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Guyonne Kalb and Wang-Sheng Lee

MELBOURNE INSTITUTE
of Applied Economic and Social Research

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Guyonne Kalb and Wang-Sheng Lee
Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

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Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
***Telephone* (03) 8344 2100**
***Fax* (03) 8344 2111**
***Email* melb-inst@unimelb.edu.au**
***WWW Address* http://www.melbourneinstitute.com**

Abstract

Based on labour supply parameter estimates and childcare demand parameters for the Australian population in 2002, this paper illustrates how an extended childcare subsidy proposed by the Taskforce on Care Costs in October 2006 can be evaluated using a microsimulation model. First, the cost to the government is predicted assuming unchanged labour supply behaviour. Then the labour supply effects of the TOCC proposal are predicted for single parents and couple families separately, including a revised cost/benefit analysis which takes the labour supply responses into account.

1. Introduction

This paper examines how, relative to the existing policy in Australia in July 2006, a proposed childcare subsidy which increases the reimbursement of out-of-pocket childcare costs is expected to affect the labour force participation of sole parents and couple families. More specifically, this paper analyses an actual policy proposal by the Taskforce on Care Costs (TOCC) to reimburse families for the cost of caring. The TOCC's primary recommendation is that the Government reimburse 50 per cent of an employee's out of pocket care costs up to a maximum of $10,000 per annum per household.[1] In addition, the alternative of a 100 per cent reimbursement was investigated. Building on the labour supply models estimated in Kalb and Lee (2007), this paper uses the Melbourne Institute Tax and Transfer Simulator (MITTS), a microsimulation model, to simulate the labour supply effects of the TOCC proposal. The paper analyses how the effect is distributed across single parent and couple families with childcare responsibilities, and conducts a cost/benefit analysis which reveals the corresponding implication for government expenditure with and without allowing for labour supply responses.

Section 2 of the paper describes the proposed alternative of the TOCC for reimbursing childcare costs in more detail. Section 3 presents the methodological approach used and the assumptions made. The simulation results of the proposed policy change are reported in Section 4. Finally, Section 5 concludes with a few brief remarks.

2. The Current Situation and the Proposed Alternative

The TOCC (2006b) designed an alternative childcare subsidy which aims to enhance the existing Childcare Tax Rebate (CCTR) by providing a 50 per cent reimbursement (or the alternative of a 100 per cent reimbursement) of out-of-pocket childcare costs up to a maximum. We use a microsimulation model to predict whether this subsidy is expected to have a positive impact on workforce participation of parents with caring responsibilities, and to compute the cost to the government after taking labour supply responses into account.

[1] A report entitled *Where to Now?* was released by the TOCC in October 2006 and officially handed to the Federal Government. Although the TOCC report also discusses elderly care and disability care costs, only the effects related to childcare costs were analysed by the authors of this paper.

In the before and after reform situation, it is assumed that the social security and income tax system are the same (as was current on 1 July 2006). In addition, it is assumed that the Child Care Benefit (CCB) remains unchanged. The only difference is that the current 30 per cent CCTR for formal childcare costs is replaced with a reimbursement of 50 per cent (or 100 per cent) of the out-of-pocket formal and informal childcare costs up to a maximum amount of either $20,000 per year per family or the earned income of the secondary earner, whichever is the lower of the two. Both the CCTR and the two alternatives proposed by the TOCC are available to couples where both partners are either in work, studying, or looking for work. If the secondary partner or the single person does not have a positive income then the maximum amount which is rebatable is set to $20,000.

The current CCTR is paid out through the tax system with a delay of 1 to 2 years (that is childcare costs made in 2004-2005 can be claimed for the 2005-2006 tax year after July 2006). The rebate paid in the current system is a tax refund. It can only be paid if the parents have a sufficiently large tax liability in the relevant tax year. In contrast, the proposed alternative would be paid out directly (fortnightly) through alternative channels. Unfortunately, the effect of this difference in timing of the payment cannot be assessed. The proposed alternative also allows for more choice by households, with regard to the type of childcare they would like to use, by allowing informal care costs to be reimbursed as well as formal childcare costs.

