Demands for Childcare and Household Labour Supply in Australia

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Abstract. Demands for formal and informal childcare are estimated using a bivariate Tobit model. Predicted costs of childcare are incorporated in the households' budget constraint and a discrete choice labour supply model is estimated. Separate models are estimated for couples and lone parents. Increases in the prices and costs of childcare lead to reductions in labour supply for lone parents and partnered mothers. Results suggest the average elasticities in Australia are closer to those found in the U.K. and are smaller than the estimates for Canada and the US. Effects are stronger for single parents and mothers facing low wages.

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I. Introduction

In Australia as in many other countries, much of public policy concerned with reducing poverty and welfare dependence has focused on promoting individuals' attachment to the labour force. In the last decade, welfare programs have been altered to reduce negative work incentives for those at the bottom of the income distribution. For families with children, the cost of non-parental childcare has been treated as crucial in the decision of parents to engage in market work and policy reforms have included substantial increases in the subsidisation of childcare services. Such policy shifts overseas sparked many studies of the relationship between labour supply and non-parental childcare use. However, to date there has been no formal study of this relationship for Australia.

In this paper, we use a specialised survey on childcare use to estimate demands for formal and informal childcare[1] by households. A bivariate Tobit model is used to allow for interdependence between the two forms of childcare and to model specifically the prevalence of zero hours of childcare. Childcare costs are imputed from these and incorporated in a flexible discrete choice model of household labour supply. The labour supply model is structural and incorporates the details of income taxes and social security payments. Simulations are then performed to look at labour supply responses to changes in the price and costs of childcare for various types of households.

Although there has been no direct estimation of the labour supply effects of childcare costs in Australia, some studies have addressed related issues. One of the earlier policy thrusts by state and federal governments consisted in ensuring the provision of sufficient childcare places to meet demand and this issue has received some attention (for example Teal, 1992; Szukalska et al., 1999). Others have been concerned with the imputation and estimation of the costs of childcare using various methodologies.[2] Although there are some disagreements, results mostly suggest that costs of childcare are large and hence should influence the parents' decision to work. It was also suggested that the childcare policies in place in the mid to late nineties did not provide incentives to low-wage mothers with young children to participate in the labour market. Finally, Cobb-Clark et al. (2000) present direct evidence from non-working partnered mothers who report that childcare problems are not the main factor

determining their decision not to participate in the labour market.

Overseas empirical results vary considerably with the particular approach used as well as the data set. (We present a table with references to overseas studies and their main results later in the paper). Generally, it has been found that policies which reduce the costs of childcare induce an increase in both labour supply and childcare use. The responses in labour supply are quite small on average but they are stronger for people at the bottom of the income distribution so that progressive measures generally elicit a larger reaction.[3] Use of childcare by employed mothers is more price sensitive than for unemployed mothers.[4] Formal childcare is also more sensitive to price and wage effects than informal care.

An important aspect of childcare is the large degree of heterogeneity across types of care. There is considerable usage of both informal services provided by relatives, often at no monetary charge, and of highly structured, formal day care centres offering large variations in quality and in fees. Availability of services differs by age of child and region, and often in ways that are unobserved by the researcher (for example access to cost-free care by relatives or friends). The existing overseas research has mainly dealt with formal care. Blau and Hagy (1998), Michalopoulos and Robins (2002, 2000) and Michalopoulos et al. (1992) are examples of the few studies that model jointly the labour supply decision and the choice of mode of childcare. In these studies, the mode of childcare and the labour supply are discrete choices. Our study is more general in the modelling of the intensity of childcare use since we model formal and informal hours of care as continuous.

A related difficulty is the modelling of the price of childcare. Self-reported prices are likely to be endogenous as parents choose among providers offering different levels of quality and other attributes (usually unobserved) along with differing price structures.[5] Generally, the endogeneity of prices for formal care has been addressed by using variables capturing regional variations as instruments. Blau and Robins (1988, 1989) use regional variations in expenditures on childcare to measure price and quality changes. Kimmel (1998), Michalopoulos and Robins (2002, 2000), and Ribar (1992, 1995) use regional variations in childcare regulations and wage levels; Blau and Robins (1988) and Leibowitz et al. (1992) impute information on wages of

childcare workers by state; while Duncan et al. (2001a, 2001b) match information on availability of services by local authority. Other researchers combine information from household surveys with surveys of care providers; that is, information from the supply side of the market is used to capture variations in the price-quality packages of childcare services available to households. We use this latter approach following Walker (1992), Blau and Mocan (1999), Blau and Hagy (1998) and Hagy (1998).

The paper is organised as follows. A discussion of the data and descriptive statistics are presented in the next section. This is followed by the estimation of the childcare demands. Section four presents labour supply estimates and responses to childcare costs. Section five compares the Australian results with the findings for overseas countries and the final section presents concluding remarks.

II. Descriptive Statistics on Childcare

Information on the use and costs of childcare is collected by the Australian Bureau of Statistics (ABS) in a specialised survey called the Child Care Survey (CCS). This household survey is conducted occasionally (recently every three years) and contains data for a large and representative sample of Australian families with children less than 12 years of age. There is limited information on income and no information on education in this survey. Consequently, we impute childcare costs for households in the Survey of Income and Housing Costs (SIHC), using a model estimated from the CCS, for the estimation of a labour supply model. The SIHC is also a large sample and representative of the general population. It offers detailed information on income, labour market activity, personal and household characteristics and is often used for labour supply estimation in Australia. The latest year for which we could obtain both the CCS and the SIHC was 1996.[6]

The 1996 CCS contains information on 11 419 children aged under 12 years living in 6 421 income units. Unlike most of the data sets used overseas, the CCS includes information on childcare for all households regardless of their employment status. Children are grouped in income units and total childcare (across all children in the income unit) is used. All empirical work is conducted separately for lone parents and couples.

Table 1 presents information on childcare use by households according to the employment status of the parents and the age of the youngest child. Approximately 60% of households use childcare services. This proportion is larger for households with working parents: 81% of employed lone parents and 69% of two-worker households use childcare. The proportion rises further when children under five years are present: nearly all working lone parents and over 80% of working couples use childcare. Among couples, 40% of total childcare hours are in formal arrangements while for lone parents, the proportion is just over 30%.[7] The proportion of formal-care hours is not very sensitive to the employment status of parents but it depends strongly on the age of the children in the household.

Table 1 Childcare use by type, parents' employment and age of youngest child

	Age of youngest child				Total
Couples	**10-11**	**5-9**	**3-4**	**0-2**	
Two working parents					
Percentage using care	45.12	59.41	89.78	81.29	69.38
Share of formal hrs in total care use	0.114	0.213	0.540	0.441	0.360
Sample size (unweighted)	397	1042	479	843	2761
One working parent					
Percentage using care	17.98	24.58	69.80	53.50	46.23
Share of formal hrs in total care use	0.069	0.154	0.703	0.445	0.460
Sample size (unweighted)	169	516	360	1039	2084
No working parent					
Percentage using care	15.81	9.23	53.38	44.77	34.55
Share of formal hrs in total care use	0.000	0.000	0.722	0.504	0.480
Sample size (unweighted)	47	113	80	220	460
All couples					
Percentage using care	35.26	45.19	78.71	63.86	57.24
Share of formal hrs in total care use	0.103	0.200	0.607	0.447	0.399
Sample size (unweighted)	613	1671	919	2102	5305
Lone parents					
Working parent					
Percentage using care	64.09	76.99	98.62	97.95	81.35
Share of formal hrs in total care use	0.088	0.195	0.563	0.416	0.294
Sample size (unweighted)	96	198	69	74	437
Non-working parent					
Percentage using care	23.86	37.32	74.03	60.04	50.16
Share of formal hrs in total care use	0.037	0.101	0.506	0.358	0.311
Sample size (unweighted)	84	232	119	244	679
All Lone Parents					
Percentage using care	45.00	55.40	82.93	69.48	62.35
Share of formal hrs in total care use	0.075	0.160	0.531	0.378	0.303
Sample size (unweighted)	180	430	188	318	1116

Notes: The numbers in the Table are weighted to represent the Australian population. The sample size refers to the number of income units.

Interestingly, most households in the survey state that they are not constrained in their

hours of childcare use. Only nine percent of the households state that they require additional childcare but find it is unavailable. (This does not include parents who say they are constrained because of high childcare prices).[8]

Table 2 presents information on average hourly costs for those households who use childcare. Most households (over 90%) who use formal care pay a positive hourly cost whereas just over 10% of households pay a positive price for their informal care usage. Focussing on formal care, we find that the average hourly cost varies by age of child, which is perhaps not surprising, but it varies almost as much by the employment status of the parents. This suggests that parents are facing more than one price and a choice is made over prices and other attributes of childcare.[9]

Table 2 Summary statistics on costs and usage for households using childcare[a]

a. By employment status

	Couples				Lone parents		
	Two workers	**One worker**	**No workers**	**Total**	**Worker**	**Non worker**	**Total**
Weekly hours of childcare	15.58	7.12	5.73	11.39	23.72	13.66	17.59
Proportion paying for care							
Any care	0.55	0.53	0.53	0.54	0.49	0.38	0.43
Formal care	0.95	0.92	0.94	0.94	0.95	0.93	0.94
Informal care	0.18	0.06	0.02	0.14	0.15	0.03	0.09
Hourly cost in $[b]							
Total care	2.58	2.12	1.43	2.38	1.79	1.17	1.53
Formal care	3.00	2.39	1.52	2.71	2.07	1.68	1.89
Informal care	3.60	3.99	1.88	3.64	2.99	2.76	2.96

b. By age of youngest child

	Couples				Lone parents			
	10-11	**5-9**	**3-4**	**0-2**	**10-11**	**5-9**	**3-4**	**0-2**
Weekly hours of childcare	2.86	5.86	18.27	15.22	8.01	13.45	31.23	20.64
Proportion paying for care								
Any care	0.17	0.32	0.76	0.60	0.17	0.28	0.70	0.51
Formal care	0.91	0.93	0.95	0.94	1.00	0.93	0.94	0.95
Informal care	0.06	0.13	0.20	0.14	0.08	0.10	0.11	0.08
Hourly cost in $[b]								
Total care	3.58	3.04	2.25	2.23	2.42	2.28	1.23	1.26
Formal care	5.32	3.27	2.57	2.58	2.41	2.50	1.92	1.55
Informal care	4.55	3.85	3.54	3.49	3.35	3.43	2.20	2.73

Notes: a) The numbers in the Table are weighted to represent the Australian population. b) The hourly cost is averaged only over the non-zero values.

