families with one child as for families that have two or more children. *Table 8* displays the results of estimating our model when we have included interaction terms for child care fees with family size. In particular, we have created a dummy variable for the household type if it has two or more children at the outset. Hence, we are estimating a separate effect of child care fees on families with more than one child. The results is that the interaction terms are insignificant, both for fees for existing children and for fees for an additional child. This implies that the effect of child care fee changes is the same regardless of family size and suggests that the estimated effects are not only effects on the timing of births.

Table 8 Heterogeneous effects with respect to family size

	(1) <i>Families with children in child care age</i>
Fees existing children	-0.119*** (0.038)
Fees existing children×more than one child	0.033 (0.037)
Fees additional child	0.006 (0.032)

Fees additional child× more than one child	-0.008 (0.024)
<hr/>	
<i>Woman's age and education</i>	<i>Yes</i>
<i>Municipal time trend</i>	<i>Yes</i>
<i>Family size time trend</i>	<i>Yes</i>
<i>Household income time trend</i>	<i>Yes</i>
Observations	187,834
R-squared	0.02

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Womans's age is the difference between the average age in the household type and the average age in the whole sample. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

4.3 Placebo test

To make sure the results we have found so far are not due to spurious correlations, we will in this section do a so called Placebo test, i.e. study the impact of the reform on a period prior to the reform. To do this will here assume that the reform was implemented so that children conceived October 1999 to Mars 2001 are affected. In other words, we will assume that children born July 1998 to December 1999 are not affected by the reform, whereas children born July 2000 to December 2001 could be affected by the reform. Our hypothesis is that the child care fees after the reform should have no effects on the fertility behaviour in this sample. Significant estimates would indicate that the analysis suffers from identification problems, which could result in spurious correlations between child care fees reductions caused by the reform and fertility behaviour of households. Thus, if trends in fertility behaviour go in the same direction as the reductions in child care fees due to the reform, we would falsely attribute the changes in fertility to the change in child care fees. Non-significant estimates would, on the other hand, indicate that there where no such trends period to the reform and thus it is highly unlikely that the effects are spurious.

The first and second column show that the fertility changes between two periods prior to the reform are not correlated with child care fees changes due to the reform. Including different trends and control variables has no effects on

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the estimates. Column three and four show the same result for childless couples. Column four and five studies the sample of families with children beyond child care age. In column five there is no effect of child care fee, but when including different trends and control variables the estimate becomes statistically significant. Since we originally did not find an effect of child care fees on this group, this estimate is a bit difficult to interpret. A closer investigation of the results show that both income- and municipality trends are needed in order to achieve the statistically significant estimate. Given the amount of regressions we run, the instability of this result, and that one in ten regressions should be statistically significant, our interpretation is that this relation is spurious.

Table 9 Placebo tests for the effects of the reform

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Families with children in child care age</i>		<i>Families without children</i>		<i>Families with children beyond child care age</i>	
Fees existing children	0.004 (0.021)	-0.002 (0.031)				
Fees additional child	0.024 (0.023)	0.064 (0.043)	-0.065 (0.103)	0.108 (0.198)	-0.004 (0.007)	-0.039** (0.016)
Woman's age		-9.297*** (0.245)		-19.748*** (0.665)		-2.054*** (0.265)
Woman's education		26.638*** (2.145)		61.230*** (11.231)		-0.104 (1.106)
<i>Municipal time trend</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>
<i>Family size time trend</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>
<i>Household income time trend</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>
Observations	93,868	93,868	6,552	6,552	10,292	10,292
R-squared	0.00	0.02	0.00	0.22	0.00	0.05

Note: Child care fees are measured in 1,000 SEK and fertility in births per 1,000 women. Woman's age is the difference between the average age in the household type and the average

age in the whole sample. Robust standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

5 Conclusion

We have explored the effect of introducing a cap on child care fees on the fertility behavior of Swedish families. Exploiting the exogenous changes in child care fees introduced by the Swedish child care reform of 2001 we can conclude that child care fees are a determinant of 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's already existing children was cut by SEK 56,000 (USD 9,500) . We also find that young mothers and older childless women increase their fertility in response to lower child care fees for having an additional child enrolled in child care.

Sweden is a particularly interesting country to study because of two reasons. First, according to theory lower child care fees should affect both female labor supply and fertility rate. In a context like the Swedish, where women already have high labor supply, it is more likely fertility rather than labor supply is the affected margin, and thus, we should expect larger effects in Sweden than in most other countries in the world. Secondly, availability of child care is not an issue in Sweden since municipalities are required by law to supply a space and enrolment is close to universal. This makes it possible, in contrast to some of the earlier studies, to study the impact of child care fees, rather than availability.

A central question is if the reform affected completed fertility or only the timing of childbirths. Since completed fertility rates are not available yet for a long time, this question can not be completely resolved. However, some results indicate that it is not just timing effects. For example, higher order births are affected to the same degree as lower order births and older women also react to the lower child care fees.

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Table A:1 Variable definitions

Variable definitions

Child: Dummy that take the value 1 if the household had a child in a 18 month period

Fees existing children: The present value of the total fees for already born children in child care until age 10.

Fees additional child: The present value of the total fees for a new child in child care until age 10.

Woman's age: The age of the women in the household - median age (34)

Uni: Dummy that takes the value 1 if the woman in the household has some university education

Table A:2 Summary statistics of differences*

	Difference 1997-1999 Difference between two per-reform periods		Difference 1999-2001 Difference between one pre-reform and one post- reform period	
	Obs	Mean (Std.D)	Obs	Mean (Std.D)
<i>Families with children in child care age</i>				
Child	93868	5.488 (277.644)	93966	5.215 (287.738)
Fees existing children	93868	-0.065 (4.811)	93966	57.408 (45.358)
Cost an additional child	93868	0.025 (2.296)	93966	-58.529 (39.619)
Woman's age	93868	-0.061 (4.510)	93966	0.053 (4.534)
Uni	93868	-0.016 (0.473)	93966	-0.049 (0.474)
<i>Childless married couples</i>				
Child	6552	14.310 (341.427)	6656	22.703 (365.302)
Fees additional child	6552	0.018 (1.592)	6656	-89.083 (39.0880)
Woman's age	6552	-0.405 (6.806)	6656	-0.669 (6.753)
Uni	6552	-0.001 (0.418)	6656	-0.026 (0.424)
<i>Families with no children in child care age</i>				
Child	10292	-0.078 (37.513)	10726	1.692 (48.867)
Fees additional child	10292	0.003 (1.124)	10726	-92.292 (43.789)
Woman's age	10292	-0.085 (2.048)	10726	-0.191 (2.155)
Uni	10292	-0.017 (0.335)	10726	-0.034 k (0.338)

Note: The regressions are run on first differences and this table displays the summary statistics on first differences. The second and third column presents the first differences between two pre-reform periods namely, household characteristics 1997 and 1999, and the corresponding birth windows for 1997 (July 1998-Dec 1999) and 1999 (July 2000- Dec 2001). The next two columns

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show statistics for the difference between the pre-reform period with household characteristics from 1999 (and children born July 2000-Dec 2001) and the post reform period with household characteristics from 2001 (and children born July 2002-Dec 2003).