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## Maximum fee vs. child benefit: a welfare analysis of Swedish child-care fee reform

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April 2007

# **Maximum Fee vs. Child Benefit: A Welfare Analysis of Swedish Child-Care Fee Reform**

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## ABSTRACT

### **Maximum Fee vs. Child Benefit: A Welfare Analysis of Swedish Child-Care Fee Reform<sup>\*</sup>**

The effects of a recent Swedish child-care fee reform are compared with those of an alternative reform, increased child benefits. The fee reform implied considerably decreased fees and was intended to increase both labor supply among parents and their economic well-being. We estimate labor supply effects using a discrete choice labor supply model, and simulate behavioral responses to the changes. We find positive, but small, effects on labor supply from reduced fees, while increased child benefits would make single mothers decrease their labor supply. On the other hand, increased child benefits would make income distribution more equal. We make a social welfare comparison and conclude that for plausible values of inequality aversion, the alternative reform would have been preferable to the implemented fee reform.

JEL Classification: H31, I38, J22

Keywords: labor supply, redistribution, reform, child care, fees, child benefit

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# 1 Introduction

In 2002, the Swedish child-care fee system was reformed by the introduction of the so-called *maximum fee*. For most parents of pre-school children the reform implied substantially reduced child-care fees. This decreased the cost of market work and made many families economically better off. In this paper, we analyze the effects of this reform on labor supply of parents of young children and on equity and social welfare. Using simulations, we compare the effects of the *maximum fee* reform to those of a possible policy alternative: increased child benefits.<sup>1</sup> The question we ask is whether the *maximum fee* performs better in terms of social welfare compared to increased child benefits.

Since the *maximum fee* has decreased marginal child-care fees, incentives for market work have been strengthened. The effect of the reform on labor supply has been studied by Lundin et al. (2007) who analyze observed pre- and post-reform labor supply, and find rather modest effects. A difficulty in using actual observations is, however, that the *maximum fee* was only part of a larger reform, which also implied that children whose parents were unemployed or on parental leave became eligible for subsidized care and that children of age 4 and 5 received 15 hours of care a week for free. By using simulations we can isolate the effects of the *maximum fee* from those of the other changes concerning child care.

There is a growing literature on the effects of the price of out-of-home child care on especially female labor supply. Child-care subsidies have in many cases been found to be a good way to promote female labor supply, both in terms of labor force participation and hours worked. Powell (1997) finds that policies that reduce child-care fees would significantly increase labor supply of married mothers in Canada both by increasing labor force participation and hours worked. Averett et al. (1997), who study married mothers in the US, also find that government subsidies to reduce child-care fees would substantially increase hours worked. Studying married mothers in the US, Ribar (1992) concludes that labor force participation is impeded by high child care costs, but in another study Ribar (1995) finds that married mothers' labor supply is relatively insensitive to changes in child-care costs once they are working. According to Kimmel (1998), who also studies US mothers, married

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<sup>1</sup>Apps and Rees (2004) also compare subsidized child care and child benefits. They show that a child-care subsidy financed by reduced child benefits increases both fertility and female labor supply.

mothers' employment are more affected by child care prices than single mothers'. However, Tekin (2005) finds that labor force participation of single mothers in the US is highly responsive to child care subsidies. Also Michalopoulos and Robins (2001) study single mothers, in Canada as well as in the US, and find significant effects on employment of child-care subsidies.

In many European countries, child-care markets work differently than in the US; they are often characterized by heavy subsidies, which also means that rationing may be a problem due to excess demand. European studies have shown that increased subsidies promote female labor supply, but to a rather weak extent, see e.g. Del Boca (2002) for Italy, Gustafsson and Stafford (1992) for Sweden, and Wrohlich (2006, 2007) for Germany. They all suggest that reduced rationing has a stronger impact on labor supply than further reduced fees. An exception is a Norwegian study by Kornstad and Thoresen (2006), showing that fee reductions would increase labor supply of married mothers more than abolished queues.

In this paper, we study Swedish single mothers and couples and their response to increased child-care subsidies. We study the effects on mothers', as well as on fathers' labor supply. Swedish municipalities are nowadays obliged to provide subsidized child care to all children aged 1–5, so there is (in principle) no rationing in Sweden. The *maximum fee* reform was costly for the Swedish public sector, and had to be covered by taxes. We do not judge whether the reform was a socially beneficial reform or not, taking the financing part into account; we simply ask whether the money spent on the reform could have been used more effectively in order to improve the well-being of families with young children. In doing so, we put the *maximum fee* against a budgetary equivalent, but hypothetical, reform of increased child benefits. We assume the same group of households to be targeted in the alternative reform: families with children aged 1–5. Hence, we analyze the two alternative reforms and their effects on labor supply and equity. To be able to predict labor supply responses to the two reforms we make simulations based on parameters obtained from the estimations of two discrete choice random utility models, one for single mothers and one for two-parent households. The estimations are made using individual pre-reform data containing detailed information on wage rates, incomes, family structure, and a number of background variables. These data are further combined with a micro simulation model, including all rules for taxes, transfers and fees in all Swedish municipalities.

The welfare effects of the two reforms are calculated in terms of equivalent variation, and are based on simulated effects following from the two reforms. It turns out that the unweighted sum of the welfare gains of all households is larger for the *maximum fee* reform than for the increased child benefit. On the other hand, the *maximum fee* also implies a higher Gini coefficient than the alternative reform. Taking distributional effects into account, we adopt a welfare analysis using distributional weights. We construct the distributional weights in the tradition of Christiansen and Jansen (1978). Which reform to prefer depends on the social welfare function's relative weight given to equality. Based on plausible values of social inequality aversion, the *maximum fee* turns out to be inferior to increased child benefits.

The rest of the paper is organized as follows: Section 2 describes the Swedish child-care fee reform and the child-benefit system. In Section 3 we specify the econometric model and in Section 4 we describe the data. The simulation approach is presented and discussed in Section 5. Section 6 presents the results for the structural model, as well as for the simulated effects on labor supply, disposable income, and welfare from the two alternative reforms. Section 7 compares the results and discusses the welfare effects. Section 8 concludes the paper.

## 2 Child-care fees and child benefits

In Sweden, child care is heavily subsidized. Before 2002, child-care fees were completely set by the municipalities. Fees then varied widely across municipalities, and were in most cases based on parental income as well as on the number of hours per week spent in child care. For example, 90 percent of the municipalities had income-based fees and 98 percent had time-based fees in 1999. The average fee for a two child family with average income was SEK 2,800 per month (EUR 311),<sup>2</sup> but varied as much as between zero and SEK 4,160 between the municipalities with the lowest and the highest fees (Skolverket, 2003). Since fees were based on both income and time spent in child care, longer working hours as well as a better paid job resulted in increased fees. In most municipalities, a one percent increase in gross family income was associated with an increased fee by 0.7-1.3 percent, with a median of 1 percent (Skolverket, 1999).

The *maximum fee* reform, which took effect in 2002, aimed at improving the

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<sup>2</sup>Throughout the paper we use the exchange rate SEK 9=1 EUR

economic situation for families with young children and increasing labor supply among parents by introducing a new fee structure for publicly subsidized child care. At the time of the reform, 80 percent of all children aged 1–5 were enrolled in public child care, a share that increased to 83 percent in 2003. A large majority of families with pre-school children have accordingly been affected by the reform. The new *maximum fee* is still based on family income, but only up to a rather low ceiling above which the fee is constant. For the first child the fee is 3 percent, for the second child 2 percent, and for the third child 1 percent of gross family income. No fees are charged for further children. The ceiling is set fairly low – in 2002, family incomes exceeding SEK 38,000 (EUR 4,222) per month were excluded from the fee base. As a result most families paid the monthly maximum amount SEK 1,140 (EUR 127), 760, and 380 for the first, second, and third child in child care (Skolverket, 2005).

