Discussion Papers No. 262, November 1999
Statistics Norway, Research Department

Tom Kornstad and Thor O. Thoresen

Means-testing the Child Benefit

Abstract:
Improving the distributional impact of transfers may be costly if it reduces labour supply. In this paper we show how effects of changes in the design of the child benefit programme can be examined by deriving information from behavioural and non-behavioural simulations on micro data. The direct distributional effects are assessed by tax–benefit model calculations. Female labour supply responses to alternative child benefit schemes are simulated under the assumption that choices are discrete. The discrete choice model is justified with reference to the complicated process of finding a new job, and the existence of peaks in the empirical distribution of hours is interpreted as variation in number of jobs across states. The distribution of income after labour supply responses is also shown. The analysis confirms that enhanced distributional impact is traded against reductions in labour supply.

Keywords: Micro simulation, Labour supply, Discrete choice, Means-testing

JEL classification: C35, D12, H23, H31, J22

Acknowledgement: We particularly thank John Dagsvik for many helpful comments and suggestions. Valuable comments are also received from Iulie Aslaksen, Nils M. Stølen, Rolf Aaberge and seminar participants at the 1998 annual meeting for the Economic Research Programme on Taxation, Halvorsbøle (Norway) and at the 55th Congress of the International Institute of Public Finance, Moscow, August 1999. We have benefited from research assistance by Ingeborg F. Solli and Bård Lian. Financial support from the Norwegian Research Council is gratefully acknowledged.

Address: Thor O. Thoresen, Statistics Norway, Research Department. E-mail: thor.olav.thoresen@ssb.no, Tom Kornstad, Statistics Norway, Research Department, E-mail: tom.kornstad@ssb.no

Discussion Papers comprise research papers intended for international journals or books. As a preprint a Discussion Paper can be longer and more elaborate than a standard journal article by including intermediate calculation and background material etc.

Abstracts with downloadable PDF files of
Discussion Papers are available on the Internet: http://www.ssb.no

For printed Discussion Papers contact:

Statistics Norway
Sales- and subscription service
N-2225 Kongsvinger

Telephone: +47 62 88 55 00
Telefax: +47 62 88 55 95
E-mail: Salg-abonnement@ssb.no

1. Introduction

The transfers to families with children have increased steadily the last decade in Norway. One important reason for this is that the child benefit expenditures have increased by about 25 per cent in real terms from 1990 to 1998, to about NOK 13 billions in 1998. All families with children less than 16 years receive child benefit, and uncertainty about whether the substantial costs of the scheme are justified by favourable distributional effects or simplicity of the universal design, have led to proposals of changes in the child benefit programme. Taxation of the child benefit as wage income or testing the transfer against family income are two alternatives of means-testing that have been suggested. Both proposals are associated with an income inequality reducing effect, as it is expected that the transfer will be more targeted towards low-income groups by these changes.

While recent contributions on means-testing and targeting either neglect effects on work incentives or employ only numerical illustrations when discussing such effects (cf., e.g., Besley 1990; Creedy 1996; Creedy 1998), the present analysis is detailed on labour supply effects. Labour supply responses are important both from an efficiency point of view and because labour supply responses influence the distribution of income, both within and between families. In the following we discuss taxation and income-testing of the child benefit with respect to 1) direct distributional effects between families, 2) labour supply responses and 3) distributional effects after labour supply responses.[1]

The direct (non-behavioural) distributional effects of altering the child benefit transfer system are described by tax-benefit model calculations, whereas a structural labour supply model is applied in the analysis of the labour supply responses. The analysis is restricted to married mothers, since the labour supply decision of lone mothers is assumed to depend on special support programmes for lone parents. The labour supply simulations are carried out for (married) mothers only, since men are rather insensitive to alterations in taxes and transfers (Blundell 1993).

Empirical specifications of labour supply models have been extensively discussed the last decades, cf. the survey in Blundell and MaCurdy (1998). It is typically assumed that hours of work is a continuous variable, and a major problem has been how to handle the problems related to non-linearities in the budget constraints induced by tax- and transfer systems. Today the standard approach is to approximate the budget constraint by a piecewise-linear budget constraint, and estimate the model by maximum likelihood. MaCurdy et al. (1990), however, show that maximum likelihood estimation of labour supply models with piecewise-linear budget sets, invoke restrictions that influence on

---

[1] Of course, there might be other important motives when determining the child benefit scheme. For instance, Sadka et al. (1982) emphasise the stigma associated with income-testing, while Lundberg et al. (1997) stress the importance of the child benefit on the intra-family distribution of consumption.

estimates. The present analysis therefor employ a less restrictive approach by modelling labour supply behaviour as a discrete choice problem, see, e.g., van Soest (1995), Bingley et al. (1995), Duncan and Weeks (1997), Aaberge et al. (1995) and Dagsvik and Strøm (1997) for other labour supply analyses employing discrete choice models.

In the specification of our model, we argue that finding work is a complex process, since job offers differ with respect to hours of work, wage rate and non-pecuniary benefits, and job searchers don't have full information about all these aspects. Job searchers then simplify the choice process by classifying jobs into different hours of work intervals, for instance full-time jobs, overtime jobs and part-time jobs in addition to the possibility of not participating in the labour market. By grouping jobs, they ignore that different jobs within an interval involve (minor) differences in hours of work and focus on the main feature of hours of work. The job searchers then optimise to a range of hours rather than to an exact level of hours of work, and the hours of work choice should then be analysed as a discrete choice problem. In contrast to Duncan and Weeks (1997) who refer to institutional constraints at the demand side as justification for their discrete choice approach, our validiation is based on the supply side behaviour of individuals.

An advantage of this approach is that the peaks in the empirical distribution of hours of work (for instance at full-time work) can be more realistically included in model specifications. One method of taking account of peaks is to introduce dummy variables in the specification of preferences, see van Soest (1995). We do, however, interpret the peaks as a sign of extensions in the number of job offers. Under this exposition the number of jobs in the various intervals should be included as parameters in the specification of the likelihood-function. Since the data do not include this information, the relative number of jobs in the various intervals are treated as parameters, which are estimated.