Finally, Table 3 presents information on the different reasons for childcare use. Work is listed as a main reason (for at least one child in the household) for 42% of the

households who use formal care and 47% of the households who use informal care. For 62% of children aged 3 to 4 years, parents give "beneficial for the child" as the main reason for formal care use. This reason is chosen mostly for those children who attend preschool. We come back to the treatment of preschool in Section three.

Table 3 Main reason for using childcare by type of care

	Formal	**Informal**
% of households giving the following reason as the main reason for at least one child		
Work	41.98	46.62
Job search/study	2.52	2.14
Personal/other	15.90	49.23
Beneficial for child	42.70	4.26
% of children for whom 'Beneficial for child' is given as the main reason for childcare		
0-2 years old	15.19	2.06
3-4 years old	62.04	6.20
5-9 years old	11.67	3.31
10-11 years old	3.96	1.97

Notes: The numbers in the Table are weighted to represent the Australian population.

To conclude this section, we provide a brief description of the policies related to childcare in place at the time of the survey in 1996. (More details on childcare policies and more generally on the Australian tax and transfer system are available from the authors). Several types of subsidies were available for childcare. Direct funding was provided to help build, equip and operate childcare centres. This was meant to ensure a sufficient number of childcare places. In addition, two kinds of subsidies were available to households. These depended on the family's income, assets, employment status, number of children and childcare expenses. The Child Care Assistance was means-tested and paid directly to the providers. This reduced the fees paid by eligible families. The Child Care Rebate was not means-tested and was paid to the parents upon receipt of claims for childcare expenses. The rebate could be claimed for work-related expenses only, including training and looking for work.

The survey data do not provide direct information on the amount of subsidy received. Furthermore, the cost figures provided by respondents are likely to reflect the payment of Child Care Assistance since this is paid directly to the providers and the survey question does not specify clearly whether gross or net costs should be given. Thus, variations in the hourly cost will measure to some extent variations in the payment of government subsidies as well as the distribution of fees charged by the care providers.

III. Estimation of Demands for Childcare

(i) The Use of External Information on Fees

In order to have some measure of exogenous variations in prices faced by households for childcare services, we use information on fees charged by the service providers. This information is collected by the Department of Family and Community Services through its Census of Child Care Services. The census is conducted regularly and includes all services receiving funding from the Commonwealth Government of Australia. This basically includes all providers of formal childcare except for preschools. We use the Census conducted over 1996 and 1997. Information is provided on 7 624 services spread across Australia. More information on the Census can be obtained from the Department of Family and Community Services (1999).

We use average fees by state and age of child to measure variations in prices faced by households for formal childcare.[10] All fees are converted to hourly rates using information provided by the Department of Family and Community Services. The resulting fees by state and age of child are presented in Table 4.

Table 4 Hourly fees by state and age of child (in dollars)

	Age of child			
States and territories	**5 and over**	**3-4**	**2**	**0-1**
New South Wales	2.866	3.260	3.463	3.756
Victoria	2.670	3.196	3.226	3.250
Queensland	2.555	2.889	3.031	3.196
South Australia	2.633	3.391	3.399	3.401
Western Australia	2.728	3.154	3.227	3.348
Tasmania	3.041	3.758	3.761	3.885
Northern Territories (NT)	2.798	3.083	3.130	3.186
Australian Capital Territory (ACT)	3.323	3.623	3.723	3.756
Total	2.739	3.173	3.282	3.419

A comparison with the hourly costs of childcare observed in the CCS (see Table 2) shows that fees are on average a little higher than the costs reported by households especially for children under school age. This could be due to the Child Care Assistance, which creates a wedge between fees charged by the services and the costs paid by the households. It is interesting that the fees charged by providers fall when older children are concerned while the average cost of formal care reported by households increases with the age of the youngest child. This could be due to the much lower Child Care Assistance available for school-aged children.

(ii) The Treatment of Preschools in the Model

The use of fees charged by providers of childcare services raises the issue of how to treat preschools and how to define formal versus informal care. In Section two we took the usual definition of formal care which includes preschools. However, preschools are not considered childcare service providers from the point of view of the Department of Family and Community Services and instead form part of the formal education system. The fees presented in Table 4 do not include fees charged by preschools. These latter fees are usually lower.[11]

There are other issues involving the treatment of preschools. Hours of preschool are more or less fixed and once the decision to use preschool has been made, the observed hours may not reflect demanded hours. Furthermore, the main reason given for preschool usage is that it is beneficial to the child (see Section two). In many ways, preschool care can be regarded more as education than childcare although it is not compulsory. From a modelling standpoint, this suggests that preschools should be treated separately from both formal and informal care. Given the relatively small sample of households who use preschools, the use of a trivariate model of childcare is not practical. In the models presented in this section, preschool is included in informal care. This decision was made based on the results from the estimation of alternative models and specification tests.[12]

(iii) Specification of the Model of Demand for Childcare

The framework used for the estimation of the system of demands for formal and informal care is a bivariate Tobit. The model takes into account the correlation between unobservables affecting formal and informal demands. In particular, proximity to family members, an unobservable characteristic, could increase the use of informal care and simultaneously reduce the hours of formal care demanded by reducing the cost of informal care relative to that of formal care. In this case, a negative correlation between error terms would be generated by the missing information.[13]

For informal care, a zero fee is payable for 90% of households. One has to reconcile this zero (observed) price with the limited quantity of informal care used, as standard demand theory would predict unlimited demand for a good with a zero price. A few

approaches have been used in the literature to solve this problem. The most straightforward one is to assume that informal care involves costs, which are not included in the observed hourly price. An alternative explanation is that the availability of informal care is likely to vary across households. Information on the proximity to other family members would be an important component in the explicit modelling of this feature of childcare. This information is generally not available in childcare surveys. Although we do not have direct information on availability of relative care, we believe that the explanatory variables in our model (for example age of parents) capture some of the variation in this determinant of childcare.

Appendix Table A1 presents the results of the bivariate Tobit model for the demand for childcare. The demand model is conditional on the labour supply choice of the parents, the gross income of the parents, as well as household composition. The dependent variables are hours of formal and informal childcare. Explanatory factors include: the number of children by age groups, the employment status and the hours of work for each parent, the income of each parent, childcare fees, an urban indicator, an ACT-NT indicator, the age group of each parent, and the sex of the lone parent. Except for rural/urban and ACT-NT indicators, variables representing geographical location have been excluded since the variation in childcare fees captures most of these effects.

We began by estimating specifications that included many interactions and nonlinearities in the explanatory variables and tested down. In the specification presented in Appendix Table A1, fees are interacted with indicator dummies for the presence of children in three age groups. Interactions of fees with the number of children in the household in the age groups 0 to 2 and 3 to 4 are included as well. (Note that this specification implies that a fee for a particular age group only matters for the household if there are children in that age group in the household). Interactions of childcare fees with household income and in particular with income groupings corresponding to policy parameters were insignificant. Labour supply levels enter nonlinearly with jumps at zero and quadratic effects for positive hours of work. Also, employment indicators and hours of work are interacted with the number of children by age group. The parents' ages affect informal childcare but not formal childcare.

Various measures of fit are provided in Appendix Table A1. Overall the models perform well in the sense that they explain over 50% of the variation in formal care demands and 20 to 34% for informal care. Also, the average predicted probability of zero hours is within one percentage point of the observed frequency for formal demands and within eight percentage points for informal demands.[14] In general the models explain the demand for formal care much better than informal care.

We now turn to the parameter estimates. For both couples and lone parents we find that formal and informal care demands are substitutes in the sense that unobservables that tend to increase one form of use also tend to reduce the other. Maximum likelihood estimates of the correlation coefficients for the error terms are -0.17 for lone parents and -0.27 for couples. Although the correlation is not very strong it is significantly different from zero for both groups of households (p-values are 0.001 and 0.000 respectively). The negative correlation could reflect the impact of unobserved characteristics such as availability of informal care or the range of quality offered in the formal care services.

(iv) Marginal Effects

To facilitate the discussion of the results of the bivariate demand model, we present marginal effects of all explanatory variables in Table 5.[15] The results seem reasonable and generally are in line with expectations. Families with more children use more childcare and so do higher income groups and families with working parents. Additional children of preschool age increase the use of formal childcare while older children reduce usage of this type of care. For example, an additional child aged 3 to 4 years increases formal childcare use by over two hours per week in two-parent households and by almost four hours for lone parents. An additional child aged 10 years or over reduces formal childcare demand by over two and a half hours per week for both couples and lone parents. Informal childcare is increased by the presence of additional children regardless of their age but effects are generally stronger for younger children. With a few exceptions, the effects of adding children of any age on the demands for childcare are large and significant.