Subsidized child care is provided by the municipalities and by law they have to provide care for all children aged 1–5.<sup>3</sup> Children of working parents are offered care during their parents' working hours only.<sup>4</sup> Parental fees contribute to a small part of the total child-care costs: 16 percent in 1999 (before the reform), and 10 percent in 2003 (after the reform). Remaining costs are covered by municipal subsidies and by conditional grants from the central government. These grants are part of the *maximum fee* reform. Since child care is a municipal matter, the fee reform had to be accompanied by a grant scheme that made a general reduction of child-care fees possible. The *maximum fee* is voluntary to the municipalities, but all municipalities have nevertheless adhered to it. However, the general implementation of the *maximum fee* reform does not imply that all municipalities have identical fee structures; it only defines the upper limit of the fees. Variations in fee design still exist, but have become considerably smaller and within the scope of the *maximum fee* reform.

The *maximum fee* has undoubtedly improved the financial situation for most families with pre-school children. The reason is twofold: First and foremost, child-care fees have generally decreased, which is obvious from Table 1 where the effects for four family types are presented. Nearly all families gained from the introduction of the *maximum fee*, but to different extents (Skolverket, 2003). High-income

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<sup>3</sup>Private child care providers are also subsidized by municipalities if they meet certain requirements and are therefore also affected by the *maximum fee* reform.

<sup>4</sup>However, after the child-care reform, four and five year old's are entitled to 15 hours a week irrespective of their parents' labor market status.



households utilizing child care during long hours gain more from the reform than low-income earners.

Second, the marginal fee – the fee increase of an additional hour of child care – has drastically decreased for most families. Before the reform long hours as well as high income resulted in high fees. After the reform, time in child care has no impact on the fee in most municipalities and since many households reach the ceiling, they pay no extra fee if they work more.

Table 1: Child-care fees 1999 and 2002 by family type

Number of children	1	2	2	2
Hours in child care (per week)	46	33	46	46
Household income	18,400	41,100	41,100	46,554
Median fee 1999	1,056	2,808	3,167	3,374
Median fee 2002 ( <i>maximum fee</i> )	552	1,900	1,900	1,900
Difference 1999–2002	504 (48%)	908 (32%)	1,267 (40%)	1,774 (53%)

*Sources:* Skolverket (1999, 2003).

Fees and incomes are expressed in SEK per month in fixed 2002 prices.

## 2.1 Child benefit

The Swedish child benefit is a universal non-taxable benefit dating back to 1948, then introduced to encourage childbirth. It is paid to all mothers with children aged 16 or younger, irrespective of the parents' labor market status and income. During 1999, the amount was SEK 750 (EUR 83) per month and child, and there was a supplementary child benefit from the third child on.<sup>5</sup>

In a redistributive perspective, child benefits are more successful than the Swedish child-care subsidies. There are two reasons for this. First, also families with children not using subsidized child care receive child benefits. This group of families is dominated by families with low labor market activity and low family income. Second, among families that utilize subsidized child care, the families with the lowest incomes cannot gain very much from a reduction of already low child-care fees.

<sup>5</sup>The monthly supplementary child benefit was SEK 200 for the third child, SEK 600 for the fourth child, and SEK 750 for following children.

### 3 Economic model and empirical specification

The effects on labor supply and income distribution are obtained by simulating a structural labor supply model, mimicking the actual choice process by identifying the alternative with the highest utility.<sup>6</sup> We follow the approach of van Soest (1995) and discretize the choice set of working hours. In the discrete choice model agents choose between a number of labor supply alternatives.<sup>7</sup>

We consider two kinds of families – single-mother households and two-parent households. In the latter we assume that spouses maximize a joint utility function and jointly determine their labor supply  $h_m$  and  $h_f$  (where subscripts indicate male and female).<sup>8</sup> Following van Soest (1995) we adopt the translog utility function, which increases in disposable income, and decreases in hours of work.

$$U(\Gamma) = \Gamma'_1 A \Gamma_1 + b' \Gamma_2, \quad (1)$$

where  $\Gamma_1 = \{\log y, \log(T - h_m), \log(T - h_f)\}$  is a vector of the logarithm of household disposable income ( $y$ ) and the logarithms of the leisure of both spouses.

$\Gamma_2 = \{\log y, \log(T - h_m), \log(T - h_f), \sigma\}$  also includes the binary variable  $\sigma$ , which takes the value of one if the household is a social assistance recipient, and zero otherwise. By including  $\sigma$  we follow e.g. Hoynes (1996), Keane and Moffit (1998) and Flood et al. (2004) and allow for possible non-participation among eligible households.  $T$  is the total amount of time available to each individual (equal to 4,000 hours per year).  $A$  is a symmetric  $3 \times 3$  matrix with the elements  $\alpha_{ij}, i, j = 1, 2, 3$ , comprising the estimable coefficients to the quadratic and cross terms in the utility function. (We do not include any quadratic or cross terms associated with receiving social assistance.)  $b$  with the elements  $\beta_i, i = 1, 2, 3, 4$ , is the  $1 \times 4$  vector of the estimable coefficients to the linear terms in the utility function. In order to specify the nature of heterogeneity in household preferences for leisure and for receiving social assistance, we model three of the coefficients (associated with  $i = l_m, l_f, \sigma$ ) as functions of observed and unobserved characteristics:

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<sup>6</sup>van Soest (1995), Aaberge et al. (1995), Aaberge et al. (1999), Flood et al. (2004), Kornstad and Thoresen (2006), and Wrohlich (2007), are some previous labor supply applications.

<sup>7</sup>Flood and Islam (2005) show that a discrete choice model produces results similar to those obtained from a continuous model.

<sup>8</sup>The procedure for single mothers is analogous, but with only one labor supply variable.

$$\beta_i = \sum_{k_i} \beta_{k_i} x_k + \theta_i, \quad i = 2, 3, 4. \quad (2)$$

The  $x$  vector contains  $k$  observed family characteristics for variable  $i$ , such as age of the youngest child, age and education level of the spouses, and area of residence.<sup>9</sup> It is, however, likely that many reasons for heterogeneity of preferences are unobserved. The vector  $\Theta = \{\theta_2, \theta_3, \theta_4\}$  therefore represents unobserved family characteristics that affect household preferences for leisure and welfare participation. We formulate a finite mixture model, which allows for unobserved heterogeneity in a very flexible way, without imposing a parametric structure. We assume that there exist  $N$  different sets of  $\Theta = \{\theta_2, \theta_3, \theta_4\}$  that determine a household's preferences, each observed with probability  $\pi_n$  (where  $\pi_n > 0$  and  $\sum \pi_n = 1, n = 1, \dots, N$ ).<sup>10</sup> This specification allows for arbitrary correlations between the husband's and the wife's work effort as well as between each spouse's work effort and preference for welfare participation.

For any possible combination of labor supply, the household obtains a certain disposable income level,  $y$ . It is composed of post-tax labor income, received benefits and other non-labor income, minus child-care fees:

$$y = w_m h_m + w_f h_f - \tau_m (w_m h_m) - \tau_f (w_f h_f) + \mu (w_m h_m + w_f h_f) - \varphi (\min [h_m, h_f], (w_m h_m + w_f h_f)) + v, \quad (3)$$

where  $w_m$  and  $w_f$  denote the gross wage rates of the spouses, and  $h_m$  and  $h_f$  are hours of market work during the year. Income taxes are determined by the tax function  $\tau$ , which is individual, while means-tested benefits are determined by household income.  $\mu$  consists of means-tested as well as of universal benefits, such as the child benefit. If both spouses work, they use subsidized child care. The child-care fee,  $\varphi$ , is determined by household labor income and time spent in child care (which we measure as working hours for the spouse with the least labor supply).  $v$  is net-of-tax non-labor, non-benefit income.

Each individual can choose between  $M$  labor supply alternatives, implying a

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<sup>9</sup>Summary statistics of the  $x_k$ 's are presented in Tables A.1 and A.2 and the estimates of the  $\beta_{k_i}$ 's in A.3.