3. Simulating a Change in Childcare Subsidies

We use MITTS, a microsimulation model, to calculate the effect of changing the current childcare subsidies to those proposed by the TOCC. The expected effects presented in this paper are based on structural labour supply models estimated and described in more detail in Kalb and Lee (2007). The labour supply effects are not actually observed but based on simulations. A more detailed general description of the behavioural microsimulation modelling approach used in this analysis can be found in Creedy and Kalb (2005, 2006) and specific information on MITTS can be found in Creedy et al. (2002, 2004).

A brief description of the simulation approach used to analyse the proposed policy reform is provided in Section 3.1. Assumptions underlying the model and limitations of the model are outlined briefly in Section 3.2.

3.1 Details on the Simulation

The microsimulation is based on a sample of representative Australian households in the 2002/2003 Survey of Income and Housing Costs (SIHC) collected by the Australian Bureau of Statistics (ABS). Using the weights provided by the ABS, the sample can be weighted to obtain population amounts. This is the latest survey available that has been incorporated in the microsimulation model. Detailed information is available on each household and on the individuals in the households. This allows us to replicate the social security payments received and income tax paid for each individual and household. Since 2002/2003 data are being used to analyse the effects of a proposed policy change in 2006, the information is updated to 2006 values using the Consumer Price Index and the Average Weekly Earnings Indices for men and women (ABS: 2006a, 2006b).

The SIHC contains no information on childcare use and cost, so these are imputed for each household based on a model estimated using the second wave of Households, Income and Labour Dynamics in Australia data (HILDA), using household and individual characteristics which are observed in the HILDA and the SIHC data. A brief description of how childcare costs are imputed is given in Appendix A. Details on this methodology can be found in Doiron and Kalb (2005a, or in the more extended version: 2005b), who estimated a model using the 1996-1997 SIHC and the 1996 Australian Bureau of Statistics' (ABS) Child Care Survey data. These models were recently updated based on the 2002 wave of the HILDA and the 2002/2003 SIHC in Kalb and Lee (2007). The updated models were used for the microsimulation analysis in this paper.

The steps in the approach used are as follows. First the cost of informal childcare and demand for formal childcare are jointly estimated using a bivariate tobit model, conditional on labour supply and on household characteristics (see Kalb and Lee 2007 for results of the estimation). Second, formal childcare demand is translated into formal childcare costs by multiplying the hours of formal childcare use with average formal childcare fees by state and age of the child. Average formal childcare fees are constructed for 2002 using information from the Census of Child Care Services (Department of Family and Community Services, 2003).[2] These fees are inflated by the CPI in the simulations in this paper. In addition, we have increased childcare fees by an

[2] See Appendix C for a table with the fees by state and age of the child.

additional amount of 42.4 per cent over the period from 2002 to mid 2006, based on four years with an additional yearly 12.4 per cent increase in childcare prices as reported for the two years from 2004 to 2006 in Taskforce on Care Costs (2006a). This would result in a 59.6 per cent price increase over the four years. Over the same time period of four years, the increase in CPI was 12.1 per cent, so the increase in childcare fees in addition to the CPI was 42.4 per cent (1.596/1.121=1.424). Third, the imputed childcare costs are used to impute revised net incomes (the original net incomes minus the imputed childcare costs) for the households in the SIHC. Finally, labour supply parameters are estimated taking into account the imputed childcare costs (see Kalb and Lee 2007 for the estimated parameters). Appendix B briefly describes the steps involved in estimating the parameters of the structural discrete choice labour supply model.

The estimated parameters from the structural labour supply model are key inputs in the behavioural component of the microsimulation model. They allow us to simulate the labour supply responses of the alternative childcare subsidy. The simulation of the effects of the subsidy involves the use of alternative budget constraints in the pre- and post-reform situation. The budget constraints incorporate all main tax and transfer programs and are computed using MITTS. In the pre-reform situation, it is assumed that the 30 per cent CCTR is available. In the post-reform situation, the CCTR is replaced with the 50 per cent (or 100 per cent) TOCC reimbursement of out-of-pocket childcare costs.