Parents' employment generally increases usage of both formal and informal childcare but the effects are stronger for informal care, and for lone-parent households. The

only exception to this is the effect of hours of work by fathers in two-parent households. Increasing hours of work for these fathers reduces formal childcare usage by a small amount (.06 hours per week for an increase of one hour of work). The

Table 5 Marginal effects on formal and informal childcare demands (standard errors in parentheses)

	Couples		Lone parents	
	Formal	**Informal**	**Formal**	**Informal**
Income:			0.004 (0.001)	0.005 (0.004)
Father	0.001 (0.000)	0.002 (0.000)		
Mother	0.002 (0.001)	0.001 (0.001)		
Hours of work:				
Father	-0.059 (0.024)	0.019 (0.043)	0.155 (0.153)	0.420 (0.202)
Mother	0.123 (0.018)	0.175 (0.027)	0.243 (0.054)	0.187 (0.085)
Employment:				
Father	0.322 (0.534)	3.115 (0.933)	5.673 (2.893)	17.092(4.213)
Mother	4.052 (0.341)	6.461 (0.500)	3.063 (2.283)	17.511(4.676)
Fees:				
Children 0-2	-0.832 (0.995)	1.455 (1.370)	-5.419 (3.739)	5.265 (5.887)
Children 3-4	-0.585 (1.308)	6.585 (2.183)	-0.144 (3.961)	3.497 (9.162)
Children 5+	-0.412 (0.133)	-0.090 (0.281)	-0.365 (0.291)	2.049 (1.421)
No. children:				
< 1 Yr.	0.320 (0.435)	3.996 (0.714)	1.511 (1.445)	11.382(3.638)
1 Yr.	2.803 (0.389)	3.876 (0.711)	3.722 (0.960)	8.161 (2.875)
2 Yrs.	4.459 (0.376)	4.151 (0.589)	7.234 (0.986)	2.955 (2.035)
3-4 Yrs.	2.291 (0.503)	6.311 (0.912)	3.888 (1.844)	9.392 (2.262)
5-9 Yrs.	-0.387 (0.201)	1.480 (0.365)	0.580 (0.659)	6.077 (1.506)
10 + Yrs.	-2.648 (0.414)	0.532 (0.580)	-2.813 (1.185)	5.607 (2.811)
Capital city:	0.378 (0.234)	0.675 (0.390)	1.144 (0.540)	-2.020 (1.419)
ACT&NT:	1.773 (0.526)	-1.093 (0.663)		
Parents' age:				
15-24 years:				6.570 (2.700)
Mother		1.627 (1.517)		
Father		3.073 (1.732)		
25-34 years:				4.145 (1.782)
Mother		0.905 (0.479)		
Father		1.174 (0.482)		
Parent is male:			2.177 (2.067)	-2.606 (3.578)

Notes: Marginal effects are computed for each data point and averaged over the samples. Standard errors are computed on these averages with a bootstrap estimator using 200 replications. Income is measured in dollars per week. Hours of work are measured in hours per week and marginal effects are averaged over the samples of workers only. Employment refers to the labour force status during the reference week. The counterfactuals for the change in employment are as follows: for those observed working, they are given hours of zero and income equal to the average income observed among non-workers when evaluating the expected value for employment set at zero. For non-workers, they are given average hours of work and income observed among workers when evaluating the expected hours of childcare for employment set at one. The averages used for the counterfactuals are computed separately for males and females and for the two types of households. Fees are measured in dollars per hour and marginal effects are averaged over the samples of households with children in the age group under consideration. The parents' age groups are relative to the 35 and over group. For couples, the capital city dummy does not include the Australian Capital Territory (ACT) or Darwin. The ACT&NT dummy is set at one for all observations in the ACT or Northern Territories (NT). We must group the NT with the ACT because this is how the data are grouped in the SIHC survey. For lone parents, the capital city dummy is also set at one for all ACT and NT observations.

mother's employment status has greater effect on childcare use than that of the father for two-parent households. Couples in which the mother works use around four additional hours of formal care and 6.5 hours of informal care per week. An employed lone mother uses three additional hours of formal childcare and 17.5 additional hours of informal care compared to a non-working lone mother. (The median hours of work for a working mother, single or coupled, is 20 hours per week).

Increasing hours of work by working mothers in couples is related to a similar increase in both formal and informal care (.10 to .20 hours of care for an additional hour of work). For working lone mothers, an additional hour of work raises both formal and informal care by around .20 to .25 hours per week. Effects of labour supply on childcare demand are substantial and significant except for fathers in two-parent couples where effects are often small and insignificant and for hours of work by lone fathers where the sample size is quite small and only the effect on informal care is significant.

Younger parents use more informal childcare but no significant effects were found for formal care. The parents' ages are possibly an indication of the availability of informal care from grandparents. Male lone parents use more formal care and less informal care; however the latter effects have high standard errors probably due to the small sample size (only seven percent of lone parents are male). Families living in urban areas (excluding the ACT) use more formal care, however this effect has a large standard error as well. Couples living in the ACT or NT use over one and a half hours per week more in formal childcare compared to couples living in one of the states. They also use one hour per week less in informal care. The effects of residence in a capital city, the ACT or NT are not significant for informal childcare use.

Income increases usage of both formal and informal childcare. Note that these income effects are computed keeping labour supply fixed hence they should be interpreted as pure income effects. The results suggest that childcare is a normal good. An increase of $100 per week in the income of a lone parent keeping their labour supply constant would raise the use of childcare by around one hour per week in total, the increase almost evenly distributed between formal and informal care. In comparison, similar

increases in the incomes of either mothers or fathers in two-parent households would cause an increase in total care of about one third of an hour.

Fees are negatively related to usage of formal care and with one exception are positively related to informal care. This is consistent with the interpretation of formal and informal care as substitute goods. Among couples, the fees for older children are negatively related to informal care although the effect is very small and insignificant. The size of the coefficients on the fees seems reasonable, but the standard errors are generally large and several of the coefficients are insignificant. This is likely to be due to the lack of variation in our instrument for childcare prices.[16]

(v) Price Elasticities of the Demand for Formal and Informal Childcare

The income, price and hours of work effects are presented in the form of elasticities in Table 6. This facilitates the comparison to other papers in the area. A similar procedure as for the marginal effects is used to derive these results.[17]

Income elasticities are positive in all cases. The effects are generally stronger for formal than for informal care. Positive and significant effects of hours of work on both types of childcare use are found for mothers. Lone fathers also increase childcare use with longer hours of work; however in couples, fathers' working hours are found to reduce hours of formal childcare.

Table 6 Childcare demand elasticities (standard errors in parentheses)

	Couples		Lone parents	
	Formal	**Informal**	**Formal**	**Informal**
Income:			0.415 (0.167)	0.107 (0.082)
Father	0.189 (0.066)	0.190 (0.035)		
Mother	0.196 (0.049)	0.024 (0.028)		
Hours of work:				
Father	-0.953 (0.363)	0.098 (0.233)	0.534 (0.746)	0.520 (0.219)
Mother	0.355 (0.135)	0.230 (0.086)	0.912 (0.202)	0.205 (0.094)
Fees:				
Children 0-2	-0.644 (0.784)	0.540 (0.517)	-3.430 (2.818)	1.147 (1.268)
Children 3-4	-0.343 (0.773)	1.606 (0.520)	-0.044 (1.738)	0.497 (1.314)
Children 5+	-0.524 (0.177)	-0.034 (0.107)	-0.499 (0.417)	0.372 (0.261)

Notes: Elasticities are computed using the marginal effects presented in Table 5. They are computed for each data point and averaged over the samples. Standard errors are computed on these averages with a bootstrap estimator using 200 replications. For hours of work, elasticities are averaged over the subsets of workers only. For fees, the averages are taken over households with children in the relevant age groups.

The own price elasticity is negative and quite strong for both types of households. It

implies that a one percent increase in childcare fees will cause a reduction in demand for formal care of 0.34 to 0.64% for couples. For lone parents the results are more variable with effects ranging from 0.04 to 3.43%. Informal care is a substitute in the sense that formal price effects are positive except for the case of older children in couples, where a small insignificant negative elasticity is observed.

The own price elasticities in a selection of other studies range between -1.994 and -0.248 for married mothers (see Table 7). Compared to these findings, our results for formal childcare are in the same direction but at the low end of the range for married mothers. As mentioned by Michalopoulos and Robins (2002), fewer studies are available for lone parents. Table 7 presents two widely ranging values, one of which (0.868) seems to arise from a misspecification as indicated by the authors, leaving us with a value of -0.34 for married mothers and lone parents combined (Blau and Hagy, 1998). Our results for lone parents suggest that the elasticity could be considerably stronger for these households especially when young children are present.

Table 7 Summary of results from other studies on the effects of childcare prices/costs

Reference	Country and year	Population (age of youngest child)	Estimated elasticity Demand for paid/formal childcare
Blau and Hagy (1998)	U.S. (1989/90)	Married and single mothers (<7)	-0.34[a]
Blau and Robins (1988)	U.S. (1980)	Married women (<14)	-0.34[a]
Ribar (1992)	U.S. (1985)	Married women (<15)	-1.86[b] -1.39[a]
Ribar (1995)	U.S. (1984/85)	Married women (<15)	-0.248 to -0.695[a]
Powell (2002)	Canada (1988)	Married women (<7)	-1.3698 to -1.9944 (centre)[a] -3.3135 to -4.2246 (sitter)[a]
Michalopoulos and Robins (2000)[c]	Canada (1988) and U.S. (1990)	Married mothers (<5)	-1.080 (all)[a] -1.414 (US)[a] -0.628 (Canada)[a]
Michalopoulos and Robins (2002)[c]	Canada (1988) and U.S. (1990)	Single parents (<5)	0.868[a]
Choné et al. (2003)	France (1997)	Married women (<3) Married women (<7)	-0.31 -0.29

Notes: a) Evaluated at each observation and averaged across all observations. b) Evaluated at the sample means. c) This elasticity is for a price change in the base model (see Table 5, page 486).

(vi) Predicted Demands for Childcare

Finally, in Table 8 we present estimates of total weekly demands for childcare (formal and informal) by employment status, income and presence of young children. The household types in Table 8 are chosen to illustrate the separate effects of the presence

of young children, hours of work and income on childcare demands.