<sup>10</sup>In our data we identify four different types, implying that  $N = 4$ .

total number of  $M^2$  choice opportunities for a two-parent household. In the empirical part, we assume that  $M = 5$ , implying 25 possible work combinations for a couple.<sup>11</sup> By including disutility from social assistance, a two-parent family may face up to  $2M^2 = 50$  work and welfare possibilities. Solving the optimization problem therefore requires evaluating the utility function in (1) for each possible work and welfare combination and then choosing the one that yields the highest utility.

To make the model estimable, we add a random disturbance term to the utilities of all possible choices

$$U_{h_m h_f \sigma} = U(\Gamma_{h_m h_f \sigma}) + \eta_{h_m h_f \sigma}, \quad (4)$$

where  $U(\Gamma_{h_m h_f \sigma})$  is defined in Equation (1) for labor supply alternatives  $h_m$  and  $h_f$ , ( $h_i = 1, \dots, M$  for  $i = m, f$ ) and for welfare participation ( $\sigma = 1$ ) or not ( $\sigma = 0$ ).  $\eta_{h_m h_f \sigma}$  is a random term, which can be interpreted as an unobserved utility component associated with alternative  $h_m h_f \sigma$ . We assume that  $\eta_{h_m h_f \sigma}$  follows a type  $I$  extreme-value distribution with cumulative density  $P(\eta_{h_m h_f \sigma} < \eta) = \exp(-\exp(-\eta))$  ( $\eta \in \mathbb{R}$ ).

Given the distributional assumptions of the stochastic terms in the utility function, the contribution to the likelihood function for a given household is

$$l = \sum_{n=1}^N \pi_n \left[ \sum_{\sigma=0}^1 \sum_{h_f=1}^M \sum_{h_m=1}^M (p|\Theta_n)_{h_m h_f \sigma} \right] \delta_{h_m h_f \sigma}, \quad (5)$$

where the unobserved type  $\Theta_n = \{\theta_{2n}, \theta_{3n}, \theta_{4n}\}$  occurs with probability  $\pi_n$  and  $\delta_{h_m h_f \sigma}$  is an indicator for the observed state for the household, and where

$$(p|\Theta)_{h_m h_f \sigma} = \frac{\exp(U(\Gamma_{h_m h_f \sigma}|\Theta))}{\sum_{\sigma'=0}^1 \sum_{h'_f=1}^M \sum_{h'_m=1}^M \exp(U(\Gamma_{h'_m h'_f \sigma'}|\Theta))}, \quad \forall h_m h_f \sigma \neq h'_m h'_f \sigma' \quad (6)$$

denotes the probability that the utility in state  $(h_m h_f \sigma)$  is the highest among all obtainable combinations, conditional on unobserved preferences.

The estimated parameters for the structural models for two-parent and single-mother households are presented in Tables A.3 and A.4 in the Appendix and discussed in Section 6.1.

<sup>11</sup>We set  $h_1 = 0$ ,  $h_2 = 375$ ,  $h_3 = 1,125$ ,  $h_4 = 1,875$  and  $h_5 = 2,650$  hours per year.

## 4 Data

The data used for this study comes from the Swedish Income Distribution Survey (HEK) and from the Swedish Longitudinal Individual Data (LINDA). We use HEK to construct the data for two-parent households, and LINDA for single-mother households.<sup>12</sup>

Our sample includes households with one to five children, where the youngest child is 1–5 years old. We use data from the 1999 survey of HEK and the 1999 wave of LINDA. We sample families with children born 1994–1998 (sample A). In a sensitivity analysis (see Section 7.1), we sample families with children born 1993–1997 (sample B). We exclude families where at least one parent is either a full-time student, retired or self-employed. After these selections Sample A includes 1,209 single-mother households and 733 two-parent households.

HEK is an annual survey conducted by Statistics Sweden. It contains information on labor market activities, demographic characteristics and incomes for a random sample of 20,000 Swedish households. The survey is a cross-sectional representation of the Swedish population. LINDA is completely based on register-information, and thus provides high-quality income data. It is a representative random sample and consists of approximately 300,000 individuals (about 3 percent of the Swedish population).

The reason for choosing 1999 as the year of study is that the *maximum fee* was not yet implemented. We therefore use the behavior of parents in the old child-care fee system to predict their responses to the *maximum fee* reform. The reason for using different data sets for different types of households is that HEK is a smaller data set and does therefore not include a sufficient number of single mothers whose youngest child is 1–5 years old. In LINDA, on the other hand, there is wage information for the sampled person only; hence we have no wage information for spouses in that data set. Since LINDA is register based, we treat the mothers who are not married and who are not cohabiting with the father of their children as single mothers. We might therefore have women in our single-mother sample who cohabit with somebody other than their children’s father. Consequently, the results for this group may be understated.

Information on income is obtained from administrative records with precise in-

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<sup>12</sup>Single-father households are excluded due to being extremely rare.

formation on labor as well as on non-labor income. Non-labor income includes any capital income, the national child benefit, and child-support payments.

The wage data was collected from *The Official Statistics on Wages* produced by Statistics Sweden. It is based on reports from employers and includes individual monthly salaries in full-time equivalents together with information on working time and occupation. Although there may be some problems with individuals who have more than one employer (only information from the main employer is included), this data is superior to the usual self-reported wage data, where the recall errors may be substantial.

We use the wage data to estimate the wage equations. To account for missing wages among non-workers, we estimate selection-corrected wage equations by maximum likelihood.<sup>13</sup> In order to be consistent regarding the stochastic specification, the wage equation estimates are then used to predict wages for both workers and non-workers.<sup>14</sup>

To generate disposable income for various combinations of hours of work, we use precise information on income tax rules as well as on eligibility rules for a number of welfare programs, such as social assistance and housing allowance. We use the FASIT model from Statistics Sweden, which is a micro simulation model that includes all rules for taxes, transfers and fees in all Swedish municipalities. Moreover, while FASIT is originally linked to the HEK data set, we have made appropriate links to LINDA as well. This enables us to calculate the child-care costs and disposable incomes for all parents. However, we have no direct information about child-care utilization. For single mothers we therefore assume that the number of working hours coincide with the use of child care, and for couples that time in child care is equal to the working hours of the parent who works the least. This should be an appropriate approximation because children to working parents are entitled to care during parents' working hours only, and all Swedish municipalities are forced by law to supply care for all children aged 1–5.<sup>15</sup> In order to calculate the child-care cost for a household, we apply household income (which we know) and time in care

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<sup>13</sup>Wage equation estimates are available on request.

<sup>14</sup>Using predicted wages for both workers and non-workers implies that the budget set is not perfectly observed. An alternative is to use observed wages for workers and predicted wages for non-workers. However, this may produce biased estimates as it could introduce spurious differences in wage distributions across the two groups.

<sup>15</sup>Kornstad and Thoresen (2006) who also assume a fixed link between hours worked and hours in child care find that for 80 percent of the Norwegian households studied, the fixed link is satisfied.

(which we approximate with working time) to each municipality’s fee structure.<sup>16</sup>

A household is defined as a social assistance recipient if it received assistance for at least one month during the year.

Descriptive statistics for the two samples used are presented in Table A.1 and A.2 in the Appendix. Single mothers are more likely to be younger, to be immigrants, to have low levels of education than married and cohabiting mothers. They are less attached to the labor market with lower labor force participation and less working hours. They also have lower wage rates and receive social assistance to a larger extent than do married and cohabiting mothers.

## 5 The Approach

We estimate the two discrete labor supply models in Section 3, one for couples and one for single mothers. The estimated parameters are used to predict pre-reform labor supply and disposable income. Then we use the parameters for simulations of the *maximum fee* reform by applying the *maximum fee* to all municipalities. We apply the fee 3 percent of gross household income for the first child, 2 percent for the second, and 1 percent for the third child for family incomes below SEK 38,000 (EUR 4,222) to all households. For incomes exceeding SEK 38,000, we apply the fees SEK 1,140 (EUR 127), 760, and 380 irrespective of hours worked. The simulations thus provide post-reform labor supply and disposable income, which we compare to the pre-reform ones.

