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Maximum fee versus child benefit: a welfare analysis of Swedish child-care fee reform

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Abstract 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 preferred to the implemented fee reform.

Keywords Labor supply · Redistribution · Reform · Child care · Fees · Child benefit

JEL Classification H31 · I38 · J22

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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 preschool children, the reform implied substantially reduced child-care fees. This decreased the cost of market work and made many families better off economically. In this paper, we analyze the effects of this reform on the 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.[1] 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 very small 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 ages 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. Concerning labor-supply effects, our results are not very different from those of Lundin et al. (2007).

There is a growing literature on the effects of the price of out-of-home child care, especially on the 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 the 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, employment among married mothers are more affected by child care prices than among 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. Baker et al. (2005) study a Canadian reform similar to the Swedish one, where child care fees in Quebec were decreased to $5 a day, and find significant effects on maternal employment from reduced fees.

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

[1] 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.

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. Lundin et al. (2007) find almost no effects on married and cohabiting mothers' labor supply from the Swedish maximum fee reform.

In this paper, we study Swedish single mothers and couples and their response to increased child-care subsidies. We study the effects on maternal, as well as on paternal, labor supply. Swedish municipalities are currently obliged to provide subsidized child care to all children ages 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 ages 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 microsimulation 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 is preferred 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: Sect. 2 describes the Swedish child-care fee reform and the child-benefit system. In Sect. 3, we specify the econometric model and in Sect. 4 we describe the data. The simulation approach is presented and discussed in Sect. 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 determined 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% of the municipalities had income-based fees and 98% 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),[2] 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.

The maximum fee reform, which took effect in 2002, aimed at improving the economic situation for families with young children and increasing labor supply among parents by introducing a new fee structure for publicly subsidized child care. The new maximum fee is still based on family income, but only up to a rather low ceiling above which the fee is constant. The share of family income that is paid has also been reduced in most municipalities. For the first child, the fee is 3%, for the second child 2%, and for the third child 1% of gross family income. No fees are charged for further children. The ceiling is 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 2003).

Subsidized child care is provided by the municipalities and by law they have to provide care for all children ages 1–5.[3] Working parents are offered care for their children during their working hours only.[4] Parental fees contribute to a small part of the total child-care costs: 16% in 1999 (before the reform), and 10% in 2003 (after the reform). Remaining costs are covered by municipal subsidies and by conditional grants from the central government.

The maximum fee has undoubtedly improved the financial situation for most families with preschool children. The reason is twofold: First and foremost, child-care fees have generally decreased. Nearly all families gained from the introduction of the maximum fee, but high-income households utilizing child care during long hours gain more from the reform than low-income earners (Skolverket 2003).

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.

The Swedish child benefit is a universal non-taxable benefit paid to all mothers with children ages 16 or younger, irrespective of the parents' labor market status and

[2] Throughout the paper, we use the exchange rate SEK 9/EUR.

[3] Private child care providers are also subsidized by municipalities if they meet certain requirements and are, therefore, also affected by the maximum fee reform.

[4] However, after the child-care reform, four and five year old children are entitled to 15 hours a week irrespective of their parents' labor market status.

income. In 1999, the amount was SEK 750 (EUR 83) per month and child, and there was a supplementary child benefit from the third child onward.[5]

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.[6] 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.[7]

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).[8] Following van Soest (1995), we adopt the translog utility function, which increases in disposable income, and decreases in hours of work.

$$U(\Gamma) = \Gamma_1' A \Gamma_1 + b' \Gamma_2, \tag{1}$$

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

$\Gamma_2 = \{\log y, \log(T - h_{\mathrm{m}}), \log(T - h_{\mathrm{f}}), \sigma\}$ also includes the binary variable σ, which takes the value of one if the household is a social assistance recipient, and zero otherwise. By including σ 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 3×3 matrix with the elements α_{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 β_i, $i = 1, 2, 3, 4$, is the 1×4 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 $i = l_{\mathrm{m}}, l_{\mathrm{f}}, \sigma$) as functions of observed and unobserved characteristics:

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

[5] The monthly supplementary child benefit was SEK 200 for the third child, SEK 600 for the fourth child, and SEK 750 for following children.