Table 8 Predicted total weekly demand for childcare hours (including zero hours)

Households	Couples			Lone parents		
	No child under 5	**One child aged 1**	**One child aged 1 + one child aged 3-4**	**No child under 5**	**One child aged 1**	**One child aged 1 + one child aged 3-4**
No working parent	2.819	4.592	6.054	9.514	14.377	32.339
One parent works- father works in couples:						
Median I, median H	4.144	6.255	6.761	18.564	38.379	72.865
Low I, low H	3.923	6.038	6.949	15.549	30.470	54.017
Low I, high H	3.848	5.846	6.353	22.277	52.419	104.536
High I, high H	4.539	6.795	7.302	24.204	56.217	109.769
Both parents work- father has median hours and income and mother has:						
Median I, median H	10.755	18.617	19.176			
Low I, low H	8.598	12.841	10.499			
Low I, high H	12.030	25.243	31.192			
High I, high H	12.648	26.674	33.701			

Values used for income (in dollars per week) and hours:

	Couples		Lone parents	
	Income	**Hours**	**Income**	**Hours**
No working parent:			275	0
Father	140	0		
Mother	225	0		
One working parent (father's values for couples):				
Low values	450	37	350	8
Median values	650	45	450	20
High values	900	45	550	37
Two working parents (mother's values for couples):				
Low values	225	8		
Median values	350	20		
High values	550	37		

Notes: For all characteristics other than labour supply and the presence of children one to 5 years old, the average characteristics over the samples are used to predict hours of care. In particular, households are given the average number of children over 5 years old. I refers to income including labour income and H indicates hours of work. The median, low and high values for income and hours are computed from sample information and are specific to the employment profile of the household. Low values correspond to the 25th percentile while high values are the 75th percentile. Specific values are given in the table. For couples, when one parent works it is assumed that the father is the worker. In this case the mother is given $57.20 for weekly income and zero hours. These are the median values for that subsample. When both parents work, the father is given median hours and income and the mother is given the hours and income listed in the Table.

We begin by looking at the effects of young children in households with working parents, assuming the parents work the median number of hours and earn the median income for the type of household in question. We find that adding a young child aged one to lone-parent households with a working parent increases total childcare demands by 20 hours per week. Note that the parent is allocated 20 hours of work per week in this case. For couples with one worker (the father), there is a modest increase of around two hours per week in childcare demand. When both parents work, the

increase is substantial —eight hours per week— but it is less than for lone parents. (The mother is also assumed to work 20 hours per week in this case). Adding a second child of preschool age, specifically a child aged 3 to 4 years, raises hours demanded by a small amount for couples but it doubles the number of hours predicted for lone parents.

Turning now to the effects of hours of work, we find that both for couples and for lone parents, it is hours of work rather than income that is the main determinant of childcare demand. For example in the case of lone parents, raising hours of work from eight to 37 increases childcare demand by 20 to 25 hours for each preschool child. Raising income from $350 to $550 per week causes an increase of roughly three hours per week per preschool child.[18] A similar result is found for couples. Increasing the mother's hours of work from eight to 37 raises total demand for childcare by roughly 10 hours per preschool child while the effect of raising income per week from $225 to $550 is an increase of approximately one hour of childcare per preschool child. For couples with only the father working, both increases in hours of work and income have small impacts only.

IV. Childcare Costs and Labour Supply Estimates

(i) The Cost of Childcare

In our framework, childcare use affects labour supply through the household budget constraint.[19] From the estimated demands, we need to derive costs of childcare for different types of households at all values of labour supply. One possible approach is to use the system of demands presented in the previous section. Costs could be estimated by multiplying the predicted demands by hourly fees for the different types of households. However since observed costs for informal care are zero for most households, this would essentially mean using zero costs for that type of care.

We choose instead to estimate a model similar to the bivariate Tobit described in Section three with informal care costs replacing the hours of informal care demanded. All explanatory variables in this specification are the same as those used in the joint demand model. Although harder to interpret, this model provides a better prediction of informal care costs than would a model based on the demand for informal care given the lack of exogenous prices for informal care and the prevalence of zero self-reported prices.

Overall, the fit of this new model and the results are similar to that of the previous framework. The approach provides a reasonable prediction of both formal and informal childcare costs.[20] To briefly discuss the results, there is little change in the coefficients for the formal care demand equation. Some differences are found in the effects on informal costs for lone-parent households. In particular, employment of the lone parent causes a much smaller effect on informal costs than on the informal hours of care demanded, which suggests the availability of care at a zero price.

(ii) The Imputation of Childcare Costs

The predicted gross costs are used to impute childcare costs for households in the SIHC sample for different labour supply choices. The modelling of the budget constraint (in this case allowing for childcare costs) and more generally the labour supply form part of the Melbourne Institute Tax and Transfer Simulator (MITTS), a microsimulation model which has been used to study various policy reforms in Australia. First, for each labour supply choice, 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 and calculated gross income). This childcare cost is generated for each possible labour supply choice allowed in the labour supply model.[21]

Net costs are calculated from the predicted gross costs of childcare and the predicted levels of Child Care Assistance and Rebate. These are calculated within MITTS based on the characteristics of the households and the predicted formal childcare costs. The subsidies are deducted from the formal costs, before adding the formal and informal costs together.[22] The result is a predicted net childcare cost based on predicted formal demands, average fees per household, total predicted informal care costs and calculated subsidies.

(iii) The Labour Supply Model

Appendix B describes details of the labour supply model used. In summary, households are assumed to maximise a utility function of household consumption

(assumed to equal net incomes) 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. Household composition, non-labour incomes (other than government benefits) and wages are treated as exogenous. Labour supply choices are discrete and include the option of not working.

The household budget constraint also incorporates childcare costs. Rather than associating each household with the predicted childcare cost, we use a simulation technique to improve the efficiency of the model. This consists of predicting childcare costs including an error term drawn from a distribution with characteristics equal to those estimated as part of the cost model. In other words, we draw from the distribution of childcare costs. Repeated draws are taken for each household and the likelihood function is averaged over these draws before being maximised. In the prediction stage, optimal labour supply is predicted for each draw and an average is taken over the draws. Technically, this involves averaging the labour supply estimates rather than the childcare costs estimates.

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 that the calculation of the Child Care Assistance and Rebate is more accurate in this approach, given that the subsidy payable for the average childcare cost is not the same as the average Child Care Assistance and Rebate. In this section, we present results for the approach where 10 values are drawn from the distribution of the unobservables in the model of hours of formal care and costs of informal care.

The results of the labour supply estimation including the childcare costs are given in the last two columns of Appendix Tables A2 and A3. These tables include the parameter estimates for the labour supply model estimated without childcare costs for comparison. The overall results are similar to the original estimates in the direction and the relative size of the parameters. Not unexpectedly, the largest changes are observed for the variables associated with children in the wife's labour supply preference and in the variables associated with children in the lone parent's labour

supply and income preferences. That the addition of childcare costs results in quite small changes in the labour supply parameters is not surprising given the size of the costs relative to many household incomes.

(iv) Elasticity of Labour Supply to Childcare Fees and Costs

Labour supply estimates for all households with children in the SIHC are given in Table 9. These are based on the new parameter estimates, which take into account the childcare costs estimated from the formal demand/informal costs model. In order to facilitate the interpretation of the results we look at labour supply responses following two types of changes in childcare costs. First, we look at the changes in expected labour supply resulting from a 10% increase in net costs of childcare. This increases the costs directly and incorporates any changes in the demands.[23] The second experiment is a 10% increase in the price of formal childcare. Demands adjust downward resulting in a smaller increase in total gross costs. The government subsidies are recomputed after the increase in price to calculate the net costs.

Table 9 Labour supply estimates and changes for households with children

	Lone parents		Couples			
			Fathers		Mothers	
	Exp hrs	Part.	Exp hrs	Part.	Exp hrs	Part.
Labour supply estimates -childcare costs not included						
Initial estimates:						
- predicted values	11.39	0.398	38.24	0.901	14.52	0.505
- actual values	11.32	0.402	38.14	0.903	14.00	0.515
- % correct predictions		45.33		37.22		30.40
Labour supply estimates -childcare costs included						
Initial estimates:						
- predicted values	11.35	0.398	38.24	0.901	14.52	0.505
- actual values	11.32	0.402	38.14	0.903	14.00	0.515
- % correct predictions		44.48		37.20		30.34
Add 10% to net costs:						
-predicted values	11.18	0.394	38.24	0.901	14.47	0.504
-change	-1.5%	-0.4ppt	0.0%	0.0ppt	-0.3%	-0.1ppt
Add 10 % to gross prices (allowing for adjustments in demand):						
-predicted values	11.29	0.396	38.25	0.901	14.49	0.504
-change	-0.5%	-0.2ppt	+0.0%	0.0ppt	-0.2%	-0.1ppt

Notes: Exp Hrs denotes expected hours of labour supply including zeroes. Part. indicates the participation rate.

The increased costs of childcare reduce participation and hours of work by a modest amount. The effects are larger for lone parents than partnered women. The impacts on fathers in two-adult households are negligible. Also as expected, an increase in costs generates a larger effect than a rise in the price due to adjustments in demands. For

lone parents, the elasticity in hours of work is –0.15 with respect to costs and –0.05 with respect to prices. For partnered women, the figures are –0.03 and –0.02 respectively.