The reform has financial consequences for the public sector. There is a direct cost of decreased child-care fees, but there are also indirect effects caused by altered labor supply and disposable income. These effects include tax revenues (labor income taxes, payroll taxes, and VAT), child-care costs (when child-care utilization changes), and expenses for housing allowance and social assistance. We take all these effects into account by aggregating the simulation results to hold for the total populations of two-parent and single-mother households with the youngest child being 1–5 years old. This enables the calculation of the aggregate net cost of the *maximum fee* reform to the Swedish public sector.

We compare the effects of the *maximum fee* reform with an alternative reform,

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<sup>16</sup>In municipalities with time differentiated fees, there are typically only a few time alternatives, so this approximation should not lead too far away from the true fees.

a reform with an income effect only. Therefore, we next calculate the child-benefit increase that gives the same budgetary implications as the *maximum fee* reform including indirect effects on public sector finances. We simulate the effects of increased child benefits, analogous to the simulations of the *maximum fee* reform.

Although both reforms make all households with preschoolers better off,<sup>17</sup> they affect household utility differently since they have different effects on labor supply and disposable income. As a means of comparison, we use equivalent variation (*EV*), a monetary value of the total utility change from each reform, defined as

$$U(h_0, y_0 + EV) + \eta_0 = U(h_1, y_1) + \eta_1, \quad (7)$$

where  $h_0$ ,  $y_0$  represent pre-reform labor supply and disposable income, and  $h_1$ ,  $y_1$  represent the post-reform ditto.  $\eta_0$  and  $\eta_1$  represent the random term included in equation (4) before and after the reform, respectively.<sup>18</sup> *EV* thus contains stochastic terms both through the  $\eta$ 's and through the unobserved heterogeneity components of  $U$ . To calculate *EV* we therefore use a numerical algorithm to find how much money the household should receive to have the same utility before the reform as after the reform.<sup>19</sup>

We can then compare the *EV* from the two reforms to conclude which reform yields the highest utility for a specific household. If one reform is preferred by some households and the other reform is preferred by others, then the reform yielding the highest aggregate *EV* ( $\sum EV$ ) is dominant according to the Potential Pareto criterion; if the dominant reform is implemented, then the households preferring that reform could compensate the households preferring the other reform.

When we compare  $\sum EV$ , we regard one additional krona in a poor household as equivalent to one additional krona in a rich household, although this can be questioned. A poor household has higher marginal utility of the extra income than a rich household. Many authors have therefore argued that instead of comparing aggregate monetary effects of reforms, the weighted sums should be compared, where households are assigned distributional weights (see e.g. Christiansen and Jansen,

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<sup>17</sup>At least weakly better off. Households who do not utilize child care neither before nor after the *maximum fee* reform get no utility change from that reform.

<sup>18</sup>Note that the random term is specific to each hours class, irrespective of the reform implemented.

<sup>19</sup>See e.g. Aaberge et al. (1995), Dagsvik and Karlström (2005) and Kornstad and Thoresen (2006) for alternative ways of estimating welfare effects in stochastic models.



1978; Drèze, 1998; Johansson-Stenman, 2005).

In the tradition of Christiansen and Jansen (1978) we attach to household  $j$  the weight  $\omega_j = y_j^{-\varepsilon}$ , where  $\varepsilon$  reflects the inequality aversion in society and  $y_j$  is the equivalence adjusted disposable household income. Hence, the social value of household  $j$ 's  $EV$  is

$$EV_j^{\text{social}} = \omega_j EV_j = y_j^{-\varepsilon} EV_j, \quad (8)$$

where a low-income household is given a stronger weight than a high-income household. How much stronger depends on the inequality aversion parameter  $\varepsilon$ . We make welfare comparisons of the two reforms for different strengths of inequality aversion and compare the sums of the weighted  $EV$ s for both reforms.

## 6 Results

### 6.1 Structural estimates

The estimated parameters of the structural models in Section 3 associated with observable and unobservable characteristics are presented in Tables A.3 and A.4 in the Appendix. The utility functions – evaluated at these estimates and at observed hours of work and disposable income – fulfill the conditions for quasi-concavity for virtually all households. The condition was rejected for only 1.5 percent of the two-parent households and 3.6 percent of the single mothers, who were then eliminated from the analysis.

Because of the non-linear nature of the model the estimates of the  $\beta_{k_i}$ 's in equation (2) are difficult to interpret directly, but they give a hint about the effects of observable characteristics on preferences for leisure and for welfare participation. For parents with preschoolers, leisure is more or less synonymous with parental child care. Hence, we find that parents with the youngest children prefer a larger share of parental care or, rather, maternal care. For mothers, both single and married, very young children therefore increase the utility of leisure (A strong positive effect on  $\beta_3$ ). Poorly educated women have a looser connection to the labor market in general, which we also find for mothers with pre-schoolers. For men, on the other hand, lower education implies less preference for leisure (those with a university degree are the omitted category), which could reflect the finding that highly educated

men spend more time caring for their children.<sup>20</sup>

We note that the cross-terms between consumption and leisure ( $\alpha_{12}$  and  $\alpha_{13}$ ) are negative, implying that households regard leisure and consumption as substitutes. In two-parent households, the leisure interaction term is negative; if one parent works a lot, the marginal utility of the other's leisure increases, which could indicate that leisure time is primarily regarded as child care time.<sup>21</sup>

Looking at the coefficients for the preferences for receiving social assistance,  $\beta_4$ , we see that couples with a one year old child are more reluctant to receiving social assistance than those with older pre-schoolers. This means that there are families with very young children eligible for social assistance, who choose not to receive it. For single mothers, we find the opposite when their youngest child is two years old; they are less reluctant to receiving social assistance compared to others. The disutility is higher among people born in Sweden than among immigrants, which is also found by Flood et al. (2004).

The estimates of the distribution of the unobserved heterogeneity components are shown in Table A.4. In the data, we identify four types of households, who are characterized by different preferences for leisure and social assistance. Almost all coefficients are significantly different from zero, which implies that preferences for leisure and social assistance to a large extent depend on these unobserved factors. Hence, when we control for observable heterogeneity, we still find differences in labor supply and welfare participation among households, due to unobserved heterogeneity. For couples, the correlation coefficient between the spouses' unobserved preference for leisure is 0.46, implying that hard working men and hard working women tend to live together (type 3), and that there are couples where both spouses have a lot of leisure (type 4). This should not be confused with the negative parameter  $\alpha_{23}$ , which reflects the marginal cross-effect on leisure and not the matching of spouses.

In Table A.5 the predicted uncompensated wage elasticities are presented. We find that labor supply is rather inelastic; for men the result is quite similar to findings in other studies. For women, there is great variation in estimated elasticities in the literature depending on model specification and data source (see e.g. Table 5 in Kornstad and Thoresen, 2007, and Appendix in Viitanen, 2005). Concerning labor force participation by married and cohabiting mothers, we find elasticities

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<sup>20</sup>See e.g. Duvander et al. (2005).

<sup>21</sup>A negative labor interaction term is also found by Aaberge et al. (1995).

considerably lower than in most studies from other countries. The exception is Wrohlich (2006), who finds the participation elasticity to be 0.15 in Germany. Also when it comes to hours worked we find an elasticity somewhat lower than what has been found in other countries for married mothers.

For single mothers, we find much larger elasticities than for married and cohabiting ones. Wage elasticities for single mothers are generally found to be higher than for married mothers,<sup>22</sup> but the existing literature shows large variation. Our results are comparable to those by Andrén (2003) and Flood et al. (2003), who study Swedish single mothers.

