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*Guyonne Kalb and Wang-Sheng Lee*

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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 data which are representative of the Australian population in 2002, this paper first analyses the demand for and cost of formal and informal childcare for couple and sole parent families, shedding light on factors which affect the demand for childcare. The predicted demand of formal childcare and the predicted costs of informal childcare arising from these models are then used to impute total childcare costs at different levels of labour supply. Finally, the predicted total costs are incorporated in the estimation procedure of structural labour supply models for couple and sole parent families. By making several extensions to the methodology adopted in Doiron and Kalb (2005a), who estimated similar models based on 1996 Australian data and which this paper largely replicates in terms of methodology, it is found that the average elasticities of labour supply with regard to the cost of childcare are quite similar to the earlier estimates. The elasticities remain at the lower end of the range found in the international literature with the exception of the elasticities for sole parents with preschool children and/or on relatively low wages.

# 1. Introduction

Childcare use is an integral part of the government's strategy to promote the well-being of Australian families. The vast majority of current funding is via payment of the Childcare Benefit (CCB). After 1 July 2006, substantial funding will also be provided through the Childcare Tax Rebate (CCTR). Understanding the factors underlying childcare demand and having (up-to-date) estimates of labour supply elasticities with respect to childcare costs at the household level are important because they can provide useful information on the types of targeted policies which might be effective. For example, if the goal is to increase workforce participation of parents with children, it is helpful to have quantitative estimates of the effects any childcare subsidies or rebates are expected to have, given current patterns of labour supply behaviour.

This paper addresses two research questions: (i) What are the factors affecting the demand for childcare? (ii) What are the labour supply responses of parents with children under 12 to prices of formal childcare or to net costs of childcare?[1] With the exception of Doiron and Kalb (2002, 2005a) and Rammohan and Whelan (2005, 2006), there has been little systematic investigation of the relationship between labour supply and non-parental childcare use in Australia.

Although the methodology used in this paper essentially mirrors an earlier study by Doiron and Kalb (2005a), there are several distinct differences. First, this paper uses more recent data from 2002 for the empirical work whereas Doiron and Kalb (2005a) was based on data from 1996. Second, this paper provides parameter estimates for childcare demand and labour supply based on a wider range of characteristics. It incorporates staff qualifications, an extended range of household variables and more precise information on hours of work and income in estimating childcare demand. It is arguable that the specification for childcare demand used in this paper improves on the one used in Doiron and Kalb (2005a), although the childcare demand model is based on a smaller sample.

Section 2 of the paper discusses the data on childcare use and cost and on labour supply used in this paper. Section 3 presents the results on the demand for formal and the cost of informal childcare models for couple families and single parents separately. Marginal

[1] Net costs are formal costs plus informal costs minus childcare subsidies.

effects for each characteristic are included to allow for an easier interpretation of the results. Section 4 estimates labour supply models, again separately for couple families and single parents, which take into account the cost of childcare in the budget constraint. It presents a few labour supply elasticities implied by the estimates to illustrate the heterogeneity of the individual elasticities. Section 5 concludes with a few brief remarks.

# 2. The Data

This section describes the three data sets which are used in this paper. The first subsection describes childcare use and cost as observed in the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Childcare fees are obtained from the Child Care Census 2002 as discussed in subsection 2.2. Finally, the Survey of Income and Housing Costs (SIHC) provides information on labour market variables and individual and household characteristics. These data are described in subsection 2.3.

## *2.1 Data on Childcare Cost and Use*

Data from wave 2 of the HILDA Survey (conducted in 2002) are first used in this study to estimate the demand for childcare.[2] Subsequently, data from the 2002 SIHC are augmented with parameters from the childcare demand models, and used for labour supply modelling. The reason for using a two-stage estimation approach involving two data sets is to allow incorporation of detailed information on the Australian tax and transfer system. For this the Melbourne Institute Tax and Transfer Simulator (MITTS), which is based on the SIHC, is needed. In principle, a simultaneous childcare demand and labour supply model could be estimated and the entire analysis could be based on HILDA as soon as MITTS can use HILDA as a base file.

Table 1 shows the amount of childcare used based on wave 2 of the HILDA survey, decomposed by family type and age of youngest child. As is to be expected, families

[2] An exact replication of Doiron and Kalb (2005a) using a more recent wave of the Australian Bureau of Statistics' (ABS) Child Care Survey (CCS) is not possible because the 2002 CCS is substantially different from the 1996 CCS, the data used in Doiron and Kalb (2005a). In particular, it is no longer possible to calculate total household demand for childcare, since at most two children under 12 years of age are included in the sample. Additional summary information on childcare use for the remaining children was collected but not included in the Confidentialised Unit Record File. In addition, the expanded CCS 2002 is currently only available through the Remote Access Data Laboratory at the ABS. As a result, the analysis using these data would have to be considerably simplified and certain parameters like the correlation between formal and informal childcare use cannot be estimated.

with younger children are more likely to use childcare and families with more adults in paid employment are more likely to use childcare.[3]