Compared to models which treat hours of work as a continuous variable, the discrete choice approach gains from treating non-convex budget sets and income-tested transfers without further complicating the estimation- and simulation procedures. By simulating the labour supply responses for each female, the analysis also takes care of the heterogeneous responses to changes in the tax and transfer system.

The results show that taxation of the child benefit as wage income for married females is not as beneficial for the lower deciles as might be expected. The reason is that the progressive components of the Norwegian income tax are not very effective in this case. From an income redistributive point of view, it is more efficient to test the transfer against family income. According to the behavioural simulation results, the responses from taxing the child benefit as wage income for the mothers are quite small. The labour supply effects of testing the child benefit against family income are, however, substantial. The income-testing is carried out by deducting one tenth of a NOK in child benefit for every NOK the family earns in excess of NOK 250 000 and then redistributing the revenue surplus as increased child benefit rates. We predict that total labour supply for married females is reduced by about 5 per cent if the child benefit scheme is altered in this revenue-neutral mode.

In the final part of the paper we study how the distribution of income is affected by these labour supply responses. Income-testing gives reductions in the middle of the income distribution, measured by reductions in equivalent income.

The paper is organised as follows: Section 2 provides a rather detailed presentation of our discrete-choice model and the estimation results. The direct effects of means-testing are described in Section 3, while the labour supply effects and the distribution of income after responses are discussed in Section 4. Section 5 concludes.

2. A discrete-choice model for labour supply

2.1 Empirical specification

The specification of the labour supply model is motivated from the two following observations: Firstly, it is difficult to compare the utility of having various jobs. Job offers differ along a variety of dimensions such as hours of work, pre-tax wage rates for ordinary as well as overtime work, tasks and work pressure, work environment and non-pecuniary benefits, and one has only limited information about these variables. Hence it is reasonable to assume that one somehow simplifies this process. Secondly, there are peaks in the empirical distribution of hours, for instance around full-time work. Nevertheless, data show that there are many other working times present, which indicates some flexibility with respect to hours of work.[2] The challenge is, thus, to establish a discrete choice model where the job searcher can choose between jobs with a large variation in hours of work and where the numbers of job offers varies across the working hours distribution.

The model specification suggested here implies that each female is assumed to choose between a large, but finite number of jobs consisting of a particular combination of hours of work, pre-tax wage rate and a package of non-pecuniary benefits. However, she simplifies the choice by classifying all jobs into different working time categories, corresponding to overtime jobs, full-time jobs, and a number of part-time jobs, in addition to the option of working at home. For simplicity, we divide the weekly

[2] The main reason that there are more full-time than part-time jobs is that there are economies of scale with respect to working time, such as the demand for full-time workers is higher than for part-time workers.

hours of work into 6 intervals of the same length. It is assumed that the female can choose between overtime jobs (45-55 hours per week), full-time jobs (34-44 hours per week), three types of part-time jobs corresponding to 23-33 hours per week, 12-22 hours per week, and 1-11 hours per week, and the possibility of not participating in the labour market.[3] The choice set of weekly hours of work, $B=\{0, 6, 17, 28, 39, 50\}$ is chosen as the middle point values of these intervals.

We also simplify by assuming that the pre-tax wage rate (w) is constant across all job offers for a particular worker.[4] The main reason for this assumption is that we do not know the wage rate distributions for the individuals in the sample. We believe that constancy of pre-tax wage rates across jobs for a particular individual is in accordance with wage bargaining in Norway, since wage rates are typically determined in negotiations with trade unions that do not discriminate between full-time and part-time workers. The wage rates for non-workers are obtained from a wage equation, see section 2.2 for further details.

Household consumption corresponding to choosing a job with hours of work in interval j is given by

$$(1) \qquad C_j = wh_j + k - T(wh_j, k), \; h_j \in B.$$

Non-labour incomes (k) include the households' capital incomes, child allowances, and other public transfers as well as labour income of the spouse.[5] In contrast to van Soest (1995), we do not include unemployment benefits as income in the non-working state. The reason is that it is difficult to receive unemployment benefits and be voluntarily without work in the Norwegian system.

A tax-benefit model is employed in the calculation of income taxes (T). This means that we take into account the most detailed aspects of the Norwegian tax system, and joint as well as separate filing are considered.

We assume that household preferences can be represented by a «Box-Cox» type utility function. See, for instance, MaCurdy (1981) and Aaberge et al. (1995) for empirical analyses applying this

---

[3] Notice that the interval length is assumed to be fixed, which implies that a modification of the likelihood function with respect to different length of intervals is avoided.

[4] Cf. Aaberge et al. (1995) for an approach with differing wage rates.

[5] A basic assumption in our work is that the female makes her working time conditioned on her husband's, as opposed to the analysis in e.g. Aaberge et al. (1995).

specification[6]. The utility of having a particular job *k* with hours of work in interval *j* can then be written as

(2) $$U_{jk} = v_j + \varepsilon_{jk}, \quad k \in B_j,$$

where

(3) $$v_j \equiv \gamma_0 \frac{C_j^{\alpha_1} - 1}{\alpha_1} + \frac{(1 - \frac{h_j}{M})^{\alpha_2} - 1}{\alpha_2} X\beta,$$

is the structural part of the utility function. Here, B_j is the choice set of jobs with weekly hours of work in interval *j*, γ_0, α_1, α_2 are parameters, β is a vector of parameters and M =8760 is the total number of annual hours. The vector of household-specific taste-modifier variables X includes ln(age) (X_1), ln(age) squared (X_2), the number of children aged less than three years (X_3) and the number of children aged three to sixteen (X_4). The classification according to children's age takes into account the high contribution rate for older pre-schoolers at child care centres, which makes these children more similar to school children. For the utility function to be quasi-concave, we require α_1<1 and α_2 <1. Note also that if $\alpha_1 \rightarrow 0$ and $\alpha_2 \rightarrow 0$, the utility function converges to a log-linear function.