The reason for the comparably small labor force participation elasticity is probably due to the high participation rate among Swedish mothers; in our sample 87 percent of married and 72 percent of single mothers are actually working.

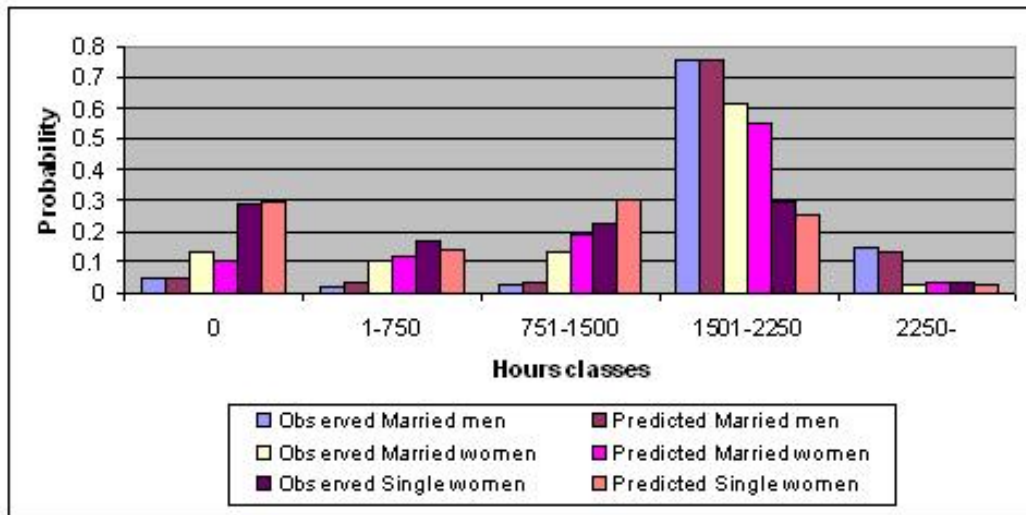


Figure 1: Observed and predicted hours of work

Figure 1 shows that the estimated model fits the data well. It shows both observed and estimated probabilities, where the latter are derived by calculating the average of the probabilities calculated in Equation (6).

## 6.2 Results of the *maximum fee* reform

The effects of the *maximum fee* reform are shown in Tables 2 and 3, where both single-mother and two-parent households are categorized according to household

<sup>22</sup>See e.g. Kimmel (1998).

disposable income.

As indicated by the wage elasticities, the effect on labor supply is stronger for single mothers than for couples. Single mothers in all income classes increase their hours worked as a consequence of the *maximum fee*, although the average effects are modest, only 1.4 percent. The effect is the strongest in the lower quartile, where hours worked increase by 16.5 percent. This effect is partly due to increased labor force participation and partly due to increased hours of work among mothers already working. Among couples, the effect on labor supply is very small in all quartiles, although both mothers and fathers, except those in the upper quartile, increase their labor supply to some extent.<sup>23</sup>

Due to decreased child-care fees, all categories of families receive higher disposable incomes. The low ceiling makes the fee reduction larger for high-income families, who gain more from the reform than low-income families in most municipalities. This is also true for the gain in utility terms, which is measured in terms of equivalent variation, *EV*.

Table 2: Simulation results for the *maximum fee* reform. Single-mother households

	Average	Lower quartile	Median	Upper quartile
Labor force participation before reform (share)	0.722	0.370	0.549	0.938
Labor force participation after reform (share)	0.727	0.387	0.559	0.938
Hours worked before reform (per year)	935	224	498	1,628
Hours worked after reform (per year)	948	261	521	1,634
Disposable income before reform (SEK per year)	129,658	83,602	101,693	174,735
Disposable income after reform (SEK per year)	134,480	86,985	105,360	181,636
EV (SEK per year)	4,349	2,002	2,882	6,696
EV (% of pre-reform disposable income)	3.4	2.4	2.8	3.8

*Note:* Hours worked are unconditional on labor force participation.

The results of the calculations of the aggregate costs for the public sector, taking also behavioral effects into account, are presented in the second column in Table 4. When the *maximum fee* is introduced revenues decrease due to decreased child-care

<sup>23</sup>According to Lundin et al. (2007) 36 percent of the households (those with the highest incomes) paid a constant maximum fee already before the reform. For them there is only an income effect associated with the *maximum fee*.

fees. At the same time, the costs to provide child care increases due to increased labor supply.<sup>24</sup> However, increased income also implies increased tax revenues, both directly and indirectly through increased consumption. Furthermore, less people need social assistance and housing allowances after the reform, leaving the public sector with a net cost of the *maximum fee* reform of SEK 1.48 billion.

### 6.3 Results of the child benefit reform

When we decide by how much to increase the child benefit, we choose an increase that has the same net aggregate cost as the *fee cap* (SEK 1,482 millions). If the child benefit would increase by SEK 5,500 per year and child aged 1–5, then the net cost would be SEK 1,489 million (see the last column in Table 4), which is approximately the same. We simulate the responses to such a reform and present the results for single mothers and for two-parent households in Table 5 and 6, respectively.

All quartiles of single mothers decrease their hours worked as a result of the increased child benefit, indicating that the income effect is strong enough to affect their behavior. Single mothers in the lower half of the income distribution also decrease their labor force participation rate. The increase in child benefit is, however, not large enough to affect labor supply among the two-parent households.

Single mothers in all quartiles are better off with the child benefit reform than with the *maximum fee* reform, both in terms of disposable income and in terms of equivalent variation. For most two-parent households the result is reversed; the child benefit reform shows to be less favorable than the *maximum fee* reform. Only those in the lower quartile are better off with increased child benefit.

## 7 Comparing the reforms

The motive for implementing the *maximum fee* reform was to increase labor supply and to improve the economic well-being of families with children. We evaluate economic well-being in terms of *EV*, which is the monetary value of the utility gain from the reform, taking the effects on leisure, consumption, and random utility into account. The aggregate utility gain for all Swedish households with children aged

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<sup>24</sup>This cost is calculated as the average cost for a full-time child-care slot. The real post-reform cost could be lower, due to more children in existing groups, or higher if new child-care centers have to be set up.

Table 3: Simulation results for the *maximum fee* reform. Two-parent households

	Average	Lower quartile	Median	Upper quartile
Husband's labor force participation before reform (share)	0.956	0.823	0.911	1.000
Husband's labor force participation after reform (share)	0.958	0.834	0.917	1.000
Husband's hours worked before reform (per year)	1,824	1,345	1,628	2,074
Husband's hours worked after reform (per year)	1,824	1,349	1,630	2,074
Wife's labor force participation before reform (share)	0.896	0.685	0.823	0.978
Wife's labor force participation after reform (share)	0.900	0.702	0.831	0.978
Wife's hours worked before reform (per year)	1,392	572	1,054	1,751
Wife's hours worked after reform (per year)	1,399	590	1,066	1,751
Disposable income before reform (SEK per year)	370,746	231,753	277,273	556,286
Disposable income after reform (SEK per year)	380,835	235,571	285,260	568,335
EV (SEK per year)	10,013	3,180	7,792	12,048
EV (% of pre-reform disposable income)	2.7	1.4	2.8	2.2

*Note:* Hours worked are unconditional on labor force participation.

Table 4: Aggregate public sector revenues and expenditures before any reform and after the *maximum fee* and increased child benefit reforms (million SEK)

	Before	<i>Maximum fee</i>	Child benefit
<b>Revenues</b>	<b>64,733</b>	<b>63,248</b>	<b>64,780</b>
Income tax	27,542	27,592	27,517
Payroll tax	23,078	23,139	23,055
VAT	10,001	10,289	10,180
Child-care fees	4,112	2,228	4,028
<b>Expenditures</b>	<b>27,569</b>	<b>27,566</b>	<b>29,105</b>
Housing allowance	672	662	681
Social assistance	553	530	495
Child-care costs	23,682	23,712	23,645
Child benefits	2,662	2,662	4,284
<b>Revenues – expenditures</b>	<b>37,164</b>	<b>35,682</b>	<b>35,675</b>
Aggregate net cost of reform		1,482	1,489
Aggregate EV		1,780	1,151

*Note:* The payroll tax is 33.06% of the gross wage rate; for the VAT we applied the rate of 17.6% on 90 % of disposable income.