**Table 1: Percentage Using Care by Age of the Youngest Child and Labour Force Status in Wave 2 of HILDA (2002)[a]**

| **Age of youngest child:** | 0-2 | 3-4 | 5-9 | 10-11 | **Total** |
|---|---|---|---|---|---|
| Couple families: Two workers (%) | 83.0 | 92.1 | 64.1 | 46.2 | 70.9 |
| Sample size (unweighted) | 227 | 126 | 320 | 118 | 791 |
| Couple families: One worker (%) | 43.3 | 49.1 | 37.6 | 10.3 | 40.7 |
| Sample size (unweighted) | 254 | 92 | 112 | 34 | 492 |
| Couple families: No workers (%) | 37.2 | 32.6 | 18.5 | 0.0 | 27.8 |
| Sample size (unweighted) | 39 | 8 | 27 | 7 | 81 |
| All couple families[b] (%) | 60.7 | 71.5 | 54.2 | 35.9 | 57.1 |
| Sample size (unweighted) | 569 | 252 | 513 | 182 | 1516 |
| Sole parents: One worker (%) | 93.0 | 84.0 | 80.6 | 74.6 | 81.2 |
| Sample size (unweighted) | 21 | 34 | 84 | 53 | 192 |
| Sole parents: Non worker (%) | 43.0 | 62.3 | 20.2 | 3.1 | 35.0 |
| Sample size (unweighted) | 72 | 32 | 59 | 18 | 181 |
| All sole parents[b] (%) | 55.1 | 69.8 | 55.2 | 54.0 | 57.6 |
| Sample size (unweighted) | 93 | 67 | 146 | 74 | 380 |

Notes: a) The numbers in the table are weighted to represent the Australian population.
b) This group includes those families with unknown labour force status.

Table 2 compares the average hours used by the different types of household based on HILDA, decomposed by employment status and age of youngest child. It also presents the average proportion of families who pay for childcare and the average hourly cost. Overall, sole parents use more hours in childcare than couple families (12.85 hours versus 11.01 hours). Approximately the same proportion of sole parents and couple families pay for childcare, but the lower hourly cost of childcare faced by sole parents relative to couple families ($2.02 versus $3.02) could be due to the introduction of the Child Care Benefit in 2000, which targets support to low-income families and which may have been included in the reported price. In addition, workers pay more than non-workers which is consistent with this explanation. As expected, the highest hours of childcare are for pre-school aged children (under age 4) for both single and couple families.

[3] Childcare use differs slightly between the HILDA wave 2 and the CCS 2002, in particular for households where at least one adult is not working. The HILDA data has on average substantially lower amounts for these groups. The large differences for sole parent families may be partly caused by the relatively small number of observations on this family type in the HILDA, resulting in more uncertainty around the sample estimates. In addition, there are some differences in the questions asked in the two surveys. Despite these differences, the patterns of use and cost of childcare by age of the youngest child and by labour force status of the parents are similar for the two 2002 datasets.

**Table 2: Weekly Hours and Hourly Cost of Childcare**

**By Employment Status**

| | Couples | | | | Sole parents | | |
|---|---|---|---|---|---|---|---|
| | Two workers | One worker | No workers | Total | Worker | Non-worker | Total |
| Average weekly hours of childcare for all | 15.69 | 5.54 | 3.21 | 11.01 | 19.67 | 6.49 | 12.85 |
| Proportion paying for childcare | 0.60 | 0.53 | 0.59 | 0.58 | 0.60 | 0.69 | 0.62 |
| Hourly cost (in $) (if non- zero) | 3.23 | 2.38 | 1.75 | 3.02 | 2.24 | 1.56 | 2.02 |

**By Age of Youngest Child**

| | Couples | | | | Sole parents | | | |
|---|---|---|---|---|---|---|---|---|
| | 0-2 | 3-4 | 5-9 | 10-11 | 0-2 | 3-4 | 5-9 | 10-11 |
| Average weekly hours of childcare for all | 14.72 | 19.01 | 6.08 | 3.36 | 18.73 | 21.01 | 8.17 | 6.46 |
| Proportion paying for childcare | 0.66 | 0.79 | 0.44 | 0.22 | 0.74 | 0.91 | 0.51 | 0.31 |
| Hourly cost (in $) (if non- zero) | 2.68 | 3.14 | 3.45 | 3.71 | 1.39 | 1.77 | 2.49 | 3.47 |

Note: The numbers in the table are weighted to represent the Australian population

### *2.2 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 for the different services 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 Out of School Hours Care (OSHC) services by the average time of a session. Table 3 presents the average fees for four age groups by State. These fees are of a similar size as the average hourly cost presented in Table 2. The values in Table 3 are used for the analyses in the rest of the paper to avoid the issue of endogeneity of the observed prices to the demand for childcare.

**Table 3: 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** |

### *2.3 Data on Labour Supply*

Weighted summary statistics for the labour supply variables from the 2002 SIHC are given in Table 4. Interviews for the SIHC of 2002/2003 were conducted in the same financial year when interviews for the second wave of HILDA were conducted. It is therefore appropriate to combine information from the two data sets for the estimation of labour supply models in Section 4.