Whereas the study assumes that individuals are rational in the sense that they make choices that maximise their perceived utility subject to the budget constraint, there are errors in this maximisation due to imperfect perception and imperfect optimisation. Such errors may arise from unobserved alternative specific variables influencing utility, for instance fringe benefits. The study assumes that the effects of these components on utility can be summarised into additive, job specific error terms ε_{jk} that are i.i.d. according to the standard type I extreme value distribution,

(4) $$\Pr(\varepsilon_{jk} < \varepsilon) = \exp(-\exp(-\varepsilon)), \quad \varepsilon \in \mathrm{R}.$$

The model specification may also suffer from other types of errors such as unobserved household characteristics or measurement errors of hours of work. For the sake of simplicity we ignore hours of work errors since they cannot be considered without complicating the estimation procedure, see Ben-Akiva and Lerman (1985) and van Soest (1995). Unobserved household characteristics are only considered in so far as they do not make the error term correlated across jobs.

---

[6] Dagsvik and Strøm (1997) provide further justification for this choice.

Given our distributional assumption and the assumption that utility is maximised, it is well known (cf. Maddala 1983) that the probability of choosing a particular job k with working time in interval j is given by

$$(5) \qquad P_{jk} \equiv P\left(U_{jk} = \max_{r}\left(\max_{s\in B_r} U_{rs}\right)\right) = \frac{e^{v_j}}{\Sigma_{r}\Sigma_{s\in B_r} e^{v_r}},$$

where v_r and v_j are household utility (2) evaluated at hours of work corresponding to interval r and j. We are, however, primarily interested in the probability of choosing some arbitrary job with working time in interval j. This probability is given by

$$(6) \qquad P_j = \sum_{s\in B_j} P_{js} = \frac{\Sigma_{s\in B_j} e^{v_j}}{\Sigma_{r}\Sigma_{s\in B_r} e^{v_r}} = \frac{n_j e^{v_j}}{\Sigma_{r} n_r e^{v_r}},$$

where n_r denotes the number of jobs with hours of work in interval r. The peaks in the distribution of hours of work, which indicates that the number of job offers varies across intervals, are represented by the assumption that there are more full-time jobs (n_4) and non-participation possibilities (n_0), while the number of different part-time and overtime jobs are identical, i.e. $n_r = n$ for $r=1,2,3,5$.

Equation (6) then implies that the probability of having a job with working time corresponding to interval j is given by

$$(7) \qquad P_j = \frac{n_j e^{v_j}}{n_0 e^{v_0} + \sum_{r=1,2,3,5} n e^{v_r} + n_4 e^{v_4}}.$$

Dividing numerator and denominator by n and rearranging the resulting equation, yield

$$(8) \qquad P_j = \frac{e^{v_j + \ln(n_j/n)}}{e^{v_0 + \ln(n_0/n)} + \sum_{r=1,2,3,5} e^{v_r} + e^{v_4 + \ln(n_4/n)}}.$$

This equation shows how the probabilities in the likelihood function can be modified to account for the differing number of job offers across intervals. Consequently, the specification of probabilities should be adjusted by adding the logarithm of the fraction between the number of jobs in the interval and n, i.e. representing the deviations from n for non-working and full-time working intervals.

A problem in that respect is that one typically does not observe the number of jobs, but this problem can be taken care of by noticing that $ln(n_i/n)$, for $i=0,1,...,5$, are parameters that vary across intervals, but not across individuals. These parameters can then be treated as interval specific parameters, and in the specification of the likelihood function we do that by introducing two dummy variables. The dummy variable D_1 is 1 for full-time work and 0 otherwise, whereas D_2 is 1 if the person works and 0 otherwise. The full-time dummy is justified by reference to demand side factors, as economies of scale with respect to working hours.[7] Accordingly, the out-of-work alternative is given special treatment, since the number of non-working options deviates from number of jobs in the market.

2.2. Data and estimation results

In the calculations of the direct effects of the child benefit we apply the Norwegian tax-benefit model LOTTE[8] and the 1994-wave of the Income Distribution Survey (IDS). LOTTE calculates taxes and transfers for a sample of individuals, more than 40 000 in 1994. Of these, about 17 000 belong to a household with a mother eligible for child benefit.

IDS does not include information about wage rates or hours of work, but these data are available from the Standard of Living Survey. We utilise that the Standard of Living Survey 1995 is a sub-sample of IDS-94 and that these two surveys can be linked on the basis of personal identification numbers. Thus, the estimation and simulations of the behavioural effects are based on smaller samples of individuals than the calculations of the direct effects. After restricting to married, female wage-earners/home-workers older than 24 and younger than 65, the sample used in the estimation includes about 500 women. This sample also includes females without children, since it is assumed that their behaviour in the labour market contains information about the labour supply behaviour of mothers. In contrast, the simulations are executed only for the child benefit-eligible females in this sample, approximately 300 mothers. Table 1 provides sample statistics for the data set exploited in the estimation.

[7] There might be other candidates for explaining peaks in the hours of work distribution. For instance can females' preferences concerning working hours be mutually influenced in favour of working full-time. Neumark and Postlewaite (1998) and Woittiez and Kapteyn (1998) provide results that can interpreted in favour of this rationalisation.

[8] The model is extensively used in the preparation of the national budgets in Norway.

Table 1. Sample statistics

Variable	*Mean*	*Standard deviation*
Household disposable income (NOK)	324794	102955
Age of wife	42.7	10.0
Number of children 0–2 years	0.18	0.42
Number of children 3–15 years	0.84	1.00
Full-time dummy	0.46	0.50
Participation dummy	0.86	0.35
Gross wage rate (NOK)	103.1	33.0
Working hours per week	27.0	14.1

Hourly gross wage rates are calculated from dividing yearly labour income by yearly hours of work. Additional information, such as indications of transitory connections to work, is employed in order to improve wage estimates (see Appendix A).