Table 5: Simulation results for the child benefit reform. Single-mother households

	Average	Lower quartile	Median	Upper quartile
Labor force participation before reform (share)	0.722	0.370	0.549	0.938
Labor force participation after reform (share)	0.715	0.346	0.535	0.938
Hours worked before reform (per year)	935	224	498	1,628
Hours worked after reform (per year)	913	212	484	1,598
Disposable income before reform (SEK per year)	129,658	83,602	101,693	174,735
Disposable income after reform (SEK per year)	135,618	87,202	106,029	183,025
EV (SEK per year)	6,665	4,103	4,787	9,410
EV (% of pre-reform disposable income)	5.1	4.9	4.7	5.4

*Note:* Hours worked are unconditional on labor force participation.

Table 6: Simulation results for the child benefit reform. Two-parent households

	Average	Lower quartile	Median	Upper quartile
Husband's labor force participation before reform (share)	0.956	0.823	0.911	1.000
Husband's labor force participation after reform (share)	0.956	0.823	0.911	1.000
Husband's hours worked before reform (per year)	1,824	1,345	1,628	2,074
Husband's hours worked after reform (per year)	1,824	1,345	1,628	2,074
Wife's labor force participation before reform (share)	0.896	0.685	0.823	0.978
Wife's labor force participation after reform (share)	0.896	0.685	0.823	0.978
Wife's hours worked before reform (per year)	1,392	572	1,054	1,751
Wife's hours worked after reform (per year)	1,392	572	1,054	1,751
Disposable income before reform (SEK per year)	370,746	231,753	277,273	556,286
Disposable income after reform (SEK per year)	376,443	237,196	282,769	562,197
EV (SEK per year)	5,696	5,442	5,496	5,910
EV (% of pre-reform disposable income)	1.5	2.3	2.0	1.1

*Note:* Hours worked are unconditional on labor force participation.

1–5 is obtained from Table 4.  $\Sigma EV$  for the *maximum fee* is SEK 1.78 billion, while  $\Sigma EV$  for increased child benefit is only SEK 1.15 billion. When making this rough comparison without any distributional concern, the *maximum fee* is superior to the

alternative reform according to the Potential Pareto criterion.

What about distributional effects? In terms of disposable income, two-parent households gain more from the *maximum fee* reform than do single mothers, and high-income households gain more than low-income ones. Hence, just like Kornstad and Thoresen (2006) we find weak negative redistributive effects from fee reductions. Table 7 presents the Gini coefficients and the 90/10 measure for the disposable income of households with 1–5 year old children before and after the two reforms.<sup>25</sup>

Table 7: Distributional effects for households with children aged 1–5 years

	Before reform	<i>Maximum fee</i> reform	Child benefit reform
Gini coefficient	0.29	0.29	0.28
P90/P10	3.26	3.32	3.22

We note that the *maximum fee* reform increases the P90/P10, implying that the reform enlarges the gap between high- and low-income families with young children. On the contrary, an increased child benefit improves income equality. Hence, the preferred reform when using the Potential Pareto criterion becomes inferior if we judge the reforms from an equity point of view. From a social perspective, increased inequality in society is regarded as undesirable and should be taken into account when analyzing social welfare. We therefore weight each household’s *EV* by a social weight  $y_j^{-\varepsilon}$ , where  $y_j$  is the equivalence adjusted disposable household income and  $\varepsilon$  is society’s inequality aversion. Hence,

$$\sum_j EV_j^{\text{social}} = \sum_j y_j^{-\varepsilon} EV_j. \quad (9)$$

The larger the value of  $\varepsilon$ , the more concerned is society about inequality. If  $\varepsilon = 0$ , then Equation (9) reduces to  $\Sigma EV$ , while  $\varepsilon = \infty$  corresponds to the Rawlsian notion of equality, where only the utility change of the least well off household matters. There have been attempts to estimate plausible values of  $\varepsilon$ . Recently, the median value of  $\varepsilon$  was estimated to 2–3 by Johansson-Stenman et al. (2002), based on Swedish students’ stated preferences for equality in society. Lambert et al. (2003)

<sup>25</sup>All figures are equivalence scale corrected. The scale used is the square root of the number of household members, used by e.g. LIS, but the results are robust to alternative equivalence scale, such as the OECD scale.



estimated the inequality aversion for several countries and concluded that Sweden has a rather strong inequality aversion compared to other countries, suggesting an  $\varepsilon > 2$ .

We calculate  $\sum_j EV_j^{\text{social}}$  for the two reforms using different values of  $\varepsilon$ , including the values 0, 1, and 2. The results for the preferred reform depending on the degree of inequality aversion are reported in Table 8.

Table 8: The preferred reform for different values of  $\varepsilon$

$\varepsilon$	Preferred reform
0	<i>Maximum fee</i> reform
1	<i>Maximum fee</i> reform
<b>1.23</b>	<b>Equivalent</b>
2	Child benefit reform

The social value of the reforms depend on the degree of inequality aversion. For low values of  $\varepsilon$ , the *maximum fee* is preferred, but for the not unreasonably high value  $\varepsilon = 2$ , the increased child benefit is preferred. The threshold value of  $\varepsilon$ , where the two reforms are equivalent from a social point of view, turns out to be 1.23. Hence, for values of  $\varepsilon < 1.23$  the *maximum fee* is preferred, while the child-benefit reform is preferred for higher degrees of inequality aversion.

## 7.1 Sensitivity Analysis

The target households of our study are families with children aged 1–5. Our results are based on household behavior in 1999, and the sample used in our estimations includes families whose children are born 1994-1998 (sample A). Accordingly, some of the children born in 1998 have not yet turned one by the beginning of 1999 and, as a consequence, the children in sample A are a bit too young during the year of study. This bias is further strengthened by that children born in late 1993 are still five years old during most of 1999, but are not included in sample A. To test whether our results are sensitive to this potential timing problem we reestimate our models using another sample of households, with children born 1993-1997 (sample B). In sample B the children are instead a bit too old. The true effects should therefore be somewhere in between the effects estimated for the two samples. The estimation results for sample B are presented in Appendix B.

When using sample B, we get almost the same labor supply effects from the *maximum fee* reform as with sample A. The child benefit increase that would be budgetary equivalent is still SEK 5,500 per year and child. Consequently, the welfare analysis does not change very much, but the threshold value of  $\varepsilon$ , where the two reforms are equivalent according to social welfare has dropped marginally from 1.23 to 1.15.

In our analysis we have focused on a specific child-care fee reduction. To see if our results are more general we have also regarded completely abolished child-care fees (for sample A). The effects of such a reform on labor supply are stronger than, but similar to, those of the *maximum fee* reform. The budgetary equivalent reform to abolished fees is increased child benefits by SEK 12,500 per year and child. Also here the effects are similar to the smaller increase.<sup>26</sup> The threshold value of  $\varepsilon$  does not change significantly when we make this exercise; it increases from 1.23 to 1.26. We can thus conclude that if the aim is to increase social welfare of families with pre-school children, the choice between lower child-care fees and higher child benefits does not depend on whether the fee reduction is made by imposing the *maximum fee* or by completely abolishing fees.

## 8 Conclusions

Swedish child care is heavily subsidized. The recent Swedish *maximum fee* reform has entailed further subsidies and increased the economic well-being of most families with young children. The *maximum fee* implies lower indirect costs of market work, thereby encouraging labor supply. However, we find weaker labor supply effects than reported in comparable studies for other countries. The main reason for this is probably the Swedish pre-reform situation, characterized by high labor force participation among mothers. Another possible explanation to the small labor-supply effects is that the Swedish child-care market is not significantly burdened with rationing problems.<sup>27</sup>

So, the main explanation to the families' improved economic situation is not to be found in increased labor supply, but rather in the size of the subsidies. The *maximum*

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<sup>26</sup>The results are presented in Appendix B.