The labour supply effects not only vary with the number of adults in the households but also with income levels and the age of children. Table 10 illustrates these results. Lone parents, particularly those with preschool children, are most affected. For these households, the elasticity in hours of work to a change in the price of childcare is –0.18. When restricting the sample to those earning less than the median wage, the effect increases to –0.22. Labour supply decreases substantially when preschool children are present (5.71 versus 11.35 hours per week). The effect is larger for lone parents facing wages below the median wage for the group (3.70 hours per week). It is interesting to note that an increase in the fee has a greater impact on lone parents with

Table 10 Effects of increases in childcare costs on labour supply by type of household

	Lone parents		Couples			
	Expected hours[a]		Expected hours[a] men		Expected hours[a] women	
All in sample	**Hours**	**% diff.[b]**	**hours**	**% diff.[b]**	**hours**	**% diff.[b]**
Initial estimate (1)	11.35		38.24		14.52	
Net costs + 10 % (2)	11.18	-1.5	38.24	0.0	14.47	-0.3
Gross price + 10% (3)	11.29	-0.5	38.25	+0.0	14.49	-0.2
Wages < median wage[c]						
Initial estimate (1)	6.47		34.36		9.71	
Net costs + 10 % (2)	6.30	-2.6	34.35	-0.0	9.68	-0.3
Gross price + 10% (3)	6.43	-0.6	34.36	0.0	9.69	-0.2
Female wage < median , male wage>median[c]						
Initial estimate (1)			40.73		11.21	
Net costs + 10 % (2)			40.72	-0.0	11.16	-0.4
Gross price + 10% (3)			40.73	0.0	11.18	-0.3
Households with children less than 5 years						
Initial estimate (1)	5.71		38.18		10.56	
Net costs + 10 % (2)	5.55	-2.8	38.17	-0.0	10.49	-0.7
Gross price + 10% (3)	5.61	-1.8	38.18	0.0	10.51	-0.5
Households with children less than 5 years and wages < median wage[c]						
Initial estimate (1)	3.70		34.32		6.88	
Net costs + 10 % (2)	3.68	-0.5	34.31	-0.0	6.84	-0.6
Gross price + 10% (3)	3.62	-2.2	34.33	+0.0	6.85	-0.4
Households with children less than 5 years and female wage < median , male wage>median[c]						
Initial estimate (1)			40.79		7.60	
Net costs + 10 % (2)			40.78	-0.0	7.54	-0.8
Gross price + 10% (3)			40.79	0.0	7.56	-0.5

Notes: a) Expected hours include zeroes. b) For (2), the difference between (2) and (1) and for (3) the difference between (3) and (1) is taken. c)For all households, the median wage levels used are the following: for lone parents $9.68, for husbands $16.29 and for wives $11.55. For households with children less than 5 years old, the median wage levels used are: for lone parents $9.61, for husbands $15.79, and for wives $11.23.

preschool children earning low wages than an increase in net costs. At the original fee, they already receive close to the maximum amount of Child Care Rebate and Assistance so that the increase in the fee causes a relatively larger increase in the net cost; the lower demand for childcare is not sufficient to counteract this completely.

For partnered women, the impact of a one percent price rise on hours of work increases from –0.02% to –0.05% when preschool children are present. As for lone parents, the labour supply of partnered women is substantially affected by the presence of young children (hours per week decline from 14.52 to 10.56). Women with young children and facing low wages work less, especially if their partner is a low-wage worker (6.88 hours per week).

Males in two-parent households are hardly affected by childcare fee increases. Men's labour supply is also practically unchanged by the presence of preschool children (on average 38.18 hours per week for men with preschool children, versus the sample average of 38.24). The wage level however is important for this group's labour supply (on average 34.36 hours per week for men on less than median wages, versus 38.24 hours per week for men on average).

V. Comparison with Other Studies

Studies in the U.S., Canada, the U.K., Germany, France, Norway and Japan have looked at the impact of childcare costs and/or childcare prices on the probability of employment and the average number of hours worked. Table 11 presents an overview of these results presented in the form of elasticities. The last few rows present our results with regards to the net childcare costs and the gross childcare price. Most other studies report the elasticity with regard to the childcare costs.

Compared to the results from other studies, our results for the total sample of women are of the same sign but are quantitatively relatively small. The impacts found for Australia are closer to those found for the U.K., Germany and France. In our study, we consistently find much higher elasticities for lone parents and more generally for low-income households. This has also been found for the U.S. in Michalopoulos et al. (1992). The simulation in the latter study examines the effect of introducing a policy

Table 11 Summary of results from other studies on the effects of childcare prices/costs

Reference	Country (year)	Population	Estimated elasticity	
		(age of youngest child)	Participation	Average hours
Anderson and Levine (1999)	U.S. (1980-1994) (review)	Married women Single women	-0.92 – 0.00 -0.50 – 0.00	
Blau and Hagy (1998)	U.S. (1989/90)	Married and single mothers (<7)		-0.20[a]
Blau and Robins (1988)	U.S. (1980)	Married women (<14)	-0.38[a]	
Conelly (1992)	U.S. (1984/85)	Married women (<13)	-0.20[b]	
Ribar (1992)	U.S. (1985)	Married women (<15)		-0.74[b] or -0.64[a]
Ribar (1995)	U.S. (1984/85)	Married women (<15)		-0.024 to -0.088[a]
Powell (1997)	Canada (1988)	Married women (<6)	-0.38[b]	-0.32[b]
Powell (2002)	Canada (1988)	Married women (<7)	-0.16[c,a]	
Michalopoulos and Robins (2000)[d]	Canada (1988) and U.S. (1990)	Married mothers (<5)	-0.156 (all)[a] -0.142 (US)[a] -0.203 (Canada)[a]	
Michalopoulos and Robins (2002)[d]	Canada (1988) and U.S. (1990)	Single parents (<5)	-0.26[a]	
Blundell et al. (2000)[e]	U.K. (1994-1996)	Married women : -unemployed partner -employed partner Single women	 -0.075[a] -0.066[a] -0.021[a]	 -0.084[a] -0.048[a] -0.020[a]
Kornstad and Thoresen (2002)	Norway (1998)	Married women (1-2)	-0.12[a]	-0.14[a]
Wrohlich (2004)	Germany (2002)	Married women (<6)	-0.03 (east)[a] -0.07 (west)[a]	-0.04(east)[a] -0.09 (west)[a]
Choné et al. (2003)	France (1997)	Married women (<3) Married women (<7)	-0.01[a] -0.01[a]	-0.02[a] -0.01[a]
Oishi (2002)	Japan (1998)	Married women (<7)	-0.60	
Our results[f]	Australia (1996/97)	Married women (<12): -total -low wages -preschool child -p.s. child & low wages Lone parents (<12): -total -low wages -preschool child -p.s. child & low wages	 -0.020 or -0.020[a] -0.023 or -0.047[a] -0.050 or -0.050[a] -0.031 or -0.061[a] -0.050 or -0.100[a] -0.038 or -0.189[a] -0.136 or -0.136[a] -0.126 or -0.000[a]	 -0.021 or -0.034[a] -0.027 or -0.045[a] -0.048 or -0.066[a] -0.053 or -0.079[a] -0.053 or -0.150[a] -0.062 or -0.263[a] -0.175 or -0.280[a] -0.216 or -0.054[a]

Notes: a) Evaluated at each observation and averaged across all observations. b) Evaluated at the sample means. c) This elasticity is derived from the simulation of a decrease in the formal childcare price ('center price') in Table 4 in Powell (2002). d) This elasticity is for a price change in the base model (see Table 5, page 486). e) These elasticities are derived from Tables 7 to 9 and 11 in Blundell et al. f) Both the results from doubling the gross price and doubling the net costs (largest effects) are presented.

that increases childcare subsidies for low-income households. They do not present elasticities but the simulations show that childcare subsidies aimed at the lower income groups are more effective at stimulating labour supply than subsidies benefiting households on higher incomes. The review paper by Anderson and Levine (1999) also mentions results that suggest that poorer households are more affected by

changes in childcare costs.

Blundell et al. (2000) is one of the few studies to look at married men. Their results (not shown in Table 11) suggest that men are hardly affected at all by childcare costs. This is similar to our findings.

There are also interesting differences in the Australian results and other overseas studies. For example, Ribar (1995) finds that in the U.S. the childcare cost elasticity is lower for women with children under 6 years of age while we consistently find the impacts on labour supply to be greater in households with preschool children. Many factors are likely to be involved in explaining the similarities and the differences between Australia and other countries such as the size of the costs relative to earnings, the prevalence of part-time work, and the availability of care. A careful study comparing these factors would be helpful in understanding the relationship between labour supply and childcare but it is beyond the scope of the present study.

VI. Conclusion

The first stage in the empirical work conducted in this paper is the estimation of joint demands for formal and informal childcare conditional on the observed labour supply of the household. Information from the Child Care Survey conducted by the Australian Bureau of Statistics in 1996 is used. The sample is representative of the population of Australian families with children under 12 years of age and includes employed and non-employed parents. We use data on fees charged by childcare centres to capture exogenous variations in prices in the market for childcare services. Lone-parent and two-parent households are analysed separately.

Our findings suggest that non-parental childcare costs in Australia are low on average, mostly because a significant amount of the care is informal with zero monetary cost. The costs vary substantially across households depending on the presence of preschool children and on the labour supply of the parents. In particular, the weekly costs are much higher for lone parents than for couples. The results for the demand functions show a substantial and negative price elasticity for formal care. For most households, informal care is a substitute for formal care. Own price elasticities of demand for formal care range from -0.3 to -0.6 for couples depending on the age of

the child. For lone parents the estimates are more imprecise and more variable although still negative. Income elasticities are also generally positive and substantial. Both formal and informal childcare are normal goods with income elasticities ranging from 0.2 to 0.4 for formal care and from 0.1 to 0.2 for informal care. (In the case of couples, the figures for informal care apply to the father's income).

These estimates are used to impute a cost of childcare based on the household characteristics for different labour supply choices. Imputed childcare costs, taking into account childcare subsidies, are incorporated in the calculation of net household incomes. A structural labour supply model is then estimated based on these adjusted net incomes using information from the 1996/1997 Survey of Income and Housing Costs. The reason for this two-stage approach is that the CCS does not include many of the variables known to be important in labour supply modelling (such as detailed data on income and education). The labour supply is modelled as a discrete choice following the approach of Van Soest (1995) and Duncan et al. (1999) and estimated by simulated maximum likelihood methods. The budget constraint incorporates all main features of the tax and transfer system in place at the time of the surveys.[24]

The impacts of childcare price and cost increases on household labour supply are simulated using the model estimates. A 10% increase in the price of childcare reduces the participation rate by around 0.5% for lone parents and 0.2% for married women. The smaller effect for married women relative to lone parents is consistent across various specifications. Effects on the labour supply of married men are negligible. A comparison of our results with overseas findings shows that the sign of the effects are similar but the quantitative results, especially for married women, are in the low end of the range. Specifically, the Australian labour supply elasticities relative to childcare costs are more similar to those found in European countries than the U.S. estimates.