Two alternative simulations of the effects of the subsidy are provided in Section 4. Both examine the implications for net government expenditure. The first assumes that labour supplies are fixed (Section 4.1), while the second (Section 4.2) allows individuals to adjust their labour supply, where appropriate, in response to the change in the tax and transfer system. For the second type of simulation, average labour supply responses are reported in addition to the effect on net government expenditure.

The behavioural labour supply responses presented in this paper are based on a quadratic utility function with preference parameters which are allowed to vary with an individual's characteristics. The behavioural simulation begins by taking the discrete hours level for each individual that is closest to the observed hours level. Next, a set of random draws of the error term in the labour supply model, which are consistent with the actual observed hours before the change, is selected. That is, for these draws of the error term, the model selects the observed hours as the labour supply point

corresponding to the highest utility level. Conditional on this set of random draws, a probability distribution over the set of discrete hours for each individual under the alternative policy regime is generated. Thus the same error terms, representing the random utility component which is for example due to unobserved factors, are used before and after the reform. However, the tax and transfer system is changed in the reform, which changes net household incomes, and as a result changes the deterministic utility levels. The labour supply after the reform is calculated as the average outcome across all draws of the error terms.

3.2 Assumptions Underlying the Analysis

In order to simulate the current situation and the situation under the alternative proposed policy, a few assumptions and simplifications are needed in the microsimulation model. A crucial assumption is that no one who would like to enter the labour market or increase their hours worked is restricted by a lack of labour demand. In the current situation of low unemployment, this is a reasonable assumption to make, although there still may be a mismatch of skills between the additional workers and the available vacancies. Another assumption in the microsimulation modelling is that everyone who is eligible for any of the government-provided payments will take up these payments.

The current CCTR received is calculated based on current childcare costs, current income and current labour force status, because information for preceding years is not available in the data. In addition, the model is a point-in-time model and cannot account for the effect of delaying the payment (that is rebating childcare costs of 2004-2005 at the end of the financial year 2005-2006). As far as the model is concerned, households receive the CCTR payment as soon as they make the childcare costs. This delay is likely to be particularly important for low-income households, where the additional childcare payments may be crucial in the labour force decision and the two-year wait for the subsidy might be very difficult to bridge (that is, without the additional payments, employment may not be viable for the primary carer). This inability to allow for time delays causes us to overestimate the CCTR effect on labour force participation, and as a consequence of overestimating the CCTR effect, the TOCC will be underestimated because we are comparing the alternative policy to something that is more favourable than the current situation is in reality. The present value of the CCTR is lower than the amount we calculate because it will be paid in the future rather than immediately. The effect of the TOCC alternatives is likely to be underestimated due to leaving out the

difference in waiting time between the current policy and the alternative policies. An upper bound of the effect we are interested in can be obtained by carrying out an alternative simulation, ignoring the CCTR completely.

Finally, any changes in childcare pricing by childcare providers or behavioural changes in households' demands for childcare (beyond the obvious increase in childcare use when labour supply increases) resulting from the proposed changes in childcare subsidies are not included in this modelling. For example, we assume that the additional subsidy will not lead to increased childcare prices and that parents are not going to choose more expensive forms of childcare due to the increased subsidy. Neither do we allow for an increase in childcare prices as a result of the potential increase in the demand for childcare due to higher subsidies.

4. Simulation Results

This section first presents the effects of the policy change on government expenditure and revenue under the assumption that there is no labour supply response to the policy change. The second subsection allows individuals to adjust their labour supply, where appropriate, and presents the corresponding effects these labour supply responses have on net government expenditure.