**Table 4: Weighted Summary Statistics for the SIHC 1996/1997 and 2002/2003**

| | **Couples (2002)** | **Couples (1996)** | **Sole parents (2002)** | **Sole parents (1996)** |
|---|---|---|---|---|
| **Continuous Variables** | **mean** | **mean** | **mean** | **mean** |
| Average hours worked by head | 37.183 | 36.910 | 16.092 | 12.861 |
| Average hours worked by spouse | 21.235 | 18.920 | | |
| Welfare participation by the household | 0.090 | 0.122 | 0.678 | 0.684 |
| Look for part-time work by head | 0.002 | 0.001 | 0.041 | 0.033 |
| Look for full-time work by head | 0.034 | 0.054 | 0.061 | 0.060 |
| Look for part-time work by spouse | 0.006 | 0.011 | | |
| Look for full-time work by spouse | 0.024 | 0.029 | | |
| Age head | 43.322 | 42.673 | 37.723 | 35.835 |
| Age spouse | 40.921 | 40.216 | | |
| Number of children in income unit | 1.061 | 1.183 | 1.671 | 1.724 |
| Percentage of households without a child | 0.443 | 0.408 | | |
| Wage rate head | 23.224 | 18.388 | 15.174 | 12.310 |
| Wage rate spouse | 17.774 | 13.852 | | |
| **Dummy Variables** | | | | |
| Living in New South Wales | 0.339 | 0.345 | 0.342 | 0.339 |
| Residence of income unit in capital city | 0.638 | 0.635 | 0.566 | 0.579 |
| Gender(woman) | | | 0.842 | 0.880 |
| *Education of head* | | | | |
| • No qualifications | 0.375 | 0.421 | 0.590 | 0.659 |
| • Vocational qualification | 0.296 | 0.292 | 0.200 | 0.193 |
| • Diploma | 0.122 | 0.128 | 0.082 | 0.060 |
| • University degree | 0.208 | 0.158 | 0.128 | 0.088 |
| *Education of spouse* | | | | |
| • No qualifications | 0.495 | 0.602 | | |
| • Vocational qualification | 0.216 | 0.170 | | |
| • Diploma | 0.088 | 0.099 | | |
| • University degree | 0.202 | 0.129 | | |
| *Youngest child in income unit is* | | | | |
| between 0 and 2 | 0.151 | 0.180 | 0.156 | 0.226 |
| between 3 and 4 | 0.070 | 0.074 | 0.129 | 0.128 |
| between 5 and 9 | 0.122 | 0.136 | 0.287 | 0.274 |
| between 10 and 15 | 0.119 | 0.114 | 0.313 | 0.253 |
| *Employment status head* | | | | |
| Non participation | 0.087 | 0.069 | 0.385 | 0.491 |
| Unemployed | 0.036 | 0.056 | 0.102 | 0.096 |
| Employed | 0.877 | 0.875 | 0.512 | 0.413 |
| *Employment status spouse* | | | | |
| Non participation | 0.318 | 0.352 | | |
| Unemployed | 0.030 | 0.042 | | |
| Employed | 0.652 | 0.606 | | |
| **Weighted number of observations** | **2,800,700** | **2,540,800** | **475,870** | **414,610** |

To allow for comparison with the situation in 1996 on which the models in Doiron and Kalb (2005a) are based, summary statistics are also given for the SIHC 1996/1997.

Comparing the two years provides a few interesting insights. First of all, it is evident that female labour force participation has increased, both for married women and sole parents (most of whom are women, although there has been a small increase in the proportion of sole fathers). This increase has in part been larger for sole parents than for married women (note that not all married women in the sample have children).

Disaggregating employment by age of the youngest child, we find that the increase is largest for parents with children under 5 years of age. Although sole parents' labour force participation has increased substantially, with the increase primarily due to an increase in employed persons and not to an increase in unemployed persons, (partial) dependence on income support has decreased only slightly. This is due to relatively generous income support and low wage rates for sole parents. As a result, they are likely to remain on welfare, at least partially, even after entering the labour force. For couple families, a 3 percentage point decrease in welfare participation (as simulated by MITTS) is observed between 1996 and 2002, possibly due to the lower number of married men and women who are unemployed in 2002.[4] In addition to the increased employment rate, there has been a slight increase in average working hours of those who are working as well.

Comparing education across the two years in the SIHC, all groups appear to have larger proportions of individuals at the higher education levels in 2002. There also appear to be relatively fewer households with preschool children in 2002. The higher education level and the decrease in the proportion of families with young children are both expected to increase labour supply. Finally, the unemployment rate in the sample for couples is clearly lower in 2002 than in 1996. For sole parents, the unemployment rate increases very slightly and the unemployment rate is much higher for this group than for married men or married women.

# 3. Demand for Childcare based on HILDA Data

This section presents the results from childcare demand models estimated based on the HILDA dataset. The models follow the specification chosen in Doiron and Kalb (2005a,b) and the results presented are from estimating a simultaneous bivariate tobit

[4] All numbers in Table 4 are derived from the raw ABS data, except for the indicator "welfare participation by the household", which is derived from observed participation in the ABS data combined with calculated eligibility for social security payments according to the MITTS programme.

model for formal childcare hours and informal childcare cost.[5] Instead of estimating a model for formal and informal childcare hours, this specification is chosen with the view of using the childcare model to predict total childcare costs for each household in MITTS. As the average price of formal childcare is available from an external source (see Table 3) and is reasonably similar across the different formal care types, predicted formal childcare costs can be obtained by multiplying the predicted demand by the relevant exogenous price. However, the same calculation cannot be so easily performed for informal childcare costs, as the price of informal childcare is often zero and may vary considerably from case to case.[6] As a result, it cannot be captured well by an average fee. A specification based on using informal childcare cost (an observed characteristic in HILDA) as a dependent variable in the bivariate tobit avoids the need to compute informal childcare cost from informal childcare demand.

An alternative approach, called the Heckman approach, separates the decision to use childcare and how much childcare to use once the decision is made to use, by having different sets of parameters for these two decisions. However, for identification reasons, the Heckman approach requires the presence of variables which are expected to influence the decision to use childcare but not the amount that is used. There are no obvious candidates amongst the variables used in the analyses. In addition, when estimating a joint model for formal and informal care, the two-step approach for each of the two equations would complicate the modelling further.[7]

In all analyses in this section, we select families with children younger than 12 years of age. Although childcare use and costs are collected for all children less than 14 years old, a brief inspection of the data revealed that childcare use for children aged 12 to 14 is quite low, so we ignore this in the following analysis.[8]

For each model, to assist interpretation of the results, we present the marginal effects (see Appendix A for details). The variables used in the models include variables which

[5] A tobit model is used because the dependent variables, formal childcare hours and informal childcare costs, never take a negative value, but are censored at zero. Informal care includes preschool given the different fee schedule compared to other formal childcare. An extensive discussion of the treatment of preschool is provided in Doiron and Kalb (2005b).
[6] For example, compare the fee for a nanny with the "fee" for a grandparent looking after the same child.
[7] In Doiron and Kalb (2005a, b) this approach was explored, but was not found successful.
[8] Only 17 per cent of weighted households with the youngest child aged between 12 and 14 use childcare. Of these households, only 3.5 per cent use formal childcare. In these households, a total of 1.2 hours of childcare is used, which is much less than the total hours of childcare used in families with a youngest child aged between 5 and 11.

describe family composition and labour force status of the parents. Several interaction terms are included to allow for different effects on the demand for childcare of the hours worked by the sole parent (or by the parent with the lowest working hours in a couple) depending on the number of children in the different age groups. In addition, the age of the parents is included as an approximation to the potential availability of grandparents, who could help to look after the children, and regional variables to indicate the urbanisation of the region in which the family lives. The HILDA data also provides information on any other adults (apart from the parents), who live in the same household, and on working arrangements which may interfere with, or be beneficial to organising childcare. The latter, although significant, are not included in the final model, because these characteristics are not observed in the SIHC and can therefore not be used for predicting childcare costs of households in the SIHC.