For certain subgroups in the population, the responses in labour supply are substantially larger. For lone parents, the average effect of an increase of 10% in the price of childcare is a fall of 0.5% in expected hours of work. This labour supply reaction is close to -1.8% for all those with preschool children and -2.2% for those with preschool children and earning low wages. The effects for married women are smaller than for lone parents at an average of -0.2%. A larger effect of -0.5% is found

for married women with preschool children. There are conflicting results from overseas studies on the relative impact of childcare costs on the labour supply of households with and without preschool children. However the findings from studies designed to isolate the effects on low-income families tend to support our results on the larger effect for low-wage women.

Appendix A: Additional Tables

Appendix Table A1 Estimation results for childcare demands. Bivariate Tobit models.

	Couples				Lone parents			
	Formal		Informal		Formal		Informal	
Variable	**Coeff**	**P-val**	**Coeff**	**P-val**	**Coeff**	**P-val**	**Coeff**	**P-val**
No. of child: aged <1	5.615	0.595	-4.133	0.612	57.264	0.064	-18.597	0.588
aged 1	18.169	0.083	-4.375	0.589	71.370	0.019	-25.193	0.458
aged 2	26.156	0.010	-3.349	0.671	89.517	0.002	-35.114	0.280
aged 3-4	20.722	0.095	-19.261	0.055	23.592	0.453	4.864	0.902
aged 5-9	-0.151	0.916	2.720	0.004	2.869	0.446	5.160	0.144
aged >9	-8.681	0.000	0.747	0.540	-11.658	0.016	0.327	0.937
Employed:					24.390	0.046	9.363	0.460
father	-11.907	0.017	6.735	0.055				
mother	-1.710	0.717	2.561	0.437				
Hours: father	0.888	0.007	-0.145	0.534	-0.595	0.197	0.368	0.470
mother	0.726	0.013	0.431	0.043	-0.128	0.738	0.064	0.881
$(\text{Hours})^2$:father	-0.015	0.006	0.002	0.560				
mother	-0.009	0.056	-0.005	0.134				
Empl*No. of ch: aged 0-2	-2.093	0.496	0.046	0.984	-20.509	0.083	16.169	0.225
aged 3-4	-1.444	0.669	-2.777	0.270	-6.121	0.566	-1.684	0.891
aged 5+	2.555	0.203	0.977	0.491	-14.027	0.093	-0.182	0.984
Min hrs*No. of ch:0-2	0.360	0.001	0.282	0.001	0.835	0.029	0.071	0.880
3-4	0.203	0.059	0.212	0.013	0.491	0.145	0.195	0.635
5+	0.009	0.892	0.023	0.629	0.684	0.012	0.219	0.478
Income:					0.018	0.013	0.010	0.240
father	0.004	0.003	0.005	0.000				
mother	0.011	0.000	0.002	0.368				
Fees*pres.ch: aged 0-2	1.089	0.221	1.336	0.051	8.530	0.002	2.187	0.460
aged 3-4	4.707	0.000	1.723	0.101	6.421	0.086	5.582	0.225
aged 5+	-2.582	0.001	-0.217	0.700	-2.487	0.229	4.346	0.046
Fees*No. of ch: aged 0-2	-3.566	0.251	0.948	0.536	-23.439	0.011	7.884	0.643
aged 3-4	-6.241	0.119	1.486	0.005	-6.427	0.550	0.236	0.426
Urban	1.862	0.133	8.956	0.079	5.824	0.046	-4.250	0.986
ACT-NT	7.611	0.000	-2.603	0.120				
Age of parent: 15-24							12.850	0.018
mother			3.551	0.153				
father			6.415	0.037				
Age of parent: 25-34							8.677	0.013
mother			2.073	0.053				
father			2.660	0.015				
Parent is male					9.419	0.222	-5.789	0.480
Constant	-40.719	0.000	-31.229	0.000	-57.549	0.000	-37.528	0.000
σ	27.400	0.000	25.013	0.000	29.818	0.000	42.136	0.000
Correlation in error terms	-0.265 (p-value=0.000)				-0.173 (p-value=0.001)			
Obs. mean, Exp. value	3.722,3.833		7.748,9.002		4.564,4.650		13.733,16.574	
Proportion at 0: obs, pred	0.797,0.796		0.509,0.565		0.798,0.799		0.444,0.528	
Correlation of pred & obs	0.538		0.337		0.504		0.212	
Log Likelihood value	-18465.961				-4665.046			
- χ^2 p-value	0.000				0.000			

Notes: The sample size for couples is 4908 and for lone parents 1079. For couples, an employment dummy is interacted with the number of children only if both parents are employed; in this case, the hours interacted with the number of children are those for the parent with the smallest hours of work. For couples the urban dummy does not include ACT-NT areas while for lone parents the urban dummy variable is set at one for all observations in the ACT-NT areas. The observed mean of the dependent variable is computed over all observations used in the regression including the censored ones. The expected value takes into account the probability of censoring and is averaged over all observations used in the regression. The observed proportion at 0 is the proportion of observations censored at 0 while the predicted proportion is the predicted probability of a censored value at 0 averaged over all observations used in the regression. The correlation between predicted and observed is computed over all non-zero observations. The p-value corresponds to the χ^2 test that all coefficients except the constant term are jointly 0.

Appendix Table A2 Labour supply estimates for couples using 10 draws from childcare costs and prices respectively (2662 observations)[a,b]

	No childcare costs		With childcare costs	
Preference parameters	**Estimates**	**p-value**	**Estimates**	**p-value**
Squared terms & cross products				
Income sq. (× 100,000)	-0.0042	0.5916	-0.0022	0.7699
Labour supply man sq. (× 100)	-0.5955	0.0000	-0.5991	0.0000
Lab. supply woman sq. (× 100)	-0.1972	0.0000	-0.1986	0.0000
Inc. & l.s. man (× 10,000)	-0.2850	0.0000	-0.2755	0.0000
Inc. & l.s. woman (× 10,000)	-0.1758	0.0000	-0.1696	0.0000
L.s. man & woman (× 100)	-0.0414	0.0001	-0.0404	0.0001
Linear terms:				
Income: constant	0.7052	0.0000	0.7003	0.0000
Number of children	-0.0064	0.2277	-0.0067	0.2056
Lab.sup. man: constant	0.3395	0.0000	0.3424	0.0000
Youngest child 0-2 yrs old	0.0051	0.3437	0.0052	0.3259
Youngest child 3-4 yrs old	-0.0042	0.5118	-0.0040	0.5335
Youngest child 5-9 yrs old	-0.0056	0.2847	-0.0056	0.2865
Number of children	0.0012	0.5449	0.0011	0.5718
Age/10	0.0626	0.0000	0.0627	0.0000
Age squared/100	-0.0086	0.0000	-0.0086	0.0000
Vocational education	0.0118	0.0005	0.0118	0.0005
Diploma	0.0128	0.0129	0.0129	0.0124
Degree	0.0068	0.1969	0.0069	0.1897
Voc. education (partner)	0.0102	0.0135	0.0102	0.0138
Diploma (partner)	0.0026	0.6474	0.0026	0.6514
Degree (partner)	0.0030	0.5792	0.0030	0.5840
Lab.sup. woman: constant	0.0580	0.0246	0.0567	0.0280
Youngest child 0-2 yrs old	-0.0676	0.0000	-0.0638	0.0000
Youngest child 3-4 yrs old	-0.0445	0.0000	-0.0412	0.0000
Youngest child 5-9 yrs old	-0.0269	0.0000	-0.0262	0.0000
Number of children	-0.0053	0.0010	-0.0052	0.0015
Age/10	0.0409	0.0006	0.0419	0.0005
Age squared/100	-0.0073	0.0000	-0.0074	0.0000
Voc. education (partner)	-0.0017	0.6035	-0.0016	0.6222
Diploma (partner)	0.0034	0.4179	0.0036	0.3980
Degree (partner)	-0.0083	0.0686	-0.0080	0.0798
Vocational education	0.0070	0.0603	0.0068	0.0648
Diploma	0.0151	0.0019	0.0151	0.0018
Degree	0.0298	0.0000	0.0303	0.0000
Fixed cost man/100	14.8652	0.0000	15.0556	0.0000
Fixed cost woman/100	5.7147	0.0000	5.7797	0.0000

Notes: a) Six discrete points of labour supply are distinguished for each man: 0 hours for non-participants and people working less than 2.5 hours, 10 hours for men working from 2.5 to 15 hours, 20 hours for men working from 15 to 25 hours, 30 hours for men working from 25 to 35 hours, 40 hours for men working from 35 to 45 hours, and 50 hours for men working more than 45 hours. Eleven discrete points of labour supply are distinguished for each woman: 0 hours for non-participants and women working less than 2.5 hours, 5 hours for women working from 2.5 to 7.5 hours, 10 hours for women working from 7.5 to 12.5 hours, 15 hours for women working from 12.5 to 17.5 hours, 20 hours for women working from 17.5 to 22.5 hours, 25 hours for women working from 22.5 to 27.5 hours, 30 hours for women working from 27.5 to 32.5 hours, 35 hours for women working from 32.5 to 37.5 hours, 40 hours for women working from 37.5 to 42.5 hours, 45 hours for women working from 42.5 to 47.5 hours, and 50 hours for women working more than 47.5 hours. b) The unobserved heterogeneity terms were found to be insignificant and are left out of these specifications.