For non-workers the pre-tax wage rates are estimated using a wage rate equation, where log(w) is the dependent variable and years of education, experience (measured as age minus years of education and minus pre-school years), and experience squared are the explanatory variables. We have considered selectivity bias in the estimation of the wage rate equation, but the parameter estimate of the Mills ratio is not statistically significant. The reason is that the participation rate is very high in Norway, about 85 per cent for married women, cf. Table 1.

Table 2 reports the estimates of the parameters in the utility function. The parameters (α_1, γ_0) and (α_2, β_0, β_1, β_2, β_3, β_4) determine the utility of consumption and leisure respectively. In order to ensure that the deterministic part of preferences is strictly quasi-concave in (C,h), α_1 and α_2 must be less than one. According to the table, the estimates of these parameters are 0.78 and -11.61 respectively, and the parameters are determined quite precisely.[9]

The estimates of β_0, β_1, and β_2 imply that women's preferences for leisure increase with age. Preference for leisure also increases if the woman has children and the point estimates indicate that preferences for leisure are not much stronger if the children are young (β_3) than if they are older (β_4).

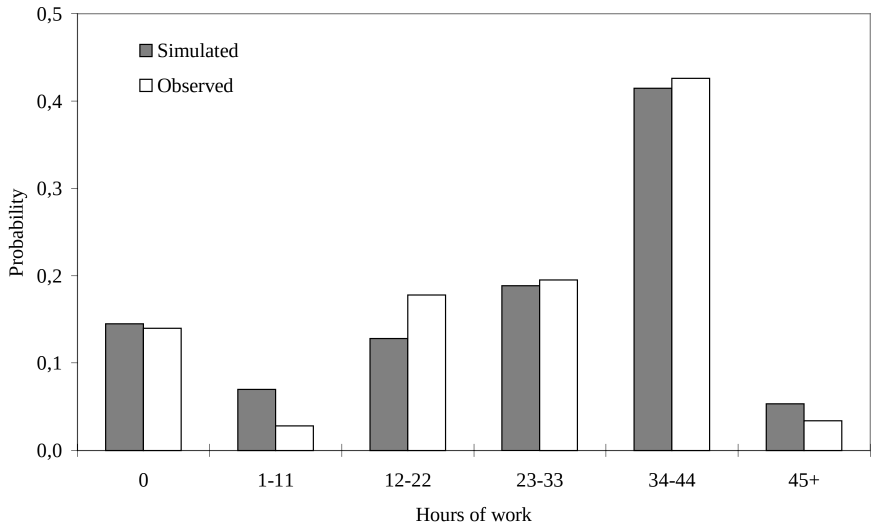
[9] A 12-state version has also been estimated with very similar results.

Table 2. Estimates of the parameters in the utility function

Variables		*Estimates*	*t-statistic*
Consumption	γ_0	0.458	2.5
	α_1	0.776	6.5
Leisure	β_0	49.257	2.2
	β_1	-27.538	2.2
	β_2	3.882	2.2
	β_3	0.315	1.7
	β_4	0.256	2.0
	α_2	-11.610	7.4
Full-time dummy	δ_1	1.125	5.6
Participation dummy	δ_2	-1.045	5.1

In order to evaluate the model specifications, Figure 1 displays the observed and simulated distribution of hours of work. It demonstrates that the model reproduces the observed distribution quite well.

Figure 1. The distribution of observed and simulated hours of work for females



3. Direct effects of targeting the child benefit

3.1 Income definitions

This section discusses the direct distributional effects of alterations in the child benefit scheme, as described by simulation results from the tax-benefit model. Empirical evaluations of the direct effect of changes in taxes and transfers are associated with methodological controversies. Income definitions and techniques for the re-weighting of income may impact on the assessment of distributional effects of tax policy changes. An extensive examination of these issues is beyond the scope of this paper, but the following points summarise our main assumptions:

- Post-tax income is defined as gross income minus taxes, plus a number of tax-free benefits such as the child benefit, housing benefits, social security benefits, etc. Interest expenses, for instance from house acquisitions, are not deducted, due to the undervaluation of imputed income from owner-occupied homes in our data.[10]
- Post-tax income is aggregated over household members, weighted with an equivalence scale and each household is represented with as many persons as the number of household members. The equivalence scale is defined by the square root of number of household members (Buhmann et al. 1988), where the relative weight given to a child is 0.75 of an adult.

3.2. Taxation of the child benefit

According to Bradshaw et al. (1993, p. 70) the Norwegian child benefit scheme is rather generous compared to other countries' schemes. It is paid to the mothers of children younger than 16 years of age. For the first child they received NOK 10 416 in 1994; the amount per child increases with the number of children in the family.[11] In Table 3 we present the distribution of equivalent income and the corresponding equivalent child benefit for married couples with children between 0–16 years of age.[12] Table 3 also includes estimates for working hours in deciles. These are imputed from the sample of approximately 300 married mothers, exploited in Section 2. The table shows a positive correlation between equivalent income and female working hours. Ranking of individual well-being according to equivalent income is thus questionable, but this problem is ignored in the following.

According to the table, the distributional impact of the child benefit can be characterised as favourable since the lower income deciles on average receive more of the benefit than the richer individuals. The result is due to a negative correlation between equivalent income and number of benefit-eligible children.

It has been proposed to tax the child benefit as wage income for the mother. Since the Norwegian tax system is progressive, one would normally assume that the inclusion of the child benefit in taxable income would prove relatively advantageous to the poorest families. However, as seen in Table 4, the direct effect of taxing the child benefit as wage income is not very beneficial for the lower deciles. The distribution of the benefit, as depicted in Table 3, is important when interpreting this result. Another reason is the ambiguous relationship between the ranking by equivalence scales and the ranking by tax

---

[10] By calculating an average ratio between the market value (only reported by a smaller number of individuals) and the income tax return value of housing, we have estimated income from housing and defined an alternative income concept. The distribution of income when including «market profits» from housing and deducting interest rates is not very different from the distribution of income when using the standard definition.