4.1 Results for Fixed Labour Supply

We briefly present results under the assumption of no labour supply response. In other words, everyone is assumed to work the same number of hours before and after the policy change. The results presented in this subsection therefore do not depend on the estimated parameters of the labour supply model. The simulated total expenditure on childcare-related subsidies in the current situation and under the alternative policies is presented in Table 1. When labour supply is fixed, government expenditure on current social security payments and family payments, and government revenue from income taxation and the Medicare levy will not change.[3] Comparing the current system (1 July 2006) which includes the 30 per cent CCTR with the current system where the CCTR is replaced with the 50 per cent TOCC reimbursement, the expected increase in total government expenditure, assuming that everyone remains at the same hours level is $0.762 billion. When the Child Care Tax Rebate is replaced with the 100 per cent TOCC reimbursement, the expected increase is $1.992 billion. These amounts are likely

[3] Labour supply is fixed to the level observed in the 2002/2003 data.

to be somewhat underpredicted if childcare costs, are indeed underestimated in our model as seems to be the case, given the predicted amount of CCB payments under the current system compared with the officially reported amount of CCB. The relative size of the effects is however expected to remain similar. That is, increasing the 50 per cent reimbursement to a 100 per cent reimbursement will be relatively costly.

The net result in terms of changes in the total subsidies as a percentage of childcare costs is that a larger proportion of childcare costs is now subsidised. However for couple families, there is a small issue in the TOCC proposal with the difference in treatment of individuals on a low income versus those without income. Under the proposed 50 per cent reimbursement, if the secondary person does not have positive income, the maximum amount which is rebatable is set to $20,000. However, if the secondary person has a small amount of income (e.g. $1,000 a year), the 50 per cent TOCC reimbursement is based on the lesser amount of the actual care costs and the total labour-related income of the lower income spouse. Under the current rebate system, eligibility for the CCTR can be fully or partly transferred to the primary earner. As a result, although in principle the proposed 50 per cent reimbursement is more generous than the current 30 per cent rebate, some couples with low secondary earnings may end up with a smaller proportion of their childcare costs subsidised after the reform.

Table 1: Total Annual Government Expenditures on Childcare Subsidies Before and After the Introduction of the TOCC Reimbursement (in $ millions)

	Current System	50% TOCC	100% TOCC
Child Care Benefit Payments	772	772	772
Child Care July 2006 Tax Rebate	458	0	0
Child Care TOCC reimbursement	0	1220	2450
Total	1230	1992	3222

Due to the clause that the reimbursements are the lesser amount of actual care costs or the total income of the lower income spouse combined with the fact that many secondary earners earn relatively small amounts, and the fact that couple families are more likely to use childcare even if the primary carer is not in paid employment, the overall effect is to increase the percentage of subsidy by a lesser amount for couple families than for sole parent families.

4.2 Results Allowing for Labour Supply Responses

In this subsection, individuals are no longer assumed to work the same hours before and after the reform. They are allowed to change their labour supply in response to the

policy change. For each simulation of the effect of changing the current system to the proposed alternative, two runs are required from the simulation model. This is due to the fact that the data used in the simulation is not collected in 2006 but in 2002/2003. Because we use observed labour supply as the starting point in our simulations and the data are from 2002/2003, the starting point also needs to be 2002/2003. We therefore need to simulate the effect on labour supply when going from the tax and transfer system as it was in 2002/2003 to the current tax and transfer system (July 2006) and to the alternative system as proposed by the TOCC. We can then take the difference between the alternative TOCC system and the current tax and transfer system by taking the difference from the two sets of results obtained from the two simulation runs.

Table 2 presents the results on Government Revenue and Expenditure under the different systems for sole parents and couples with dependent children separately. The first three rows in each part of the table present the predicted revenue, consisting of the amount of income tax and the Medicare levy. The table shows that both revenue components increase for sole parent and couple families.