Appendix Table A3 Labour supply estimates for lone parents using 10 draws from childcare costs and prices respectively (456 observations)[a,b]

	No childcare costs		With childcare costs	
Preference parameters	**Estimates**	**p-value**	**Estimates**	**p-value**
Squared terms & cross products				
Income squared (× 100,000)	-1.1699	0.1574	-0.4802	0.0454
Labour supply squared (× 100)	-0.0519	0.3872	-0.0174	0.7537
Inc. & lab. sup. (× 10,000)	-1.1701	0.2907	-2.0237	0.0001
Linear terms				
Income				
constant	6.8925	0.0019	5.8222	0.0004
Youngest child 0-2 yrs old	-1.4606	0.0192	-2.0246	0.0000
Youngest child 3-4 yrs old	-2.1883	0.0000	-1.9569	0.0000
Youngest child 5-9 yrs old	-0.5184	0.1803	-0.6018	0.0548
Number of children	0.4956	0.0143	0.3785	0.0072
Age/10	-2.1001	0.0535	-1.7901	0.0326
Age squared/100	0.2285	0.0923	0.1858	0.0705
Vocational education	0.5061	0.1250	0.6305	0.0310
Diploma or degree	-0.1968	0.4816	-0.2026	0.4234
female	1.0636	0.0341	1.1759	0.0012
Labour supply				
constant	-0.2400	0.0310	-0.2150	0.0252
Youngest child 0-2 yrs old	0.0501	0.0896	0.0414	0.1198
Youngest child 3-4 yrs old	0.0282	0.3313	0.0180	0.4559
Youngest child 5-9 yrs old	0.0033	0.8700	0.0117	0.4635
Number of children	-0.0050	0.5003	0.0041	0.4821
Age/10	0.1430	0.0044	0.1332	0.0022
Age squared/100	-0.0183	0.0037	-0.0174	0.0012
Vocational education	0.0028	0.8025	0.0046	0.6404
Diploma or degree	0.0224	0.1159	0.0276	0.0285
female	-0.0947	0.0001	-0.0828	0.0000
Fixed cost				
Constant	2.4623	0.0011	2.9594	0.0001
Live in capital city	0.1051	0.1922	0.0906	0.3476
Children 0-4 yrs old	0.9240	0.0158	1.1204	0.0025
Youngest child 5-9 yrs old	0.0679	0.6916	0.0931	0.5777
Live in NSW	0.1321	0.1427	0.1389	0.1993
Female	-1.3431	0.0462	-1.7631	0.0067

Notes: a) Eleven discrete points of labour supply are distinguished for each person: 0 hours for non-participants and people working less than 2.5 hours, 5 hours for people working from 2.5 to 7.5 hours, 10 hours for people working from 7.5 to 12.5 hours, 15 hours for people working from 12.5 to 17.5 hours, 20 hours for people working from 17.5 to 22.5 hours, 25 hours for people working from 22.5 to 27.5 hours, 30 hours for people working from 27.5 to 32.5 hours, 35 hours for people working from 32.5 to 37.5 hours, 40 hours for people working from 37.5 to 42.5 hours, 45 hours for people working from 42.5 to 47.5 hours, and 50 hours for people working more than 47.5 hours. b) The unobserved heterogeneity terms were found to be insignificant and are left out of these specifications.

Appendix B: The Labour Supply Model

The labour supply model is described in detail in Kalb (2002). Here, we provide an overview only. Given the aim of simulating policy changes with regard to taxes and transfers, priority is given to incorporating all possible details of the taxation and social security system. The approach follows most of the literature in adopting a neoclassical framework: utility is maximised conditional on the total amount of time available to each adult and a household budget constraint. It is expected that utility increases with an increase in leisure and home production time (referred to as leisure for convenience) and income (consumption of all other goods). Households maximise utility by choosing leisure (and hence labour supply) for each adult.[25] The labour supply values for each parent are the endogenous variables in the model. Wage rates, non-labour income (other than taxes and transfers), household composition and other household attributes are exogenous. Specifically, the exogenous factors include: the number and ages of children, the number of parents, the age and education level of each parent, and components of income other than labour earnings, transfers and taxes. The rules of the taxation and social security systems are used to relate the net income of the household with its choices of labour supply.

Turning to the choice of functional form, the labour supply function is modelled as a discrete choice. Restricting the number of possible working hours to a limited set of discrete values is done in many other studies (for example, Van Soest, 1995; Keane and Moffitt, 1998; Duncan et al., 1999). The advantage of using a discrete choice framework is that it allows more complex modelling of the budget constraint. Assuming there are two adults in the household, the labour supply is derived from the following:

$$\max U(x, l_1, l_2) \quad (1)$$

subject to a time constraint for each adult:

$$l_1 + h_1 = T \quad \text{and} \quad l_2 + h_2 = T \quad (2)$$

$$(h_1, h_2) \in \mathcal{A} \times \mathcal{B}$$

and subject to a budget constraint:

$$x = w_1 h_1 + w_2 h_2 + y_1 + y_2 + B(c, w_1 h_1 + w_2 h_2 + y_1 + y_2) - \tau(B, w_1 h_1 + y_1, w_2 h_2 + y_2, c) \quad (3)$$

where $U(\,)$ is the utility function of a two-adult household; l_1 and l_2 indicate the leisure hours (including home production) per week of the husband and wife (married or de facto)

respectively; h_1 and h_2 are the hours of work of husband and wife; $\mathcal{A}$ and $\mathcal{B}$ are the sets of discrete points from which values can be chosen for h_1 and h_2; T is the total time available for each person in the household; x indicates net income per week, which is assumed equal to household consumption; w_1 and w_2 are the gross wage rates of husband and wife respectively; y_1 and y_2 are the non-labour incomes of husband and wife; c is a set of household attributes; B(.) is the amount of benefit a household is eligible for given their household characteristics c and household income; and τ is the tax function that indicates the amount of tax to be paid.

In the discrete choice case the budget constraint is defined on a discrete set of points $h_1 \in \mathcal{A} = \{0, h_{11}, h_{12}, ..., h_{1m}\}$ and $h_2 \in \mathcal{B} = \{0, h_{21}, h_{22}, ..., h_{2k}\}$ on the interval [0,T], instead of being defined on a continuous set of working hours [0,T].[26] Using these sets, net income x is calculated for all (m+1)×(k+1) combinations of h_1 and h_2. For this limited set of hours, one can then calculate the level of utility generated by each possible combination of hours. The choice of labour supply is simultaneously determined for both adult members of the household. Depending on the choice of utility function, different interactions between household income and the labour supply of adults can be modelled. For one-adult households, the model is simplified by excluding everything related to the second adult.

To deal with unobserved market wages for people who are not working, we estimate their potential wage using a wage equation estimated on workers.[27] 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).

Based on the assumption of utility maximisation for each household and assuming households behave independently, the likelihood function can be written as:

$$\prod_i \Pr(U(x((h_{1i}, h_{2i})_r), (h_{1i}, h_{2i})_r, \varepsilon_r) \geq U(x((h_{1i}, h_{2i})_s), (h_{1i}, h_{2i})_s, \varepsilon_s) \textit{ for all } s) \quad (4)$$

where r stands for the combination h_1 and h_2 that is preferred; s stands for all possible combinations that can be made, given the discrete choice sets for hours worked; and ε_r and ε_s represent error terms. Adding an error term to the utility function prevents contributions to the likelihood of any data point from becoming zero, by allowing for

optimisation errors. Choosing an extreme value specification for the error term in (4) results in a multinomial logit model.

Following Keane and Moffitt (1998), a quadratic specification is used for the utility function. This utility function is simple but quite flexible in that it allows for the leisure of each person and income to be substitutes or complements. Parameters representing fixed costs of working are included in the utility when positive labour choices are made. The fixed cost of working parameter, γ, is included in the income variable x to indicate the cost of working versus non-participation (following Callan and Van Soest, 1996). As a result of the inclusion in x, this cost of working parameter is measured in dollars per week. The utility is specified as follows:

$$U(x,h_1,h_2)=\beta_x(x-\gamma_1-\gamma_2)+\beta_1 h_1+\beta_2 h_2+\alpha_{xx}(x-\gamma_1-\gamma_2)^2+\alpha_{11}(h_1)^2+\alpha_{22}(h_2)^2+ \alpha_{x1}(x-\gamma_1-\gamma_2)h_1+\alpha_{x2}(x-\gamma_1-\gamma_2)h_2+\alpha_{12}h_1h_2 \quad (5)$$

where α.. and β. are preference parameters and γ_1 and γ_2 are the fixed cost of working parameters to be estimated (where the indices 1 and 2 denote the husband and wife respectively). The fixed cost is zero when the relevant person is not working. For single adult households, all terms related to h_2 drop out of the utility function and γ_2 is set to zero.

We include observed heterogeneity by allowing β_1, β_2, β_x, γ_1 and γ_2 to depend on the personal and household characteristics listed above. Unobserved heterogeneity is added to β_1, β_2, β_x, and γ_2, in the form of a normally distributed error term with zero mean and unknown variance. Finally, the model is estimated using simulated maximum likelihood. In estimation, the unobserved heterogeneity parameters were found to be insignificant and were dropped. More detail on the model and implied average wage elasticities can be found in Kalb (2002) and Creedy and Kalb (2005) respectively.

References

Anderson, P.M. and P.B. Levine (1999), 'Child Care and Mothers' Employment Decisions', Working Paper No. 7058, National Bureau of Economic Research.

Blau, D.M. and A. Hagy (1998), 'The Demand for Quality in Child Care', Journal of Political Economy, 106(1), 104-146.

Blau, D.M and H.N. Mocan (1999), 'The Supply of Quality in Child Care Centers', Working Paper No. 7225, National Bureau of Economic Research.

Blau, D. M. and P.K. Robins (1988), 'Child-Care Costs and Family Labor Supply', Review of Economics and Statistics, 70(3), 374-381.

Blau, D. M. and P.K. Robins (1989), 'Fertility, Employment and Child-Care Costs', Demography, 26(2), 287-299.

Blundell, R., A. Duncan, J. McCrae, and C. Meghir (2000), 'The Labour Market Impact of the Working Families' Tax Credit', Fiscal Studies, 21(1), 75-104.

Callan, T. and A. van Soest (1996), 'Family Labour Supply and Taxes in Ireland', Economic and Social Research Institute Working Paper No. 78, Dublin, Ireland.

Choné, P., D. le Blanc and I. Robert-Bobée (2003), 'Female Labor Supply and Child Care in France', CESifo Working Paper No. 1059.

Cobb-Clark, D.A., A. Liu, and D. Mitchell (2000), 'Reassessing the Role of Child Care Costs in the Work and Care Decisions of Australian Families', Australian Bulletin of Labour, 26(4), 279-297.