<sup>27</sup>The rationing explanation is in line with the findings of Kornstad and Thoresen (2007) that labor supply of Norwegian married and cohabiting mothers is somewhat less elastic in a non-rationing than in a rationed setting.

*fee* entails a sizable net cost to the public sector, a cost that must be financed by distortive taxes. This paper does not analyze this aspect. Our approach is instead to compare the *maximum fee* reform to an alternative, budgetary equivalent, reform of increased child benefit targeted to the same group of households.<sup>28</sup> The two reforms are compared in a welfare analysis, where welfare is calculated in terms of equivalent variation. The comparison shows that the *maximum fee* is the superior reform with regard to aggregate welfare. However, according to our simulations, two-parent and high-income households have gained more from the increased subsidies than single mothers and low-income households. This is not the case for the child benefit reform, which distributes welfare more equally among families. We compare the welfare effects for different values of inequality aversion and find that if the inequality aversion parameter  $\varepsilon \leq 1.23$ , then the *maximum fee* is preferable from a social welfare point of view. With higher weight on the equity aspect, increased child benefits would instead increase social welfare more.

The reform was implemented by a Social Democratic government. The question is whether  $\varepsilon \leq 1.23$  is a realistic figure for a government concerned with distributional effects? As discussed in Section 7, empirical studies suggest an inequality aversion greater than 2. This means that the implementation of the *maximum fee* was indeed inconsistent with the concern for income redistribution among the Swedish people and in the Social Democratic government. In other words, the gain in terms of increased labor supply is smaller than the cost in terms of foregone equity.<sup>29</sup>

It should be noted that this paper does not regard any long term consequences of any of the simulated reforms. Apps and Rees (2004) find that female labor supply and fertility rates are higher in the long run if subsidies take the form of subsidized child care rather than child benefits. This would speak in favor of the *maximum fee* in the long run. Our results are thus limited to short run effects on families with pre-school children and suggest that, for plausible values of inequality aversion,

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<sup>28</sup>Bergstrom and Blomquist (1996) discuss the choice between child-care subsidies and child benefits when tax rates are endogenous and find that childless people prefer larger subsidies to child care, because this promotes labor supply among parents, which in turn allows for tax cuts. Although our results indicate that the *maximum fee* would not allow for tax cuts, but rather increased taxes, one should bear in mind that the reform could affect other policies, as well, which in turn could have effects on the whole economy and not only those in the target group.

<sup>29</sup>A policy inconsistency of the same kind is found by Christiansen (1979) when studying the Norwegian child benefits.

the child-benefit reform would have been preferable to the already implemented *maximum fee* reform.

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## A Appendix: Sample statistics

Table A.1: Sample averages for single-mother households

Variables	Mean
On welfare	0.29
Age	32 (6)
<i>Education (highest)</i>	
Primary school	0.33
High school	0.60
University	0.07
Born in Sweden	0.81
Resides in Stockholm	0.23
Youngest child 1 year old	0.11
Youngest child 2 years old	0.16
Number of children 1–5 years old	1.14 (0.35)
Participation rate	0.72
Hours worked per year	950 (804)
Gross wage per hour (SEK)	82 (13)
Number of observations	1,209

Standard deviations within parentheses



Table A.2: Sample averages for two-parent households

Variables	Husband Mean	Wife Mean
On welfare	0.06	
Age	36 (6)	33 (5)
<i>Education (highest)</i>		
Primary school	0.13	0.10
High school	0.70	0.71
University	0.17	0.19
Born in Sweden	0.88	0.88
Reside in Stockholm	0.18	
Youngest child 1 year old	0.28	
Youngest child 2 years old	0.22	
Number of children 1–5 years old	1.60 (0.52)	
Participation rate	0.95	0.87
Hours worked per year	1,983 (605)	1,396 (756)
Gross wage per hour (SEK)	126 (22)	101 (13)
Number of observations	733	
Standard errors within parentheses		

Table A.3: Estimates of the structural labor supply model

Variables	Two-parent households				Single-mother households	
	Husband		Wife			
<i>Leisure</i>	$\beta_2$		$\beta_3$		$\beta_3$	
Child 1 year old	0.25	(0.65)	1.40***	(0.53)	6.08***	(0.71)
Child 2 years old	-0.37	(0.63)	0.82	(0.54)	0.83**	(0.38)
Reside in Stockholm	-0.06	(0.59)	-1.02*	(0.57)	-0.69**	(0.32)
Born in Sweden	-1.37**	(0.69)	-1.46***	(0.54)	-2.04***	(0.45)
Primary school	-1.61*	(0.87)	4.69***	(0.83)	2.35***	(0.64)
High school	-1.56***	(0.65)	-0.27	(0.56)	0.81	(0.52)
Age	-1.21***	(0.20)	-0.50	(0.17)	-0.20	(0.23)
Age <sup>2</sup> /100	1.62***	(0.28)	0.74***	(0.26)	0.31	(0.34)
<i>Being on welfare, <math>\beta_4</math></i>						
Child 1 year old*	-0.97***	(0.37)			-0.58	(0.55)
Child 2 years old*	-0.43	(0.45)			1.16**	(0.51)
Reside in Stockholm*	-0.39	(0.54)			-1.07**	(0.55)
Born in Sweden	-3.00***	(0.60)	-0.66	(0.58)	-4.12***	(1.22)
Primary school	0.13	(0.81)	1.87**	(0.95)	2.72***	(1.05)
High school	0.66	(0.74)	0.99	(0.85)	-0.20	(0.73)
Age	0.10	(0.28)	-0.20	(0.34)	-2.03**	(0.89)
Age <sup>2</sup> /100	-0.19	(0.38)	0.25	(0.51)	2.81**	(1.29)
<i>Utility function parameters</i>						
$\beta_1^*$	8.62***	(2.71)			15.19***	(3.52)
$\alpha_{11}^*$	-1.49***	(0.50)			-2.74***	(0.76)
$\alpha_{22}^*$	-16.55***	(1.05)				
$\alpha_{33}^*$	-10.83***	(0.77)			-3.47***	(0.74)
$\alpha_{12}^*$	-1.82***	(0.53)				
$\alpha_{13}^*$	-0.94*	(0.56)			-1.18	(0.76)
$\alpha_{23}^*$	-4.22***	(1.05)				
Log likelihood			-1,475			-2,082
Number of observations			733			1,209

Standard errors within parentheses. \*, \*\*, \*\*\* denote significance at 10, 5, and 1 percent levels, respectively.

\*Only one estimate for the household.

Table A.4: Estimates of the distribution of unobserved heterogeneity

Type (n)	Type prob. for two-parent households	Husband's leisure	Wife's leisure	Social assistance	Type prob. for single mothers	Leisure	Social assistance
	$\pi_n$	$\theta_2$	$\theta_3$	$\theta_4$	$\pi_n$	$\theta_3$	$\theta_4$
1	0.66	52.00*** (1.86)	30.81*** (0.84)	0.84 (1.28)	0.10	70.50*** (14.87)	3.35 (2.98)
2	0.19	54.84*** (3.42)	47.36*** (1.10)	-0.55 (1.32)	0.05	20.02*** (5.10)	-41.44*** (17.46)
3	0.08	-19.80*** (0.06)	22.62*** (1.65)	19.74*** (0.06)	0.40	17.12*** (4.61)	-36.15** (15.82)
4	0.07	84.40*** (1.37)	46.21*** (2.26)	-2.44*** (1.34)	0.45	14.49*** (4.48)	-28.97** (13.35)

Standard errors in parenthesis. \*, \*\*, \*\*\* denote significance at the 10, 5, and 1 percent levels, respectively.