The following seven rows in both parts of Table 2 present information on government expenditure components. All expenditures, except the rebates, decrease with the introduction of the TOCC reimbursement policies. In theory, an increase in income can have two alternative (and opposite) effects on the amount of tax rebate received. First, the increase in paid income taxes could mean there is a larger amount of tax to be offset by the tax rebates. This would cause tax rebates to increase. Second, the increase in income could mean that individuals now fall into the withdrawal range of the rebate, which would cause a decrease in tax rebates. The first effect dominates in most cases. That is, tax rebates mostly increase slightly due to the increase in income tax paid by the households. The exception is for the 50 per cent TOCC in the sole parents group. In this group, the second effect dominates.

Amongst the expenditures, allowances (such as NewStart Allowance or Parenting Allowance) and family payments decrease to the largest extent. Only few households with children would receive any pension payments, and people on pensions (such as Disability Support Pension or the Age Pension) are usually not expected to respond to financial incentives. The following row represents the net government expenditure taking the difference between total expenditure and total revenue. The fact that it is negative for couple families with children indicates that the government receives more

income tax and Medicare levy payments from these households than it spends on income support and family payments for these households. That is, net revenue is positive for this group. Finally, the predicted amounts of childcare subsidies are presented separately in the bottom row and are an additional separate expenditure to the government.[4]

Table 2: Government Revenue and Expenditure under the Different Policies by Demographic Group (in $millions per year)

	Current System	50% TOCC	100% TOCC
Sole parents			
Government Revenue			
Income Tax	2594.2	2644.4	2702.6
Medicare	137.3	139.9	142.2
Total Revenue	2731.5	2784.3	2844.8
Government Expenditure			
Tax Rebates	424.8	421.9	423.8
Family Tax Benefit, part A and B	4874.6	4869.8	4865.2
Allowances	4035.2	3949.6	3840.9
Pensions	364.0	363.8	362.9
Pharmaceutical Allowance	60.3	59.9	59.6
Rent Allowance	626.4	625.0	623.5
Total Expenditure	10385.3	10290.0	10175.9
Net Expenditure	7653.8	7505.7	7331.1
Childcare subsidies	281.4	436.2	821.4
Couples with dependent children			
Government Revenue			
Income Tax	36875.6	36992.3	37146.6
Medicare	3001.1	3015.3	3035.0
Total Revenue	39876.7	40007.6	40181.7
Government Expenditure			
Tax Rebates	743.2	745.4	749.7
Family Tax Benefit, part A and B	11615.1	11533.9	11423.7
Allowances	3630.7	3599.5	3564.6
Pensions	1233.7	1233.7	1233.3
Pharmaceutical Allowance	10.1	10.0	10.0
Rent Allowance	634.5	632.1	628.4
Total Expenditure	17867.3	17754.6	17609.7
Net Expenditure	-22009.4	-22253.0	-22572.0
Childcare subsidies	708.8	1272.8	2361.3

[4] The total childcare subsidies presented in Table 2 are somewhat different from those presented in Table 1. This is mostly due to the predicted changes in labour supply. In addition, there is a small difference due to the calculation of all payments at the discrete labour supply points, which means all observed hours are rounded to the closest multiple of 5 hours (for all individuals except partnered men) or 10 hours (for partnered men).

Compared with the increase in childcare subsidies due to implementing the 50 per cent and 100 per cent TOCC reimbursement (of 0.719 billion and 2.193 billion dollars per year respectively), the increase in net government revenue (or the decrease in net government expenditure) is about 54 and 40 per cent of the additional cost in subsidies respectively.[5] For sole parents, the cost of the 50 per cent TOCC reimbursement seems to be close to completely returned in increased tax revenue and decreased income support. An increase in labour supply of sole parents is more likely to result in both increased tax revenue and decreased income support than an increase in labour supply of partnered mothers. The partners' incomes of the latter group may be sufficient to make most partnered mothers ineligible for income support even when they are not in paid employment.