Connelly, R. (1992), 'The Effect of Childcare Costs on Married Women's Labor Force Participation', Review of Economics and Statistics, 74(1), 83-90.

Creedy, J. and G. Kalb (2005), 'Behavioural Microsimulation Modelling With the Melbourne Institute Tax and Transfer Simulator (MITTS): Uses and Extensions', presented at the 2004 Productivity Commission Conference, Quantitative Tools for Microeconomic Policy Analysis, Canberra (forthcoming in the conference volume).

Del Boca, D. (2002), 'Do Child Care Costs Affect Labor Supply', Working Paper No. 18, Centre for Household, Income, Labour and Demographic Economics, Italy.

Department of Family and Community Services (1999), 1997 Census of Child Care Services and 1996 Census of Child Care Services, Commonwealth of Australia.

Doiron, D. and G. Kalb (2002), 'Demand for Childcare Services and Labour Supply in Australian Families', The Australian Economic Review, 35(2), 204-213.

Doiron, D. and G. Kalb (2004), 'Demands for Childcare and Household Labour Supply in Australia', Melbourne Institute Working Paper No. 06/04, University of Melbourne.

Duncan, A., C. Giles and J. MacCrae (1999), 'Household Labour Supply, Childcare Costs and In-Work Benefits: Modelling the Impact of the Working Families Tax Credit in the UK', Working Paper, Institute for Fiscal Studies, London.

Duncan, A., G. Paull, and J. Taylor (2001a), 'Mothers' Employment and Use of Childcare in the United Kingdom', Working Paper No. 01/23, Institute for Fiscal Studies, London.

Duncan, A., G. Paull, and J. Taylor (2001b), 'Price and Quality in the UK Childcare Market', Working Paper No. 01/14, Institute for Fiscal Studies, London.

Hagy, A. P. (1998), 'The Demand for Child Care Quality: A Hedonic Price Theory Approach', Journal of Human Resources, 33(3), 683-710.

Kalb, G. (2002), 'Estimation of Labour Supply Models for Four Separate Groups in the Australian Population', Melbourne Institute Working Paper No. 24/02, University of Melbourne.

Kalb, G. and R. Scutella (2002), 'Estimation of Wage Equations in Australia: Allowing for Censored Observations of Labour Supply', Melbourne Institute Working Paper No. 8/02, University of Melbourne.

Keane, M. and R. Moffitt (1998), 'A Structural Model of Multiple Welfare Program Participation and Labor Supply', International Economic Review, 39(3), 553-589.

Kimmel, J. (1998), 'Child Care Costs as a Barrier to Employment for Single and Married Mothers', Review of Economics and Statistics, 80(2), 287-299.

Kornstad, T. and T.O. Thoresen (2002), 'A Discrete Choice Model for Labor Supply and Child Care', Statistics Norway Research Department Discussion Paper No. 315.

Leibowitz, A., J. Klerman, and L. Waite (1992), 'Employment of New Mothers and Child Care Choice', Journal of Human Resources, 27(1), 112-134.

Michalopoulos, C., and P.K. Robins (2000), 'Employment and Child-Care Choices in Canada and the United States', Canadian Journal of Economics, 33(2), 435-470.

Michalopoulos, C., and P.K. Robins (2002), 'Employment and Child-Care Choices of Single-Parent Families in Canada and the United States', Journal of Population Economics, 15(3), 465-493.

Michalopoulos, C., P.K. Robins and I. Garfinkel (1992), 'A Structural Model of Labor Supply and Child Care Demand', Journal of Human Resources, 27(1), 166-203.

Oishi, A.S. (2002), 'The Effect of Childcare Costs on Mothers' Labor Force Participation', Japanese Journal of Social Security, 1(1), 51-67.

Powell, L.M. (1997), 'The Impact of Child Care Costs on the Labour Supply of Married Mothers: Evidence from Canada', Canadian Journal of Economics, 30(3), 577-594.

Powell, L.M. (2002), 'Joint Labor Supply and Childcare Choice Decisions of Married Mothers', Journal of Human Resources, 37(1), 106-128.

Ribar, D.C. (1992), 'Child Care and the Labor Supply of Married Women: Reduced Form Evidence', Journal of Human Resources, 27(1), 134-165.

Ribar, D.C. (1995), 'A Structural Model of Child Care and the Labor Supply of Married Women', Journal of Labor Economics, 13(3), 558-597.

Ross, R.T. (1986), 'Analysis of the 1980 Sydney Survey of Work Patterns of Married Women: Further Results', Economic Record, 62(178), 325-337.

Ross, R.T. and P. Saunders (1990), 'The Labour Supply Behaviour of Sole Mothers and Married Mothers in Australia: Evidence from the 1986 Income Distribution Survey', mimeo, SPRC, University of New South Wales.

Szukalska, A., R. Percival, and A. Walker (1999), 'Modelling Child Care Utilisation and Benefits', NATSEM Technical Paper no. 18.

Teal, F. (1992), 'The Use and Cost of Child Care in Australia', The Australian Economic Review, 97, 3-14.

Van Soest, A. (1995), 'Structural Models of Family Labor Supply: A Discrete Choice Approach,' Journal of Human Resources, 30(1), 63-88.

Walker, J. R. (1992), 'New Evidence on the Supply of Child Care: A Statistical Portrait of Family Providers and an Analysis of Their Fees', Journal of Human Resources, 27(1), 40-69.

Wrohlich, K. (2004), 'Child Care Costs and Mothers' Labor Supply: An Empirical Analysis for Germany', Discussion Paper 412, German Institute for Economic Research (DIW) Berlin.

Endnotes

[1] Informal childcare includes relative and non-relative care, while formal childcare includes before and after school care, long day care, family day care, occasional care, and other formal care arrangements. The treatment of preschools is discussed later in the paper.

[2] For example see Ross (1986), Ross and Saunders (1990), and various researchers at NATSEM (see for example Szukalska et al. (1999) and the references therein). Also in a companion paper, Doiron and Kalb (2002), we estimate childcare cost functions for different types of households.

[3] Anderson and Levine (1999) provide a review of econometric studies and conclude that the overall elasticity of labour force participation for mothers with respect to childcare prices lies between -0.05 and -0.35. Highly skilled women are less affected.

[4] In the empirical work to date many of the data sets only include information on childcare for those households in which mothers work. Explaining the relationship between childcare demand and the decision to participate has been much more difficult because of this feature of the data.

[5] There are additional problems with the modelling of prices namely that observed prices are frequently zero and generally not constant as often one must buy a fixed number of hours of care in advance. With the exception of selection effects into paid childcare, little work has been done on the nonlinear pricing schedules offered for childcare services. Exceptions are Ribar (1995) and Walker (1992).

[6] Since the time of writing, the 1999 CCS and the 1999/2000 SIHC have become available. In addition, the Household, Income and Labour Dynamics in Australia (HILDA) survey now provides an alternative source of information. Although the sample of children is smaller in HILDA, this data set offers information on childcare use *and* the variables necessary to estimate labour supply functions.

[7] In this section of the paper, preschool is included in formal childcare.

[8] See Del Boca (2004) for an example of the modelling of the rationing of childcare.

[9] It is likely that these hourly costs incorporate some of the government subsidies paid for childcare. This is another reason why prices will vary by households. See the end of this section for more details.

[10] Information on fees is provided separately for different types of providers (community based long day care services, private long day care services, employer and non-profit long day care services, family day care schemes, and outside school hours care services). A weighted average fee across types of services is computed from the Census data using the number of children in the particular type of care to construct weights to be applied to the providers.

[11] Please see Doiron and Kalb (2004) for more details.

[12] These results are available in our working paper (Doiron and Kalb, 2004).

[13] A more general selection-type model was also estimated but this model was not well behaved and convergence was only achieved when the errors in the selection and on hours were forced to have perfect correlation of 1.0. This is not surprising given the lack of an instrument to help identify the choice of entering the childcare market separately from the choice of hours of care.

[14] Comparisons of predicted and observed childcare demands by type of household are provided in Doiron and Kalb (2004).

[15] For continuous variables (such as, hours of work, income, fees, number of children), these are the derivatives of the predicted dependent variable (the expected hours of childcare including the probability of zero hours) with respect to the variable in question. For indicator variables, they are the differences in the expected hours of childcare with the indicators set alternatively at one and zero. In all cases, the marginal effects are computed at each data point and averaged over the sample. Standard errors are computed on these averages with a bootstrap estimator using 200 replications.

[16] Despite the large standard errors, the results on the impact of fees are generally consistent across alternative specifications (see Doiron and Kalb, 2004).

[17] That is, elasticities are calculated for each data point and averaged over the samples. Standard errors on these averages are computed with a bootstrap estimator using 200 replications.

[18] These hours and income levels correspond to the 25th and 75th percentiles observed in the subsample of working lone-parent households.

[19] Since we are combining information from two different data sources, we cannot model the correlation in unobservables between labour supply choices and childcare use.

[20] More details are provided in Doiron and Kalb (2004).

[21] Since we combine information from two surveys based on the characteristics of the households, we need to verify that the two samples are similar overall. This is done in Doiron and Kalb (2004).

[22] It is assumed that all people paying for formal childcare are eligible for the rebate (that is they are either working or in training or searching for a job). This will understate the childcare cost to some extent; although given the statistics on reasons for childcare presented previously, we expect that most families with children in formal childcare use this type of care for employment or education reasons.

[23] This experiment is useful in comparing our results to overseas studies (see Section 5).

[24] The calculation of the budget constraint and the labour supply form part of the Melbourne Institute Tax and Transfer Simulator (MITTS). Please see Section 4 for more discussion.

[25] It is assumed that all non-employed are voluntarily not working and that participants are at their preferred labour supply points.

[26] 0, h_{11}, h_{12}, etc represent the discrete values that labour supply can take. Here we have chosen 0, 5, 10, 15,…, 50 hours of labour supply for married women and singles. Given the low number of married men working low part-time hours, they are assumed to choose from 0, 10, 20, 30, 40 or 50 hours.

[27] This follows the approach used by Van Soest (1995) and many others in the area.

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