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

[7] Flood and Islam (2005) show that a discrete choice model produces results similar to those obtained from a continuous model.

[8] The procedure for single mothers is analogous, but with only one labor supply variable.

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.[9] 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 π_n (where $\pi_n > 0$ and $\sum \pi_n = 1, n = 1, \ldots, N$).[10] 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:

$$\begin{aligned} y = {} & w_{\mathrm{m}} h_{\mathrm{m}} + w_{\mathrm{f}} h_{\mathrm{f}} - \tau_{\mathrm{m}}(w_{\mathrm{m}} h_{\mathrm{m}}) - \tau_{\mathrm{f}}(w_{\mathrm{f}} h_{\mathrm{f}}) + \mu(w_{\mathrm{m}} h_{\mathrm{m}} + w_{\mathrm{f}} h_{\mathrm{f}}) \\ & - \varphi\big(\min[h_{\mathrm{m}}, h_{\mathrm{f}}], (w_{\mathrm{m}} h_{\mathrm{m}} + w_{\mathrm{f}} h_{\mathrm{f}})\big) + v, \end{aligned} \tag{3}$$

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 τ, which is individual, while means-tested benefits are determined by household income. μ 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, φ, 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 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.[11] 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

$$U_{h_{\mathrm{m}} h_{\mathrm{f}} \sigma} = U(\Gamma_{h_{\mathrm{m}} h_{\mathrm{f}} \sigma}) + \eta_{h_{\mathrm{m}} h_{\mathrm{f}} \sigma}, \tag{4}$$

where $U(\Gamma_{h_{\mathrm{m}} h_{\mathrm{f}} \sigma})$ is defined in (1) for labor supply alternatives h_{m} and h_{f} ($h_i = 1, \ldots, M$ for $i = \mathrm{m}, \mathrm{f}$) and for welfare participation ($\sigma = 1$) or not ($\sigma = 0$). $\eta_{h_{\mathrm{m}} h_{\mathrm{f}} \sigma}$ is a random term, which can be interpreted as an unobserved utility component associ-

[9] Summary statistics of the x_k's are presented in Tables 8 and 9 and the estimates of the β_{k_i}'s in Table 10.

[10] In our data, we identify four different types, implying that $N = 4$.

[11] We set $h_1 = 0$, $h_2 = 375$, $h_3 = 1{,}125$, $h_4 = 1{,}875$ and $h_5 = 2{,}650$ hours per year.

ated with alternative $h_{\mathrm{m}}h_{\mathrm{f}}\sigma$. We assume that $\eta_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma}$ follows a type I extreme-value distribution with cumulative density $P(\eta_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma} < \eta) = \exp(-\exp(-\eta))$ $(\eta \in \mathbb{R})$.

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

$$l = \sum_{n=1}^{N} \pi_n \left[\sum_{\sigma=0}^{1} \sum_{h_{\mathrm{f}}=1}^{M} \sum_{h_{\mathrm{m}}=1}^{M} (p|\Theta_n)_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma} \right] \delta_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma}, \tag{5}$$

where the unobserved type $\Theta_n = \{\theta_{2_n}, \theta_{3_n}, \theta_{4_n}\}$ occurs with probability π_n and $\delta_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma}$ is an indicator for the observed state for the household, and where

$$(p|\Theta)_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma} = \frac{\exp(U(\Gamma_{h_{\mathrm{m}}h_{\mathrm{f}}\sigma}|\Theta))}{\sum_{\sigma'=0}^{1} \sum_{h'_{\mathrm{f}}=1}^{M} \sum_{h'_{\mathrm{m}}=1}^{M} \exp(U(\Gamma_{h'_{\mathrm{m}}h'_{\mathrm{f}}\sigma'}|\Theta))}, \quad \forall h_{\mathrm{m}}h_{\mathrm{f}}\sigma \neq h'_{\mathrm{m}}h'_{\mathrm{f}}\sigma' \tag{6}$$

denotes the probability that the utility in state $(h_{\mathrm{m}}h_{\mathrm{f}}\sigma)$ 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 10 and 11 in the Appendix and discussed in Sect. 6.1.