The labour supply responses for single parents are reported in Table 3 while the labour supply responses for couples are reported in Table 4. Comparing labour supply effects across the demographic groups, a larger effect is observed for sole parents than for partnered mothers. The larger effect could be partly due to a larger proportion of sole parents using informal care (and paying for this informal care, even if it is a small amount), especially when they are on a low income, and partly it could be due to the lower wages (and lower household incomes) of sole parents on average, which means the childcare subsidy is more relevant to this group's labour supply. As a result, they are likely to benefit to a larger extent from the proposed changes.

Table 3: Summary of Labour Supply Responses for Single Parent Families with Dependent Children (in per cent of the population)

	Current System	50% TOCC	100% TOCC
Labour force participants	52.18	53.99	57.03
Self employed	4.91	4.91	4.91
Wage and salary workers	47.27	49.08	52.12
Average hours change (in hours per week)		0.57	1.46

[5] These two percentages are derived by adding childcare subsidies for sole parents and couples with children and by adding the net expenditures for sole parents and couples with children. We then take the difference between the alternative policy and the current policy and compute the proportion of the change in the childcare subsidies which is compensated by the increased revenue for the government.

Table 4: Summary of Labour Supply Responses for Couple Families with Dependent Children (in per cent of the population)

	Current System		50% TOCC		100% TOCC	
	Men	Women	Men	Women	Men	Women
Labour force participants	89.17	61.12	89.27	61.74	89.40	62.63
Self employed	14.64	8.14	14.64	8.14	14.64	8.14
Wage and salary workers	74.53	52.98	74.63	53.6	74.76	54.49
Average hours change (in hours per week)			0.04	0.20	0.08	0.51

A very small effect is observed for partnered men. This result is as expected and is consistent with results found by other researchers.[6] Married men usually work full time and are not affected much by changes in financial incentives. The effect observed for partnered women is somewhat larger than for partnered men but lower than for sole parents. We suspect that the relatively small effect is due to the reimbursement being paid to a relatively large number of individuals who already are in the labour market.

As mentioned in Section 3.2, we assess the effect of the rebate being paid at the time that the cost is made rather than after 1 to 2 years, as is the case with the current CCTR. In an alternative simulation, we exclude the CCTR when predicting current labour supply in July 2006. This would lead to a lower predicted labour supply in the starting point.[7] Compared with these lower labour supply levels, the labour supply under the alternative policies proposed by the TOCC would look more favourable, particularly for sole parents.

5. Conclusion

This paper has analysed how, relative to the existing policy in Australia in July 2006, a proposal by the Taskforce on Care Costs (TOCC) to increase childcare subsidies through the provision of increased reimbursements to families for the cost of caring is expected to affect the labour force participation of sole parents and couple families. An estimated childcare demand and labour supply model (Kalb and Lee, 2007) has been used to predict the labour supply responses arising from a policy change proposed by

[6] Most other researchers ignore the effects on married men, most likely due to the small effects expected or observed for men. Blundell et al. (2000) are an exception and they find a small effect.

[7] On average for sole parents, labour supply would be 0.4 hours lower and labour force participation would be 1.4 percentage points lower. For married women, labour supply would be 0.15 hours lower and labour force participation would be 0.45 percentage points lower and for married men the difference would be quite small but in the same direction as for the other two groups.

the TOCC in 2006. Such analysis can be useful in providing additional information to assist policy formulation and planning.

This paper has shown that replacing the 30 per cent CCTR with a 50 per cent reimbursement of childcare costs (making it independent of income tax payments) up to a maximum of $20,000 of childcare costs per family per year is expected to have substantial labour supply responses. The reforms are predicted to return just over 50 per cent of the original additional outlay for the increased subsidies through increased income tax and reduced income support payments arising from increased labour supply. The predicted increase in revenue as a percentage of the original additional cost is particularly high for sole parents (nearly 100 per cent). Further increasing the reimbursement from 50 per cent to 100 per cent reduces the percentage of the original cost returned to the government to 40 per cent.

Although this paper has not addressed the complex issue of administering the alternative subsidy, it appears that carefully constructed childcare subsidy reforms could potentially have a substantial effect on labour force participation at a relatively modest cost to the government.