Finally, external data from the Census of Child Care Services are used to construct average hourly fees for formal childcare by State of Residence and by age of the child (see Table 3). These fees are combined with the HILDA data to explore the potential effect of the price of childcare on the demand for childcare. The interaction with the number of children in the relevant age group ensures only the relevant fees are included in estimation. Actual hourly fees at the individual level, using the information in the HILDA data, could be constructed as well. However, as mentioned before, this information is likely to be endogenous to the choice for childcare use, where families are likely to have a choice from different childcare options at different prices. The more aggregate fee schedule derived from the Census information, which is used here, does not suffer from this potential endogeneity and should pick up any systematic regional variation in childcare fees. The same external data source is also used to construct qualification and experience variables, using the Census of Child Care tables following an approach similar to the approach used to construct average childcare fees by State and age of the child. The two measures are the proportion of staff working in childcare facilities who have a qualification and the proportion of staff who have at least three years experience. These proportions can be calculated from the Census tables as weighted averages over the different formal care services by State and age of the child.

In addition to estimating a formal demand and informal cost model, formal and informal demand for childcare models have been estimated.[9] Before discussing the results on the first type of model presented here, we briefly summarise the main differences between the two types of model. Using informal cost of childcare, instead of informal demand for childcare, changes the predicted marginal effects of the different characteristics on the demand for formal care only slightly. Naturally, the marginal effects of the different characteristics on informal cost of care (measured in dollars per week) are different from the corresponding marginal effects on informal demand for care (measured in hours per week).

Although average informal childcare use is larger for sole parents than for couple families, the average cost of informal childcare use is lower for sole parents (see row 5 from the bottom of Tables 5 and 6 for the latter observation). That is, sole parents pay less for informal childcare than couple families. Similar proportions of sole parents and couple families do not use informal childcare and similar proportions do not pay for informal childcare (see row 4 from the bottom of Tables 5 and 6 for the latter observation). Overall, only 14 per cent of all families have a non-zero cost of informal childcare, whereas about 45 per cent of all families would use informal childcare.

The proportion of non-users of/non-payers for childcare is predicted reasonably well, as is the prediction of the amount of childcare used by sole parents. Similar to the underprediction of informal childcare demand, the underprediction of informal childcare cost is higher for couple families than for sole parents. This is due to using the same parameters to predict whether or not childcare is used or paid for and to predict the amount or cost of childcare used when using childcare. As mentioned before, an alternative approach separating these two decisions (first to use childcare, and second, how much childcare to use once the decision is made to use) would not be practical.

Tables 5 and 6 show that there is a negative correlation between the two equations in the bivariate tobit model, as expected, for both demographic groups. The correlation is stronger for sole parents than for couple families, possibly indicating that the couple families have more scope to organise childcare between the two parents in such a way that the total amount of childcare required (formal and informal) can be minimised. Whenever sole parents are not available themselves to provide childcare, they need to

[9] See Appendix B for results on the formal and informal demand for childcare models.