[11] For instance, the child benefit for the fifth child was 13 392 NOK in 1994.

[12] There are special arrangements for lone parents.

progression (see, e.g., Lambert 1993), implying that persons with high incomes might be found in the lower equivalent income deciles. Most crucially, the key progressive element in the Norwegian tax system, the surtax,[13] is not very effective in this case. The tax revenue increases by about NOK 4,3 billion with this reform, but only about seven per cent is due to the surtax. This means that only a smaller fraction of mothers is liable to surtax.

Table 3. Average equivalent income (NOK) in deciles and the corresponding values for esti mated working hours and the child benefit. Married couples with children 0–16 years. 1994

Decile	*Equivalent income*	*Estimated number of weekly hours of work for mothers**	*Equivalent child benefit*
1	89 875	12	13 599
2	120 295	18	12 502
3	135 436	18	11 650
4	147 697	26	11 003
5	158 662	26	11 299
6	169 888	28	11 050
7	182 727	28	10 314
8	199 012	31	9 801
9	222 466	31	9 801
10	342 266	30	9 746
Average	176 832	25	11 076

*The measures for working hours have been imputed from the sub-sample of married mothers exploited in the behavioural analysis.

Since the lower deciles' share in the increased tax burden is larger than the upper deciles' share, the reform cannot be recommended on equity grounds, as defined here. In fact, measured by the Gini coefficient, the inequality among individuals in households with children increases by about three per cent by including the child benefit in taxable income. A three per cent increase in the Gini coefficient corresponds to introducing an equal-sized lump-sum tax of three percent of the mean income and redistributing the collected tax revenue as proportional transfers where each unit receives three per cent of its income (Aaberge 1997). Alternatively, it can be interpreted as a three per cent increase in the expected difference in incomes between two individuals drawn at random from the income distribution (Jenkins 1991).

However, the distributional effects can be improved by redistributing the collected revenue into an equal sized increase in all child benefit rates. The direct distributional effect of this revenue-neutral

[13] The first threshold for the surtax was at 208 000 NOK for tax class 1 in 1994, for spouses filing separately.

reform is presented in Table 5. The table clearly shows that low-income individuals in decile 1 gain the most, while the 30 per cent richest lose out. Individuals in the middle of the income distribution are only marginally influenced. In total, the inequality (measured by the Gini coefficient) is reduced by 0.5 per cent by implementing this revenue-neutral reform.

Table 4. Average equivalent income (NOK) in deciles and the corresponding values for increases in taxes when including the child benefit in taxable income. Married couples with children 0–16 years. 1994

Decile	*Equivalent income*	*Tax burden increase (measured as reductions in equivalent income)*
1	89 875	4 210
2	120 295	4 827
3	135 436	4 548
4	147 697	4 179
5	158 662	4 236
6	169 888	4 149
7	182 727	3 968
8	199 012	3 972
9	222 466	3 963
10	342 266	4 130
Average	176 832	4 218

Table 5. Revenue-neutral reform: The direct effect of taxing the child benefit and redistributing the collected revenue as child benefit. Pre-reform average equivalent income (NOK) in deciles and the corresponding values for reductions in equivalent income. Married couples with children 0–16 years. 1994

Deciles	*Equivalent income*	*Reduction in equivalent income*
1	89 875	-1 076
2	120 295	189
3	135 436	165
4	147 697	-10
5	158 662	-18
6	169 888	97
7	182 727	187
8	199 012	477
9	222 466	476
10	342 266	695
Average	176 832	118

3.3. Income-testing the child benefit

Enhanced redistributional effect can be achieved by testing the transfer against family income. Many alternatives of income-testing transfers imply thresholds in the budget constraint with immense increases in effective marginal tax rates. The model of income-testing analysed here is a linearised version of income-testing, involving a deduction of one-tenth of a Norwegian krone in child benefit for every krone the family earns in excess of NOK 250 000. In reality, this means a ten per cent increase in marginal tax rates for incomes above NOK 250 000. Thus, a family with two children and a child benefit of NOK 21 336 will "lose" it's child benefit in the interval from NOK 250 000 to 463 360 in family income.

As for the analysis of taxation, we provide results for income-testing in combination with child benefit rate increases, as well as for income-testing only. Table 6 shows that both alternatives imply unambiguous redistributional effects. Compared to the effects from taxation of the child benefit, described in table 4 and 5 above, income-testing entails more advantageous distributional effects. When income-testing the allowance and using the collected revenue as child benefit rate increases, the reform reduces inequality by nearly six per cent, as measured by the Gini coefficient. The 30 per cent poorest individuals gain at the expense of the 60 per cent richest.[14] Individuals in decile 4 are less affected.

This assessment of the direct distributional effects of targeting the child benefit, have shown that income-testing implies stronger positive distributional effects than taxation. Only the alternative where the child benefit is taxed as wage income without increasing rates, is predicted to increase inequality. However, both taxation and income-testing might also involve substantial adjustments in behaviour. In the next section we discuss the labour supply responses.

---

[14] The average figure in the last column in Table 6 implies that the reform is not strictly revenue-neutral for households with married mothers, revenue neutrality is achieved for all households under the transfer arrangement.