Appendix A

The Imputation of Childcare Costs

The estimated parameters of a demand for formal childcare and cost of informal childcare model are used to impute childcare costs for households in the SIHC sample at different levels of hours of work. The modelling of the budget constraint for each household (in this case allowing for childcare costs) and the labour supply form part of the Melbourne Institute Tax and Transfer Simulator (MITTS), a microsimulation model for Australia.

First, for each hours level, a gross income level (together with all transfers and taxes) is computed within the MITTS model. Then, for each household with children of 12 years or younger in the SIHC a predicted cost of childcare is imputed based on the characteristics of the household (State, urban, number and age of children, couples versus lone parents, hours of labour supply, qualifications of childcare workers, childcare fees, and calculated gross income). This childcare cost is generated for each possible hours level allowed in the labour supply model.

Net costs are calculated from the predicted gross costs of childcare and the predicted levels of childcare benefits. These are calculated within MITTS based on the characteristics of the households and the predicted formal childcare costs (which are computed from predicted formal childcare demand multiplied by the average childcare fees for that particular household). Any childcare subsidies are deducted from formal costs (and informal costs in the "working model"), before adding the formal and informal costs together. The result is a predicted net childcare cost for each household based on predicted formal demands, average fees per household, total predicted informal care costs and calculated subsidies.

Appendix B

The Labour Supply Model

The labour supply model is described in more technical detail in Kalb (2002) and Appendix II in Doiron and Kalb (2005a). Here, we provide a brief non-technical overview. The parameter estimation and microsimulation of discrete hours labour supply in this paper follows the general method outlined in Van Soest (1995), which is explained in more expository detail in Creedy and Kalb (2005). Essentially, three steps are involved:

Step 1: *Specify a model explaining labour supply behaviour based on utility maximisation.*

Households are assumed to maximise a utility function of household consumption (assumed to equal net household income) and leisure hours of the adults, subject to a time constraint for each adult and a household budget constraint. This budget constraint includes all main tax and transfer programs in place at the time of the survey. Households maximise utility by choosing leisure (and hence labour supply) for each adult.

The assumption behind discrete hours labour supply modelling is that utility maximising individuals choose from a relatively small number of hours levels rather than being able to vary hours worked continuously, an assumption which reflects the fact that individuals typically have a finite number of working options available. Individuals in the model have the choice between 11 labour supply points if they are single and 66 points if they are a couple family. In this paper, married women and singles are assumed to choose between 0, 5, 10, 15, …, 50 hours whereas married men are assumed to choose from 0, 10, 20, …, 50 hours, given that few married men work low part-time hours. Married men and married women are assumed to choose jointly from any combination of the 6×11 points. More labour supply means less leisure time. Each of the available labour supply points is associated with a net household income level and with an amount of leisure (which includes home production time) for each adult individual in the household.

Step 2: *Incorporate all possible details of the tax and transfer system.*

In order to compute labour supply parameter estimates, several inputs for each

individual need to be gathered. First, for all possible different values that labour supply can take, estimates of the childcare costs for each individual need to be imputed. These predictions are obtained by using a model for predicted demand for formal childcare and cost of informal care. Next, reflecting these childcare costs and other taxes and transfer payments, information about the net incomes at all possible hours levels for each individual are generated in MITTS. With a complex tax and transfer system, the required net incomes are obtained by applying the rules of the system, along with the assumption that households take up benefits at each hours level if they are eligible. As the wage rates of those currently not working cannot be observed, it is necessary to impute wage rates for non-workers using estimated wage functions. A two-stage selection model is used to correct for possible selection bias. Separate wage equations are estimated for married men, married women, single men, single women and lone parents (see Kalb and Scutella, 2002).