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.[12]

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 Sect. 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% 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

[12] Single-father households are excluded due to being extremely rare.

and, therefore does 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 information 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.[13] 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.[14]

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 microsimulation 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 ages 1–5.[15] In order to calculate the child-care cost for a household, we apply household income (which we know) and time in care (which we approximate with working time) to each municipality's fee structure.[16]

[13] Wage equation estimates are available on request.

[14] 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.

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

[16] 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 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 8 and 9 in the Appendix. Single mothers are more likely to be younger, to be immigrants, and 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 Sect. 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% of gross household income for the first child, 2% for the second, and 1% 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; 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,[17] 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

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

where h_0, y_0 represent pre-reform labor supply and disposable income, and h_1, y_1 represent the post-reform ditto. η_0 and η_1 represent the random term included in

[17] 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.

(4) before and after the reform, respectively.[18] EV thus contains stochastic terms both through the η'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.[19]

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 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 ε 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

$$EV_j^{\text{social}} = \omega_j EV_j = y_j^{-\varepsilon} EV_j, \tag{8}$$

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

6 Results

6.1 Structural estimates

The estimated parameters of the structural models in Sect. 3 associated with observable and unobservable characteristics are presented in Tables 10 and 11 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% of the two-parent households and 3.6% of the single mothers, who were then eliminated from the analysis.

[18] Note that the random term is specific to each hours class, irrespective of the reform implemented.

[19] 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.

Because of the non-linear nature of the model the estimates of the β_{k_i}'s in (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 their utility of leisure (a strong positive effect on β_3). Poorly educated women have a looser connection to the labor market in general, which we also find for mothers with preschoolers. 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.[20]

We note that the cross-terms between consumption and leisure (α_{12} and α_{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.[21]

Looking at the coefficients for the preferences for receiving social assistance, β_4, we see that couples with a one year old child are more reluctant to receiving social assistance than those with older preschoolers. 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 is 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 11. 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 α_{23}, which reflects the marginal cross-effect on leisure and not the matching of spouses.

In Table 12, 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 considerably lower

[20] See e.g. Duvander et al. (2005).

[21] A negative labor interaction term is also found by Aaberge et al. (1995).

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,[22] 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% of married and 72% of single mothers are actually working.

Figure 1 in the Appendix 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 (6).

6.2 Results of the maximum fee reform

The effects of the maximum fee reform are shown in Tables 1 and 2, where both single-mother and two-parent households are categorized according to household 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%. The effect is the strongest in the lower quartile, where hours worked increase by 16.5%. This effect is partly due to increased labor force participation and partly due to increased hours of work among mothers already working.

Table 1 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

[22] See e.g. Kimmel (1998).

Table 2 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

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.

Due to decreased child-care fees, all categories of families receive higher disposable incomes. The low cap 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*.

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 3. When the maximum fee is introduced, revenues decrease due to decreased child-care fees. At the same time, the costs to provide child care increases due to increased labor supply.[23] 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 maximum fee (SEK 1,482 millions). If the

[23] 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 Aggregate public sector revenues and expenditures before any reform and after the maximum fee and increased child benefit reforms (million SEK)

	Before	Maximum fee	Child benefit
Revenues	**64,733**	**63,248**	**64,780**
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
Expenditures	**27,569**	**27,566**	**29,105**
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
Revenues–expenditures	**37,164**	**35,682**	**35,675**
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 4 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

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 3), 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 Tables 4 and 5, 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