Table A.5: Uncompensated wage elasticities

	Two-parent households		Single-mother households
	Husband	Wife	
<i>Labor force participation</i>			
Man's wage increases	0	0	
Woman's wage increases	0	0.15	0.35
<i>Hours worked conditional on participation</i>			
Man's wage increases	0.06	0	
Woman's wage increases	-0.06	0.18	0.51

## B Appendix: Sensitivity analysis

In this Appendix we first present the results of the sample including families with children born 1993 – 1997 (Sample B). Then we conduct a sensitivity analysis on sample A where child-care fees are abolished altogether and compare that reform to increased child benefits of SEK 12,500.

Table B.1: Simulation results for the *maximum fee* reform. Single-mother households (Sample B)

	Average	Lower quartile	Median	Upper quartile
Labor force participation before reform (share)	0.721	0.322	0.545	0.955
Labor force participation after reform	0.727	0.348	0.554	0.955
Working hours before reform (per year)	987	202	519	1,740
Working hours after reform (per year)	1,001	222	541	1,740
Disposable income before reform (SEK per year)	131,505	81,878	102,238	178,357
Disposable income after reform (SEK per year)	136,192	83,968	105,515	185,526
Equivalent variation (SEK per year)	4,256	1,384	2,611	6,898
Equivalent variation (% of pre-reform disposable income)	3.9	2.7	3.2	4.4

Table B.2: Simulation results for the *maximum fee* reform. Two-parent households (Sample B)

	Average	Lower quartile	Median	Upper quartile
Husband's labor force participation before reform (share)	0.950	0.809	0.904	1.000
Husband's labor force participation after reform (share)	0.952	0.816	0.908	1.000
Husband's working hours before reform (per year)	1,818	1,369	1,626	2,048
Husband's working hours after reform (per year)	1,819	1,372	1,628	2,048
Wife's labor force participation before reform (share)	0.902	0.724	0.835	0.980
Wife's labor force participation after reform (share)	0.907	0.737	0.842	0.980
Wife's working hours before reform (per year)	1,401	671	1,088	1,729
Wife's working hours after reform (per year)	1,406	686	1,098	1,729
Disposable income before reform (SEK per year)	351,461	225,244	263,979	528,732
Disposable income after reform (SEK per year)	360,914	228,737	270,827	540,490
Equivalent variation (SEK per year)	9,650	3,961	7,247	11,757
Equivalent variation (% of pre-reform disposable income)	2.7	1.8	2.7	2.2

Table B.3: Simulation results for the child benefit reform increasing benefits by SEK 5,500. Single-mother households (Sample B)

	Average	Lower quartile	Median	Upper quartile
Labor force participation before reform (share)	0.721	0.322	0.545	0.955
Labor force participation after reform (share)	0.718	0.300	0.539	0.955
Working hours before reform (per year)	987	202	519	1,740
Working hours after reform (per year)	965	202	507	1,740
Disposable income before reform (SEK per year)	131,505	81,878	102,238	178,357
Disposable income after reform (SEK per year)	137,667	85,946	106,981	186,705
Equivalent variation (SEK per year)	6,804	4,248	4,965	9,957
Equivalent variation (% of pre-reform disposable income)	5.2	5.2	4.9	5.6

Table B.4: Simulation results for the child benefit reform increasing benefits by SEK 5,500. Two-parent households (Sample B)

	Average	Lower quartile	Median	Upper quartile
Husband's labor force participation before reform (share)	0.950	0.809	0.904	1.000
Husband's labor force participation after reform (share)	0.950	0.809	0.904	1.000
Husband's working hours after reform (per year)	1,818	1,369	1,626	2,048
Husband's working hours before reform (per year)	1,818	1,369	1,626	2,048
Wife's labor force participation before reform (share)	0.902	0.724	0.835	0.980
Wife's labor force participation after reform (share)	0.902	0.724	0.835	0.980
Wife's working hours before reform (per year)	1,401	671	1,088	1,729
Wife's working hours after reform (per year)	1,401	671	1,088	1,729
Disposable income before reform (SEK per year)	351,461	225,244	263,979	528,732
Disposable income after reform (SEK per year)	357,357	230,965	269,688	534,879
Equivalent variation (SEK per year)	5,896	5,721	5,709	6,143
Equivalent variation (% of pre-reform disposable income)	1.7	2.5	2.2	1.2

Table B.5: Simulation results for abolished child-care fees. Single-mother households

	Average	Lower quartile	Median	Upper quartile
Labor force participation before reform (share)	0.741	0.382	0.580	0.954
Labor force participation after reform (share)	0.748	0.404	0.592	0.954
Working hours before reform (per year)	964	238	536	1,655
Working hours after reform (per year)	982	275	561	1,666
Disposable income before reform (SEK per year)	130,251	83,861	102,249	175,320
Disposable income after reform (SEK per year)	137,727	88,409	107,916	185,732
Equivalent variation (SEK per year)	6,744	2,959	4,682	9,934
Equivalent variation (% of pre-reform disposable income)	5.2	3.5	4.6	5.7

Table B.6: Simulation results for abolished child-care fees. Two-parent households

	Average	Lower quartile	Median	Upper quartile
Husband's labor force participation before reform (share)	0.956	0.826	0.913	1.000
Husband's labor force participation after reform (share)	0.959	0.837	0.918	1.000
Husband's working hours before reform (per year)	1,822	1,329	1,623	2,077
Husband's working hours after reform (per year)	1,823	1,334	1,625	2,077
Wife's labor force participation before reform (share)	0.903	0.708	0.837	0.978
Wife's labor force participation after reform (share)	0.920	0.775	0.871	0.978
Wife's working hours before reform (per year)	1,405	594	1,079	1,757
Wife's working hours after reform (per year)	1,418	649	1,106	1,757
Disposable income before reform (SEK per year)	370,791	233,161	278,500	553,772
Disposable income after reform (SEK per year)	395,503	248,744	300,098	581,475
Equivalent variation (SEK per year)	24,299	13,929	20,774	27,703
Equivalent variation (% of pre-reform disposable income)	6.6	6.0	7.5	5.0

Table B.7: Simulation results for the child benefit reform increasing benefits by SEK 12,500. Single-mother households

	Average	Lower quartile	Median	Upper quartile
Labor force participation before reform (share)	0.741	0.382	0.580	0.954
Labor force participation after reform (share)	0.728	0.333	0.554	0.954
Working hours before reform (per year)	964	238	536	1,655
Working hours after reform (per year)	954	217	508	1,587
Disposable income before reform (SEK per year)	130,251	83,861	102,249	175,320
Disposable income after reform (SEK per year)	141,589	92,009	111,755	189,552
Equivalent variation (SEK per year)	12,775	9,274	10,440	16,241
Equivalent variation (% of pre-reform disposable income)	9.8	11.1	10.2	9.3

Table B.8: Simulation results for the child benefit reform increasing benefits by SEK 12,500. Two-parent households

	Average	Lower quartile	Median	Upper quartile
Husband's labor force participation before reform (share)	0.956	0.826	0.913	1.000
Husband's labor force participation after reform (share)	0.956	0.826	0.913	1.000
Husband's working hours before reform (per year)	1,822	1,329	1,623	2,077
Husband's working hours after reform (per year)	1,822	1,329	1,623	2,077
Wife's labor force participation before reform (share)	0.903	0.708	0.837	0.978
Wife's labor force participation after reform (share)	0.903	0.708	0.837	0.978
Wife's working hours before reform (per year)	1,405	594	1,079	1,757
Wife's working hours after reform (per year)	1,405	594	1,079	1,757
Disposable income before reform (SEK per year)	370,791	233,161	278,500	553,772
Disposable income after reform (SEK per year)	385,336	247,537	292,879	568,232
Equivalent variation (SEK per year)	14,545	14,376	14,382	14,460
Equivalent variation (% of pre-reform disposable income)	3.9	6.2	5.2	2.6