Table 6. The direct effect of income-testing the child benefit and redistributing the collected revenue as child benefit rate increases. Pre-reform average equivalent income (NOK) in deciles and the corresponding values for increases in equivalent income. Married couples with children 0–16 years. 1994

Decile	*Equivalent income*	*Reduction in equivalent income, income-testing*	*Reduction in equivalent income, income-testing and rate increase*
1	89 875	52	-4 709
2	120 295	747	-3 750
3	135 436	2183	-1 962
4	147 697	3568	-325
5	158 662	4982	1 076
6	169 888	6170	2 584
7	182 727	7286	4 215
8	199 012	8029	5 586
9	222 466	8677	7 132
10	342 266	8666	7 805
Average	176 832	5036	1 765

4. Simulations of female labour supply responses

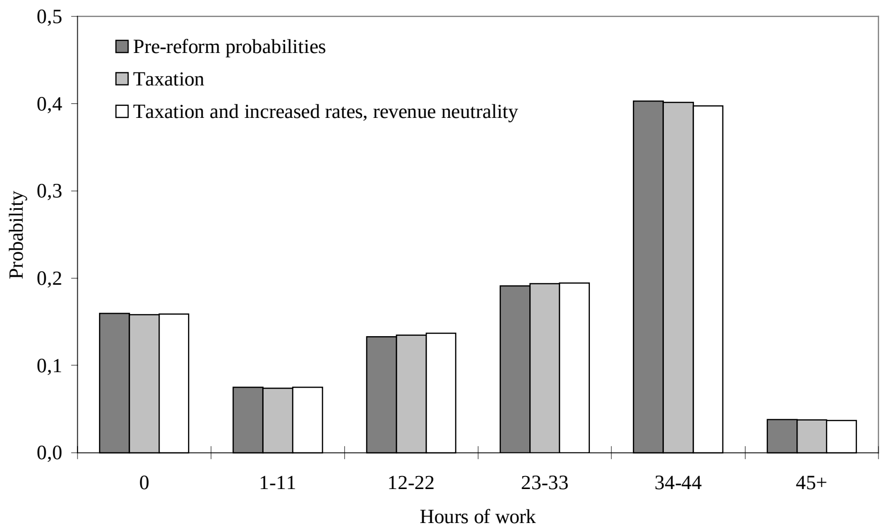
4.1. The responses to taxation

In this section we use the empirical labour supply model presented in Section 2, to evaluate the labour supply responses of taxation of the child benefit. The estimates in table 2 are applied in order to simulate the response for about 300 child benefit-eligible mothers. Application of this model requires calculations of disposable income for each household corresponding to the different states of labour supply and the various schemes for the child benefit. The tax-benefit model LOTTE is employed in these calculations.

Taxation of the child benefit implies that labour supply is influenced by two contradictory effects. The reduction in non-labour income will increase labour supply, since mothers will reduce their consumption of leisure (assuming that leisure is a normal good). The second effect stems from the tax base extension, which might involve reductions in marginal post-tax wage income, since some mothers will be forced into another tax-band. It is normally assumed that female labour supply is negatively influenced by reductions in the after-tax wage rate (cf. Blundell and MaCurdy [1998] for survey of international studies and Aaberge et al. [1995] for responses by Norwegian females).

Figure 2 shows the probabilities of choosing various labour market states due to the altered child benefit regime. Probabilities for both the non-revenue-neutral version and the revenue-neutral version of taxation are compared to pre-reform probabilities. Most notably, the responses are rather limited.

Figure 2. Simulations of the hours of work distribution under various child benefit schemes



However, we notice that taxation (only) implies that the probabilities of choosing working hours less than 12 hours and more than 33 hours decrease slightly, compared to the pre-reform probabilities. Thus, it is predicted that this reform will imply more part-time work and less full-time and non-working states. On aggregate, the expected hours of work increase by 0.1 per cent only. This estimate, however, ignores uncertainty about parameter values and possible selection bias of the sample used in the simulations.

When redistributing the collected revenue in terms of increased child benefit rates, the overall effect is a reduction in the labour supply. Aggregate expected working hours decreases by approximately 0.4 per cent, since taxation is combined with increases in non-labour income, which induces women to consume more leisure.

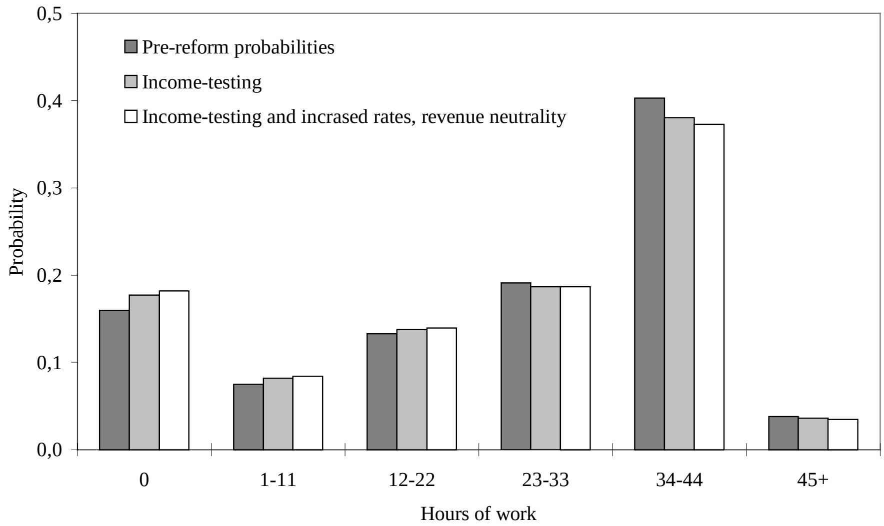
Thus, we predict that taxation of the child benefit as wage income will induce a small increase in labour supply. However, if this reform is made revenue-neutral by redistributing the collected revenue as increased child benefit rates, we expect a small reduction in labour supply. In other words, taxation and rate increases, which was shown to be the distributionally beneficial alternative (see Section 3), will presumably lead to a reduction in labour supply. This is in line with conventional understanding about the trade-off between equity and efficiency concerns.