**Table 5: Demand for Formal Care and Cost of Informal Care in Couple Families (1,272 Observations)**

| | Formal care in hours per week | | | Informal cost in dollars per week | | |
|---|---|---|---|---|---|---|
| | Coeff. | z-value[a] | Marg. Eff. | Coeff. | z-value[a] | Marg. Eff. |
| *Number of children:* | | | | | | |
| Aged <1 | 5.228 | 0.07 | 0.564 | -122.061 | -0.28 | 0.058 |
| Aged 1 | 18.582 | 0.24 | 3.797 | -96.544 | -0.22 | 3.342 |
| Aged 2 | 25.368 | 0.33 | 5.440 | -56.360 | -0.13 | 8.514 |
| Aged 3–4 | -181.295 | -1.86 | 3.929 | -253.319 | -0.62 | 10.972 |
| Aged 5–9 | 4.878 | 0.19 | 0.499 | 134.124 | 0.94 | 2.230 |
| Aged 10-14 | -5.655 | -0.22 | -2.051 | 93.388 | 0.65 | -3.013 |
| Hours of work: mother | 0.703 | 2.39 | 0.213 | 1.141 | 0.75 | 0.104 |
| Hours of work: father | 0.332 | 1.04 | -0.032 | 1.250 | 0.74 | 0.098 |
| Hours of work squared: mother | -0.006 | -1.12 | | -0.038 | -1.39 | |
| Hours of work squared: father | -0.006 | -1.12 | | -0.007 | -0.24 | |
| Minimum hrs of both parents * No. ch: 0–2 | 0.473 | 3.61 | | 0.841 | 1.23 | |
| Minimum hrs of both parents * No. ch: 3-4 | 0.500 | 3.46 | | 0.849 | 1.20 | |
| Minimum hrs of both parents * No. ch: 5+ | -0.010 | -0.14 | | 0.247 | 0.63 | |
| Income of mother | -0.003 | -0.70 | -0.001 | 0.061 | 3.98 | 0.008 |
| Income of father | 0.000 | 0.12 | 0.000 | 0.005 | 0.68 | 0.001 |
| Fees * No.ch: aged 0–2 | -16.042 | -1.16 | -6.039 | 81.021 | 1.04 | 14.672 |
| Fees * No.ch: aged 3–4 | -0.166 | -0.01 | -0.065 | 21.196 | 0.25 | 5.966 |
| Fees * No.ch: aged 5+ | -3.628 | -1.07 | -1.262 | -11.932 | -0.62 | -2.346 |
| Number of other adults | -9.078 | -3.12 | -2.198 | -52.391 | -2.87 | -6.743 |
| *Region* | | | | | | |
| Capital city | 3.916 | 1.64 | 0.941 | 6.936 | 0.59 | 0.888 |
| Australian Capital territory | 21.229 | 1.69 | 7.315 | -146.767 | -1.54 | -8.637 |
| Proportion of qual. staff * no. ch: aged 0–2 | 0.468 | 0.39 | 0.176 | -1.626 | -0.24 | -0.295 |
| Proportion of qual. staff * no. ch: aged 3–4 | 2.146 | 1.92 | 0.833 | 2.193 | 0.44 | 0.617 |
| Proportion of qual. staff * no. ch: aged 5+ | 0.097 | 0.33 | 0.034 | -1.115 | -0.65 | -0.219 |
| Proportion of exp. staff * no. ch: aged 0–2 | 1.299 | 0.55 | 0.489 | -7.206 | -0.53 | -1.305 |
| Proportion of exp. staff * no. ch: aged 3–4 | 2.503 | 1.32 | 0.972 | 6.036 | 0.67 | 1.699 |
| Proportion of exp. staff * no. ch: aged 5+ | 0.254 | 0.42 | 0.088 | -0.588 | -0.17 | -0.116 |
| Age of mother: 15–24 | | | | -63.320 | -1.32 | -6.634 |
| Age of father: 15–24 | | | | 4.634 | 0.07 | 0.570 |
| Age of mother: 25–34 | | | | -24.623 | -1.51 | -3.189 |
| Age of father: 25–34 | | | | 19.631 | 1.20 | 2.635 |
| Constant | -36.668 | -5.29 | | -237.457 | -5.92 | |
| Sigma | 28.650 | 22.01 | | 118.858 | 16.67 | |
| Correlation in error terms (mean, z-value) | | | (-0.108, | -1.89) | | |
| Observed mean, expected value | 5.074 | 5.165 | | 7.747 | 9.272 | |
| Proportion at 0: observed, predicted | 0.757 | 0.758 | | 0.864 | 0.871 | |
| Correlation of predicted and observed | 0.486 | | | 0.446 | | |
| Log likelihood value | | | -3119.866 | | | |
| $\chi^2$ p-value, pseudo $R^2$ | | | 0.000, 0.0712 | | | |

Note: Variables are significant at the 5 per cent level if the z-value is over 1.96 or under -1.96, and variables are significant at the 10 per cent level if the z-value is over 1.64 or under -1.64.

**Table 6: Demand for Formal Care and Cost of Informal Care in Sole Parent Families (361 Observations)**

| | Formal care in hours per week | | | Informal cost in dollars per week | | |
|---|---|---|---|---|---|---|
| | Coeff. | z-value[a] | Marg. Eff. | Coeff. | z-value[a] | Marg. Eff. |
| *Number of children:* | | | | | | |
| Aged <1 | 6.375 | 0.77 | 1.535 | 5.715 | 0.23 | 10.754 |
| Aged 1 | 22.010 | 1.87 | 5.766 | -40.871 | -1.31 | 4.266 |
| Aged 2 | 29.340 | 2.66 | 7.750 | -17.276 | -0.68 | 7.552 |
| Aged 3–4 | -59.058 | -1.88 | -3.263 | 58.914 | 1.40 | 10.312 |
| Aged 5–9 | 5.464 | 1.83 | 1.227 | -5.417 | -0.60 | 0.424 |
| Aged 10-14 | -8.647 | -2.52 | -2.591 | -1.554 | -0.16 | 0.962 |
| Hours of work | 1.215 | 2.89 | 0.239 | 1.200 | 0.94 | 0.230 |
| Hours of work squared | -0.019 | -2.36 | | -0.011 | -0.45 | |
| Hours of work * No. ch: 0–2 | 0.631 | 2.55 | | 1.875 | 2.56 | |
| Hours of work * No. ch: 3-4 | 0.124 | 0.51 | | 0.492 | 0.73 | |
| Hours of work * No. ch: 5+ | 0.194 | 1.78 | | 0.014 | 0.04 | |
| Income | -0.002 | -0.44 | -0.000 | 0.034 | 1.64 | 0.005 |
| Fees * No.ch: aged 0–2 | -4.994 | -1.67 | -1.630 | 9.759 | 1.27 | 1.683 |
| Fees * No.ch: aged 3–4 | 19.577 | 2.34 | 8.848 | 1.944 | 0.17 | 0.593 |
| Fees * No.ch: aged 5+ | -3.794 | -2.27 | -0.853 | 7.740 | 1.55 | 1.006 |
| Number of other adults | -7.074 | -2.33 | -1.914 | -8.815 | -0.94 | -1.228 |
| *Region* | | | | | | |
| Capital city | 4.665 | 1.33 | 1.254 | -11.355 | -1.10 | -1.579 |
| Parent is male | -16.424 | -2.64 | -3.431 | -8.608 | -0.53 | -1.849 |
| *Age of parent* | | | | | | |
| Aged 15-24 | | | | -15.213 | -0.64 | -1.920 |
| Aged 25-34 | | | | -13.697 | -1.05 | -1.272 |
| Constant | -21.718 | -3.14 | | -124.535 | -4.47 | |
| Sigma | 23.017 | 12.75 | | 54.821 | 8.91 | |
| Correlation in error terms (mean, z-value) | | | (-0.325, | -3.32) | | |
| Observed mean, expected value | 5.247 | 5.347 | | 5.285 | 5.600 | |
| Proportion at 0: observed, predicted | 0.729, | 0.729 | | 0.862, | 0.861 | |
| Correlation of predicted and observed | 0.600 | | | | 0.729 | |
| Log likelihood value | | | -867.819 | | | |
| $\chi^2$ p-value, pseudo $R^2$ | | | 0.000, 0.1153 | | | |