Step 3: *Estimate the parameters of the labour supply model.*

The discrete labour supply values for each individual are the endogenous variables in the model. They include the option of not working. Wage rates, non-labour income (other than taxes and transfers), household composition and other household attributes are exogenous. Separate models are specified for sole parents and couple families. Parameters on net income and leisure/home production time in the household utility function indicate how much the household values each adults' leisure and home production time and how much it values income. These parameters may depend on individual and household characteristics such as for example, age of the individual, education and age of the youngest child. To give an example, the presence of a young child usually decreases the preference for labour supply of women.

Following Keane and Moffitt (1998), a quadratic utility specification is used for the utility function in this paper, where the preference parameters are allowed to vary with individuals' characteristics. An advantage of this utility function is that it is simple but quite flexible in that it allows for the leisure of each person and income to be substitutes or complements.

Having specified a utility function and a budget constraint, a maximum likelihood approach is used to find parameter values which would produce the highest probability of observing the actual hours values. A likelihood function is specified, based on actual hours of labour supply and net income, the set of hypothetical net incomes at alternative

unobserved hours, actual individual characteristics, and the parameters to be optimised. Given a system of non-linear equations derived from the first-order conditions of this maximisation problem, numerical methods involving a sequence of iterations from an arbitrary starting point to the solution are employed.

Since we are interested in analysing the effect of varying childcare costs on hours worked, the household budget constraint also incorporates childcare costs. Rather than associating each household with one specific predicted childcare cost amount, recognising the uncertainty in predicted childcare costs, we use a simulation technique. This involves repeated draws from the distribution of childcare costs to improve the efficiency of the model. This method provides a more efficient prediction of the childcare costs since it incorporates the variation in unobservables affecting costs, based on the estimated variance of these unobservables. A further advantage is the more accurate calculation of the CCB in this approach, given that the subsidy payable for the average childcare cost is not the same as the average CCB. The labour supply model used in the simulation for this paper is based on 10 values drawn from the distribution of the unobservables in the model of hours of formal care and costs of informal care. The labour supply models incorporating childcare costs are therefore estimated using a simulated maximum likelihood approach. In other words, 10 draws are taken for each household and the likelihood function is averaged over these draws before being maximised. The optimal hours level of work can be predicted for each draw and an average is taken over the draws. Technically, this involves averaging the hours of work estimates rather than the childcare costs estimates.

Note that the estimated parameters of the labour supply model are actually those of the utility function. These parameters indirectly determine labour supply in terms of a distribution of hours worked. By assuming an ‘extreme value’ distribution for the error term in the utility function, it is possible to derive the relationship between the probability distribution of hours of work and measured utility levels at each hours level in a convenient form. After estimation, a point estimate of the expected hours of work (that is, labour supply) can be computed by multiplying the probability of working at each discrete value of labour supply by the corresponding discrete value of labour supply, and taking the sum of these product terms.

Appendix C

Childcare Fees

An additional external source of data was used to obtain average hourly childcare fees by age of the child and State of residency. Average fees were calculated from the Child Care Census 2002 (Department of Family and Community Services, 2003), weighting the hourly fees of different types of childcare by the number of children of a particular age using that type of childcare. The hourly fees are calculated by dividing the weekly fees of Private Long Day Care and Community Long Day Care by 50 hours, Family Day Care by 35 hours, and Outside School Hours Care services by the average time of a session. Table C.1 presents the average fees for four age groups by State. The 12.4 per cent additional yearly increases in childcare fees are used to construct hourly fees for later years.

Table C.1: Hourly fees by state/territory and age of child in 2002 (in $)

	Age of child			
States/Territories	*5+*	*3-4*	*2*	*0-1*
New South Wales	3.57	4.00	4.22	4.56
Victoria	3.35	3.84	3.85	3.89
Queensland	3.12	3.56	3.63	3.70
South Australia	3.43	3.96	3.91	3.97
Western Australia	3.78	3.71	3.77	3.88
Tasmania	4.12	4.28	4.25	4.28
Northern Territory	4.59	3.67	3.68	3.76
Australian Capital Territory	4.22	4.30	4.38	4.39
Total	3.43	3.86	3.94	4.07

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