4.2. Income-testing and labour supply

As discussed in Section 3.3, income-testing is carried out by deducting one-tenth of a krone in child benefit for every krone the family earns in excess of NOK 250 000. Figure 3 shows that the labour supply effects are stronger when targeting the child benefit through income-testing, than in the taxation examples above. The probabilities of choosing longer hours of work decrease under the new child benefit scheme. Income-testing and increasing child benefit rates (revenue neutrality) is predicted to reduce the mothers' labour supply by about 5 per cent, while income-testing (only) reduces aggregate female labour supply by approximately 3.9 per cent, according to the simulations. These responses can be converted into substantial reductions in market production.

In other words, when improving the distributional effect of the child benefit scheme through income-testing, we expect that female labour supply will be substantially reduced. As for taxation, the preferred version of the reform on equity grounds, income-testing and rate increases, implies the largest reductions in labour supply.

Figure 3. Simulations of the hours of work distribution under various child benefit schemes



One main advantage of the micro simulation approach is that the distribution of income after labour supply responses can be considered. In table 7 we demonstrate how the behavioural adjustments impact on the distribution of income. We use the revenue-neutral alternative of income-testing, income-testing and increased rates, as example. Both pre-reform and post-reform income are calculated as the mathematical expectation of post-tax income. This is done by multiplying post-tax income corresponding to each labour supply interval, by the respective probability of choosing that interval, and summarising over all intervals. The individuals are ranked according to the same income definition as in tables 3 to 6. The figures in table 7 are based on the limited sample of households which we have information about the labour supply responses for. Thus, the figures for average equivalent income in table 7 are different from figures in the tables above.

Table 7 shows that the income reductions are larger in the middle of the distribution. The small effects in decile 1 and decile 10 result from the arrangement of the income-testing. Since the income-testing start at 250 000 NOK in family income, mothers in decile 1 are less affected by the reform because their family incomes are often below 250 000 NOK, regardless of the mother's choice of hours of work. These families typically have low male incomes. Similarly, the husbands in the households in decile 10 typically have very high incomes, so high that the child benefit can be totally deducted against their income. The composite marginal tax rates of the females are then unchanged by the deduction of child benefit against total wage income for the household. It can also be shown that the mothers in decile 10 are somewhat less responsive to tax law changes than the others. The average reduction in equivalent income is approximately one per cent of the income in the reference system.

Table 7. Average equivalent income (NOK) in deciles and the corresponding values for reductions* in equivalent income due to labour supply responses from income-testing the child benefit. Married couples with children 0–16 years. 1994

Decile	*Equivalent income*	*Reductions in equivalent income due to labour supply responses*
1	111 166	713
2	133 159	1 247
3	144 419	2 189
4	153 922	2 279
5	162 917	2 630
6	171 192	3 049
7	180 945	3 109
8	194 767	2 527
9	213 456	2 309
10	296 224	996
Average	176 217	2 105

*The figures are calculated by comparing expected disposable income under the tax law for 1994 and expected disposable income when the child benefit transfer scheme is altered.

5. Concluding remarks

This study presents a micro simulation framework for analysing means-testing of transfer schemes. We suggest to analyse this issue by considering results from non-behavioural and behavioural simulations on micro data. This implies that the behavioural effects of various designs of the child benefit scheme can be explicitly considered. The mothers' labour supply responses to alternative child benefit schemes are simulated under the assumption that choices are discrete. We argue that a discrete choice specification represent a realistic depiction of the rather complex job-finding process, as the individual simplify the choice process by classifying jobs into different hours of work intervals. It is shown that the peaks in the hours of work distribution can be interpreted as differing number of job offers across intervals, under this framework.

From a policy-making perspective, the present analysis offers information about advantages and limitations of various transfer schemes, with respect to the distributional impact and labour supply effects. The distributional impacts of the behavioural adjustments are also described. In addition, the policy-makers might also emphasise the social stigma associated with income-testing, and the effects on the intra-family distribution of consumption might also be valued. When comparing taxation and income-testing of the child benefit, we find that the distribution of income among families with children improves when the transfer is income-tested, but at the expense of reductions in female labour supply. Taxation of the child benefit has very modest effects on both the income distribution and the female labour supply.

References

Aaberge R. (1997): Interpretation of Changes in Rank-Dependent Measures of Inequality, *Economic Letters* **55**, 215–19.

Aaberge, R., J.K. Dagsvik and S. Strøm (1995): Labor Supply Responses and Welfare Effects of Tax Reforms, *Scandinavian Journal of Economics* **97**, 635–659.

Ben-Akiva, M. and S. Lerman (1985): *Discrete Choice Analysis*, Cambridge (MA): MIT Press.

Besley, T. (1990): Means Testing Versus Universal Provision in Poverty Alleviation Programmes, *Economica* **57**, 119–29.

Bingley, P., G. Lanot, Elizabeth Symons and I. Walker (1995), Child Support Reform and the Labour Supply of Lone Mothers in the United Kingdom, *The Journal of Human Resources* **30**, 256–279.

Blundell, R.W. (1993): "UK Taxation and Labour Supply Incentives", in A.B. Atkinson and G.V. Mogensen (eds.): *Welfare and Work Incentives: A North-European Perspective*, Oxford: Clarendon Press.

Blundell, R. and T. MaCurdy (1998): Labor supply: A Review of Alternative Approaches, Working Paper Series No. W98/18, The Institute for Fiscal Studies.

Bradshaw, J., J. Ditch, H. Holmes and P. Whiteford (1993): Support for Children. A Comparison of Arrangements in Fifteen Countries, Research Report No. 21, Department of Social Security, HMSO.

Buhmann, B., L. Rainwater, G. Schmaus and T.M. Smeeding (1988): Equivalence-scales, well-being, inequality, and poverty: sensitivity estimates across ten countries using the Luxembourg Income Study (LIS) database, *Review of Income and Wealth* **34**, 115–142.

Creedy, J. (1996): Comparing Tax and Transfer Systems: Poverty, Inequality and Target Efficiency, *Economica* **63**, S163-S174.