Note: Variables are significant at the 5 per cent level if the z-value is over 1.96 or under -1.96, and variables are significant at the 10 per cent level if the z-value is over 1.64 or under -1.64.

get either formal or informal childcare as a replacement. This means that if less formal care is used it will need to be compensated by more informal care. Although average informal childcare use is larger for sole parents than for couple families, the average cost of informal childcare use is lower for sole parents.

Due to the many interaction terms and the nonlinear specification, interpretation of the coefficients is not straightforward. Therefore, we make use of the marginal effects (presented in columns 3 and 6 in Tables 5 and 6) for each of the characteristics in the discussion. For couples and sole parents, more formal childcare is required when young children are present, particularly for 1 to 4 year old children and this decreases for older

children, until it becomes negative when children aged 10 or older are present. For children aged 3 and 4, informal childcare costs are highest due to attendance at preschools (which is included in informal care in our model for practical reasons related to the different fee structure of preschools compared to other formal care).

The effects for newborn children are smaller than for older children. They appear to use less formal care and relatively more informal care, which is provided at relatively low cost to couple families. Given maternity leave arrangements, the expectation is that more parental care would be used for newborn children.

As expected, the hours of work variable has a positive effect on the amount of childcare required. Comparing the marginal effects of hours of work, which include all parameters related to hours of work, the following is found. The hours worked by the mother in couple families is more relevant (and significant) than the father's hours of work. On average, increasing the mother's labour supply by one hour will require 0.21 extra formal hours of childcare and 10 cents of extra cost in informal care.[10] Increasing the father's labour supply by one hour decreases the demand for formal childcare by 0.03 hours. The effect for sole parents is even stronger (although insignificant for formal childcare). An increase in labour supply by 1 hour increases the demand for formal childcare by 0.24 hours and informal cost by 23 cents.[11] Examining the separate components of this overall effect from hours of work, for all groups, the increase in childcare use and cost with labour supply is higher at first, then decreasing when more hours are worked already, as is evident from the positive coefficient for hours of work and the negative coefficient on hours of work squared. The additional childcare required is higher when more young children are present, as is shown by the interaction of hours of work and the number of children in a particular age group. For couple families, the labour supply of the partner working the lowest hours is used to construct the interaction term. Finally, the effect of hours of work on childcare use appears to be somewhat higher for sole parents than for couples, in particular when formal care and school-aged children are concerned.

The effect of income is quite small and generally insignificant. However, in the informal cost equations, the partnered mother's income is significant and the sole

[10] In the demand for formal and informal childcare model, a total of 0.38 extra hours of childcare is expected for the mother as reported in Table B.1 (0.20 extra formal hours and 0.18 extra informal hours).
[11] In the demand for formal and informal childcare model, a total of 0.52 extra hours of childcare is expected for the sole parent as reported in Table B.2 (of which 0.30 hours is in informal care).

parent's income is close to 10-per cent significance level. The price of childcare appears to have the expected effect in most cases although it is mostly insignificant. The marginal effects for the fees are averaged across the households with children in the relevant age group only. The effect of childcare fees for 3 to 4 year old children has a strong positive significant effect on the demand for formal childcare by sole parents. This may be related to the unexpected negative result of the number of children aged 3 and 4 on the demand for formal childcare by sole parents.

The presence of another adult in the household decreases the demand for formal childcare significantly in both demographic groups and decreases the informal childcare costs although the parameters in the informal cost equation are insignificant for sole parents. This variable had a positive effect on the amount of informal care used by the family. This indicates that informal care by other adults in the household is presumably given without payment. Similarly, a younger age of the sole parent (under 35 years) decreases the cost of informal care (insignificantly) whereas it increased the use of informal care, reinforcing the idea that this variable possibly picks up those cases where grandparents are more likely to be able to help their child with the care for their grandchildren. In couple families, none of the effects are close to significance at conventional levels.

Families living in capital cities or the Australian Capital Territory use more formal childcare than families living outside these regions. The effects of regional characteristics may indicate the higher availability of formal childcare in urban areas, although the effects are at most significant at the 10-per cent level. The effect on informal cost is less clear and differs for couples (a positive effect for capital cities and a negative effect for the Australian Capital Territory) and sole parents (a negative effect).

Except for the proportion with qualifications for 3 to 4 year olds, which is significant at the 10 per cent level, most of the aggregate measures of qualifications or experience of staff are not significant. Perhaps qualifications are seen as more important in the care for this age group than in the other age groups. However, they all have a positive effect on the formal childcare demand of couple families, which is according to expectations. None of these variables were significant in the sole parent model, so they have been excluded from the final version presented here.

# 4. Labour Supply Modelling

Using the demand for childcare results from the previous section, a labour supply model accounting for childcare costs is estimated. In subsection 4.1, the imputation of childcare costs, using the demand for childcare models, is described. These imputed costs are then used in the labour supply model as set out in subsection 4.2. Subsection 4.3 reports the estimated parameters of the models for couples and single parents separately., Finally, in subsection 4.4, the corresponding implied labour supply elasticities of the price of childcare are presented, which assist in interpreting the model results.