Table 5 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

behavior. Single mothers in the lower half of the income distribution also decrease their labor force participation rate. The child benefit increase 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 ages 1–5 is obtained from Table 3. $\sum EV$ for the maximum fee is SEK 1.78 billion, while $\sum EV$ 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

Table 6 Distributional effects for households with children ages 1–5 years

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

Table 7 The preferred reform for different values of ε

ε	Preferred reform
0	Maximum fee reform
1	Maximum fee reform
1.23	**Equivalent**
2	Child benefit reform

and Thoresen (2006), we find weak negative redistributional effects from fee reductions. Table 6 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.[24]

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 disposable 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 ε is society's inequality aversion. Hence,

$$\sum_j EV_j^{\text{social}} = \sum_j y_j^{-\varepsilon} EV_j. \tag{9}$$

The larger the value of ε, the more concerned is society about inequality. If $\varepsilon = 0$, then (9) reduces to $\sum EV$, 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 ε. Recently, the median value of ε 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) estimated the inequality aversion for several countries and concluded that Sweden has a rather strong inequality aversion compared to other countries, also suggesting an $\varepsilon > 2$.

We calculate $\sum_j EV_j^{\text{social}}$ for the two reforms using different values of ε, including the values 0, 1, and 2. The results for the preferred reform depending on the degree of inequality aversion are reported in Table 7.

[24] 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.

The social value of the reforms depend on the degree of inequality aversion. For low values of ε, the maximum fee is preferred, but for the not unreasonably high value $\varepsilon = 2$, the increased child benefit is preferred. The threshold value of ε, 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 ages 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 potential 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 presented in Brink et al. (2007).

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 ε, 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.[25] The threshold value of ε 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 preschool 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 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

[25] The results can be found in Brink et al. (2007).

than reported in comparable studies for other countries.[26] The main reason for this is probably the Swedish pre-reform situation, characterized by high labor force participation and high labor supply 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.[27]

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 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.[28] 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 Sect. 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.[29]

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 preschool children and suggest that, for plausible values of inequality aversion, the child-benefit reform would have been preferable to the already implemented maximum fee reform.

[26] Lundin et al. (2007) who study the same Swedish reform, also find very small labor-supply effects.

[27] 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.

[28] Bergstrom and Blomquist (1995) 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.

[29] A policy inconsistency of the same kind is found by Christiansen (1979) when studying the Norwegian child benefits.

Appendix: Sample statistics

Table 8 Sample averages for single-mother households

Variables	Mean
On welfare	0.29
Age	32
	(6)
Education (highest)	
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 9 Sample averages for two-parent households

Variables	Husband mean	Wife mean
On welfare	0.06	
Age	36	33
	(6)	(5)
Education (highest)		
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	1,396
	(605)	(756)
Gross wage per hour (SEK)	126	101
	(22)	(13)
Number of observations	733	