Creedy, J. (1998): Means-Tested versus Universal Transfers: Alternative Models and Value Judgements, *Manchester School of Economic and Social Studies* **66**, 100–117.

Dagsvik, J. and S. Strøm (1997): A Framework for Labor Supply Analysis in the Presence of Complicated Budget Restrictions and Qualitative Opportunity Aspects, Memorandum from Department of Economics, University of Oslo.

Duncan, A. and M. Weeks (1997): Behavioural Tax Microsimulation with Finite Hours Choices, *European Economic Review* **41**, 619–626.

Jenkins, S. (1991): "The Measurement of Economic Inequality", in Osberg, L (ed.): *Readings on Economic Inequality*, New York: Sharpe, 3–38.

Klevmarken, N.A., I. Andersson, P. Brose, E. Grønkvist, P. Olovsson and M. Stoltenberg-Hansen (1995): Labor Supply Responses to Swedish Tax Reforms 1985–1992, Tax Reform Evaluation Report no. 11, National Institute of Economic Research, Stockholm.

Lambert, P. (1993): Evaluating Impact Effects of Tax Reforms, *Journal of Economic Surveys* **7**, 205–242.

Lundberg, S.J., R.A. Pollak and T.J. Wales (1997): Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit, *Journal of Human Resources* **32**, 463–480.

MaCurdy, T.E. (1981): An Empirical Model of Labor Supply in a Life-cycle Setting, *Journal of Political Economy* **89**, 1059–1084.

MaCurdy, T.E., D. Green and H. Paarsch (1990): Assessing Empirical Approaches for Analyzing Taxes and Labour Supply, *Journal of Human Resources* **25**, 415–490.

Maddala, G.S. (1983): *Limited-dependent and Qualitative Variables in Econometrics*, Cambridge (U.S.): Cambridge University Press.

Neumark, D. and A. Postlewaite (1998): Relative Income Concerns and the Rise in Married Women's Employment, *Journal of Public Economics* **70**, 157-183.

Sadka, E., I. Garfinkel and K. Moreland (1982): "Income Testing and Social Welfare: An Optimal Tax-Transfer Model", in I. Garfinkel (ed.): *Income-Tested Transfer Programs: the Case For and Against*, New York: Academic Press.

van Soest, A. (1995): Structural Models of Family Labor Supply. A Discrete Choice Approach, *The Journal of Human Resources* **30**, 63–88.

Woittiez, I. and A. Kapteyn (1998): Social Interactions and Habit Formation in a Model of Female Labour Supply, *Journal of Public Economics* **70**, 185-205.

Appendix A

Key variables in labour supply analysis are hours of work and hourly wage rate. Unfortunately, these variables are not easily measured. In the present analysis the hourly wage rate is measured by combining information about annual hours of work obtainable in the Standard of Living Survey and labour income[15] from the Income Distribution Survey. The wage rates for women without work have been obtained from an estimated wage equation, where log(w) is the dependent variable and years of education, experience (measured as age minus years of education and minus pre-school years), and experience squared are the explanatory variables.

The Standard of Living Survey also includes questions about the actual wage rate, either the hourly wage or weekly, fortnightly, and monthly payments. In order to calculate the hourly gross wage rate from these questions, we divide the weekly, fortnightly, and monthly payments by hours of work for the corresponding period.[16] Thus, the data contain two sources of deriving wage rates measures. Table B1 presents average wage rates in intervals (corresponding to the 6 different states in the discrete choice model) by the two methods of obtaining information about wages. The table reveals that the means in each interval differ widely by the two methods.[17] The correlation between the two wage measures is only about 0.25 (when interval 0 is excluded).[18] This low correlation is below the figures reported in Klevmarken et al. (1995), who discuss a related problem in Swedish data.

One of the disadvantages of our method is that the interviews in the Standard of Living Survey were carried out in January and February 1995, while the income data cover 1994. This, for instance, leads to a situation in which the estimates on the wage rate for individuals with temporary variations in the employment rate, could be biased. For this reason we exclude females who have received unemployment benefit and those who have given a positive response to the question about strong variations in hours of work. This has reduced the sample from 586 to 507 subjects. For 490 of these 507 we have observations on both wage measures, and Table B2 provides a comparison. The correlation coefficient increases from 0.25 to 0.58, when restricting the sample to individuals with a permanent connection to the labour market.

---

[15] The unemployment benefit is subtracted from labour income.

[16] Assuming that there are 4.35 weeks in a month.

[17] The calculations for interval 1 are identical in the two methods.

[18] Since information about the wage rates is missing for some observations we restrict the comparison in Table 3 to females with non-missing wage rates.

Table B1. Comparison of two methods of deriving wage measures. Non-restricted sample

		Yearly income (from the Income Distribution Survey) divided by hours of work			*Weekly, fortnightly, and monthly payments (from the Standard of Living Survey) divided by hours of work*		
Interval	*Number of obser-vations*	*Mean*	*Minimum value*	*Maximum value*	*Mean*	*Minimum value*	*Maximum value*
0	100	72	60	105	72	60	105
1	18	132	1	476	84	4	159
2	107	103	0	262	96	36	958
3	114	99	32	175	88	35	161
4	232	97	1	202	96	11	181
5	15	128	39	249	118	55	225
All	586	96	0	476	91	4	958

Table B2. Comparison of two methods of deriving wage measures. Sample restricted to indi viduals with a permanent connection to the labour market

		Yearly income (from the Income Distribution Survey) divided by hours of work			*Weekly, fortnightly, and monthly payments (from the Standard of Living Survey) divided by hours of work*		
Interval	*Number of obser-vations*	*Mean*	*Minimum value*	*Maximum value*	*Mean*	*Minimum value*	*Maximum value*
0	71	73	60	105	73	60	105
1	13	120	4	396	84	4	159
2	86	108	26	262	89	36	154
3	96	102	32	175	90	35	161
4	210	100	20	202	97	11	181
5	14	134	39	249	120	55	225
All	490	100	4	396	91	4	225