### *4.1 The Imputation of Childcare Costs*

The predicted demand for formal childcare and cost of informal childcare from the models in Tables 5 and 6 are used to impute childcare costs for households in the SIHC sample at different levels of labour supply. The budget constraint for each household (in this case allowing for childcare costs) can be constructed using the Melbourne Institute Tax and Transfer Simulator (MITTS), a microsimulation model for Australia.[12] 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 and calculated gross income). This predicted childcare cost can be generated for each possible hours level allowed in the discrete choice labour supply model, discussed in the next subsection.

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, before adding the formal and informal costs together.[13] The result is a predicted

[12] See Creedy et al. (2002, 2004) for details on MITTS, and see Creedy and Kalb (2005, 2006) for a general description of the behavioural microsimulation modelling approach.

[13] It is assumed that all people paying for formal childcare are eligible for the childcare benefit (that is they are either working, in training or searching for a job). This will understate the childcare cost to some extent; although statistics (not shown) suggest that most families with children in formal childcare use this type of care for employment or education reasons.

net childcare cost for each household based on predicted formal demands, average fees per household, total predicted informal care costs and calculated subsidies.

### *4.2 The Labour Supply Model*

The labour supply model is described in detail in Kalb (2002). In this subsection, only a brief overview is provided.

#### 4.2.1 The Economic Model

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.[14] 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 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. Separate models are specified for sole parents and couple families.

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:

$$\max U(x, l_1, l_2) \tag{1}$$

subject to a time constraint for each adult:

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

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

$(h_1, h_2) \in A \times B$

and subject to a budget constraint:

$$x = w_1h_1 + w_2h_2 + y_1 + y_2 + B(c, w_1h_1 + w_2h_2 + y_1 + y_2) - \tau(B, w_1h_1 + y_1, w_2h_2 + y_2, c) \qquad (3)$$

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; $A$ and $B$ 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 $\tau$ is the tax function which indicates the amount of tax to be paid.

In the discrete choice case the budget constraint is defined on a discrete set of points $h_1 \in A = \{0, h_{11}, h_{12}, ..., h_{1m}\}$ and $h_2 \in B = \{0, h_{21}, h_{22}, ..., h_{2k}\}$ on the interval [0,T], instead of being defined on a continuous set of working hours [0,T].[15] 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.

### 4.2.2 Specification of the Econometric Model

To deal with unobserved market wages for people who are not working, we estimate their potential wage using a wage equation estimated on workers.[16] A two-stage selection model is used to correct for possible selection bias. Separate wage equations

[15] 0, $h_{11}$, $h_{12}$, etc represent the discrete values which 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.

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

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:

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

where r stands for the combination $h_1$ and $h_2$ that is preferred; s stands for all possible combinations which can be made, given the discrete choice sets for hours worked; and $\varepsilon_r$ and $\varepsilon_s$ 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, $\gamma$, 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:

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

where $\alpha$.. and $\beta$. are preference parameters and $\gamma_1$ and $\gamma_2$ 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 $\gamma_2$ is set to zero.

We include observed heterogeneity by allowing $\beta_1$, $\beta_2$, $\beta_x$, $\gamma_1$ and $\gamma_2$ to depend on the personal and household characteristics listed above. Unobserved heterogeneity is added to $\beta_1$, $\beta_2$, $\beta_x$, and $\gamma_2$, 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.

### 4.2.3 Including Childcare Costs in the Modelling

Importantly, as 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 simulated maximum likelihood approach to estimate the labour supply model. This involves repeated draws from the distribution of childcare costs to allow for the uncertainty associated with the childcare costs in this model. The draws are generated by including a draw from the error term when predicting childcare costs and demand using the model. In this section, we present results for the approach where 10 values are drawn from the distribution of unobservables in the model of hours of formal care and costs of informal care. In other words, 10 draws are taken for each household and the likelihood function for the labour supply model is averaged over these draws before being maximised. The optimal hours of work level can be predicted for each draw and an average is taken over the draws. This method provides an 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 Benefits is more accurate in this approach, given that the subsidy payable for the average childcare cost over 10 draws is not the same as the average subsidy based on the imputed childcare costs, where the individual subsidies are calculated at each of the imputed childcare costs separately before averaging. Technically, this involves averaging at a later stage, and over the hours of work estimates rather than the childcare costs estimates.

## *4.3 Labour Supply Results for Couples and Single Parents*

The results of the labour supply estimation including the childcare costs are given in the last two columns of Tables 7 and 8. These tables include the parameter estimates for the labour supply model estimated without childcare costs for comparison. The two model specifications are generally similar in the direction and relative size of the parameters.

**Table 7: Labour Supply Estimates for Couples Using 10 Draws from Childcare Costs and Prices Respectively (3,404 observations)[a,b]**