Standard errors within parentheses

Table 10 Estimates of the structural labor supply model

Variables	Two-parent households				Single-mother households	
	Husband		Wife			
Leisure	β_2		β_3		β_3	
Child 1 year old	0.25	(0.65)	1.40[c]	(0.53)	6.08[c]	(0.71)
Child 2 years old	−0.37	(0.63)	0.82	(0.54)	0.83[b]	(0.38)
Reside in Stockholm	−0.06	(0.59)	−1.02[a]	(0.57)	−0.69[b]	(0.32)
Born in Sweden	−1.37[b]	(0.69)	−1.46[c]	(0.54)	−2.04[c]	(0.45)
Primary school	−1.61[a]	(0.87)	4.69[c]	(0.83)	2.35[c]	(0.64)
High school	−1.56[c]	(0.65)	−0.27	(0.56)	0.81	(0.52)
Age	−1.21[c]	(0.20)	−0.50	(0.17)	−0.20	(0.23)
$\text{Age}^2/100$	1.62[c]	(0.28)	0.74[c]	(0.26)	0.31	(0.34)
Being on welfare, β_4						
Child 1 year old*	−0.97[c]	(0.37)			−0.58	(0.55)
Child 2 years old*	−0.43	(0.45)			1.16[b]	(0.51)
Reside in Stockholm*	−0.39	(0.54)			−1.07[b]	(0.55)
Born in Sweden	−3.00[c]	(0.60)	−0.66	(0.58)	−4.12[c]	(1.22)
Primary school	0.13	(0.81)	1.87[b]	(0.95)	2.72[c]	(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[b]	(0.89)
$\text{Age}^2/100$	−0.19	(0.38)	0.25	(0.51)	2.81[b]	(1.29)
Utility function parameters						
β_1*	8.62[c]	(2.71)			15.19[c]	(3.52)
α_{11}*	−1.49[c]	(0.50)			−2.74[c]	(0.76)
α_{22}*	−16.55[c]	(1.05)				
α_{33}*	−10.83[c]	(0.77)			−3.47[c]	(0.74)
α_{12}*	−1.82[c]	(0.53)				
α_{13}*	−0.94[a]	(0.56)			−1.18	(0.76)
α_{23}*	−4.22[c]	(1.05)				
Log likelihood	−1,475				−2,082	
Number of observations	733				1,209	

Standard errors within parentheses. [a], [b], [c] denote significance at 10, 5, and 1% levels, respectively.
*Only one estimate for the household

Table 11 Estimates of the distribution of unobserved heterogeneity

Type (n)	Type prob. for two-parent households π_n	Husband's leisure θ_2	Wife's leisure θ_3	Social assistance θ_4	Type prob. for single mothers π_n	Leisure θ_3	Social assistance θ_4
1	0.66	52.00[c]	30.81[c]	0.84	0.10	70.50[c]	3.35
		(1.86)	(0.84)	(1.28)		(14.87)	(2.98)
2	0.19	54.84[c]	47.36[c]	−0.55	0.05	20.02[c]	−41.44[c]
		(3.42)	(1.10)	(1.32)		(5.10)	(17.46)
3	0.08	−19.80[c]	22.62[c]	19.74[c]	0.40	17.12[c]	−36.15[b]
		(0.06)	(1.65)	(0.06)		(4.61)	(15.82)
4	0.07	84.40[c]	46.21[c]	−2.44[c]	0.45	14.49[c]	−28.97[b]
		(1.37)	(2.26)	(1.34)		(4.48)	(13.35)

Standard errors in parenthesis. [a], [b], [c] denote significance at the 10, 5, and 1% levels, respectively

Table 12 Uncompensated wage elasticities

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

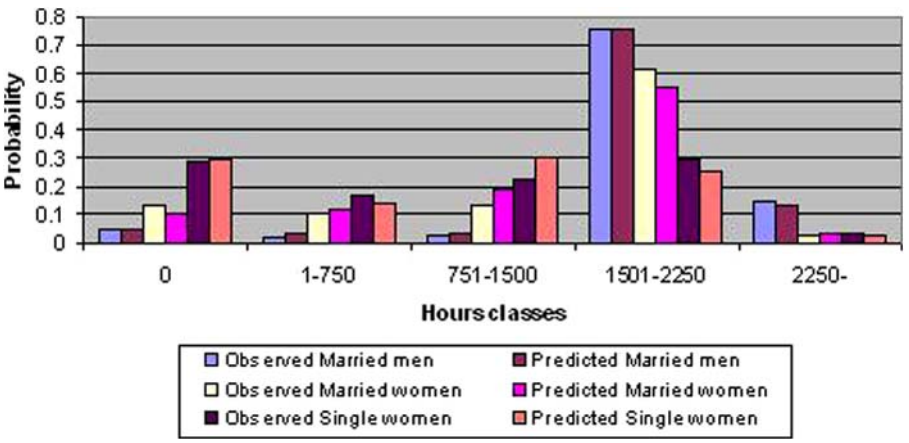

Fig. 1 Observed and predicted hours of work

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