| Preference parameters in the | No childcare costs | | With childcare costs | |
|---|---|---|---|---|
| quadratic utility function | Estimates | p-value[c] | Estimates | p-value[c] |
| *Squared terms & cross products* | | | | |
| Income sq. (× 100,000) | -0.0012 | 0.8002 | -0.0004 | 0.9275 |
| Labour supply man sq. (× 100) | -0.5339 | 0.0000 | -0.5369 | 0.0000 |
| Labour supply woman sq. (× 100) | -0.1703 | 0.0000 | -0.1720 | 0.0000 |
| Inc. & labour supply man (× 10,000) | -0.2348 | 0.0000 | -0.2314 | 0.0000 |
| Inc. & labour supply woman (× 10,000) | -0.1702 | 0.0000 | -0.1656 | 0.0000 |
| Labour supply man & woman (× 100) | -0.0478 | 0.0000 | -0.0466 | 0.0000 |
| *Linear terms:* | | | | |
| *Income:* constant | 0.5181 | 0.0000 | 0.5170 | 0.0000 |
| Number of children | -0.0114 | 0.0021 | -0.0112 | 0.0024 |
| *Labour supply man:* constant | 0.3161 | 0.0000 | 0.3179 | 0.0000 |
| Youngest child 0-2 yrs old | -0.0020 | 0.6761 | -0.0013 | 0.7824 |
| Youngest child 3-4 yrs old | -0.0050 | 0.3612 | -0.0041 | 0.4557 |
| Youngest child 5-9 yrs old | 0.0037 | 0.4572 | 0.0039 | 0.4357 |
| Number of children | 0.0010 | 0.5528 | 0.0011 | 0.5422 |
| Age/10 | 0.0566 | 0.0000 | 0.0567 | 0.0000 |
| Age squared/100 | -0.0078 | 0.0000 | -0.0078 | 0.0000 |
| Vocational education | 0.0034 | 0.2523 | 0.0035 | 0.2477 |
| Diploma | -0.0007 | 0.8585 | -0.0007 | 0.8628 |
| Degree | 0.0047 | 0.2442 | 0.0047 | 0.2428 |
| Voc. education (partner) | 0.0017 | 0.5869 | 0.0017 | 0.5873 |
| Diploma (partner) | 0.0007 | 0.8766 | 0.0007 | 0.876 |
| Degree (partner) | 0.0032 | 0.4196 | 0.0032 | 0.4219 |
| *Labour supply woman:* constant | 0.0128 | 0.5670 | 0.0124 | 0.5800 |
| Youngest child 0-2 yrs old | -0.0658 | 0.0000 | -0.0611 | 0.0000 |
| Youngest child 3-4 yrs old | -0.0394 | 0.0000 | -0.0356 | 0.0000 |
| Youngest child 5-9 yrs old | -0.0204 | 0.0000 | -0.0198 | 0.0000 |
| Number of children | -0.0069 | 0.0000 | -0.0069 | 0.0000 |
| Age/10 | 0.0545 | 0.0000 | 0.0551 | 0.0000 |
| Age squared/100 | -0.0082 | 0.0000 | -0.0082 | 0.0000 |
| Voc. education (partner) | -0.0007 | 0.7974 | -0.0007 | 0.8047 |
| Diploma (partner) | 0.0028 | 0.4473 | 0.0028 | 0.4473 |
| Degree (partner) | -0.0052 | 0.1338 | -0.0051 | 0.1387 |
| Vocational education | 0.0104 | 0.0005 | 0.0105 | 0.0005 |
| Diploma | 0.0143 | 0.0004 | 0.0144 | 0.0004 |
| Degree | 0.0309 | 0.0000 | 0.0312 | 0.0000 |
| Fixed cost man/100 | 19.3428 | 0.0000 | 19.4563 | 0.0000 |
| Fixed cost woman/100 | 8.0680 | 0.0000 | 8.1131 | 0.0000 |

*Notes:* a) Six discrete points of labour supply are distinguished for each man: 0 hours for non-participants and men 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, …, 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. c) Variables are significant at the 5 per cent level if the p-value is less than 0.05 (which is equivalent to a z-value of 1.96), and variables are significant at the 10 per cent level if the p-value is less than 0.10 (which is equivalent to a z-value of 1.64).

**Table 8: Labour Supply Estimates for Lone Parents Using 10 Draws from Childcare Costs and Prices Respectively (731 Observations)[a,b]**

| Preference parameters in the quadratic utility function | No childcare costs | | With childcare costs | |
|---|---|---|---|---|
| | **Estimates** | **p-value[c]** | **Estimates** | **p-value[c]** |
| *Squared terms & cross products* | | | | |
| Income squared (× 100,000) | -1.0649 | 0.0225 | -0.9347 | 0.0256 |
| Labour supply squared (× 100) | -0.0360 | 0.4835 | -0.0525 | 0.2547 |
| Income & labour supply (× 10,000) | -1.4775 | 0.0472 | -1.5111 | 0.0155 |
| *Linear terms* | | | | |
| *Income* | | | | |
| Constant | 1.0640 | 0.5020 | 0.9952 | 0.4686 |
| Youngest child 0-2 yrs old | 0.3102 | 0.5010 | 0.2335 | 0.5896 |
| Youngest child 3-4 yrs old | 0.0043 | 0.9930 | -0.1495 | 0.7297 |
| Youngest child 5-9 yrs old | 0.5033 | 0.1603 | 0.4364 | 0.1847 |
| Number of children | 0.1521 | 0.2794 | 0.1232 | 0.3278 |
| Age/10 | 1.5205 | 0.0442 | 1.3361 | 0.0388 |
| Age squared/100 | -0.2026 | 0.0263 | -0.1737 | 0.0278 |
| Vocational education | -1.0768 | 0.0000 | -0.9427 | 0.0000 |
| Diploma or degree | -0.7170 | 0.0008 | -0.6268 | 0.0012 |
| Female | -0.4673 | 0.2047 | -0.4129 | 0.2467 |
| *Labour supply* | | | | |
| Constant | -0.1303 | 0.0503 | -0.1493 | 0.0184 |
| Youngest child 0-2 yrs old | -0.0377 | 0.1359 | -0.0056 | 0.7815 |
| Youngest child 3-4 yrs old | 0.0033 | 0.8855 | 0.0172 | 0.3388 |
| Youngest child 5-9 yrs old | -0.0375 | 0.0572 | -0.0295 | 0.0892 |
| Number of children | 0.0010 | 0.8679 | 0.0034 | 0.512 |
| Age/10 | 0.0607 | 0.0718 | 0.0822 | 0.0095 |
| Age squared/100 | -0.0070 | 0.1180 | -0.0098 | 0.0195 |
| Vocational education | 0.0343 | 0.0016 | 0.0248 | 0.0077 |
| Diploma or degree | 0.0382 | 0.0007 | 0.0321 | 0.0009 |
| Female | -0.0188 | 0.4427 | -0.0218 | 0.3389 |
| *Fixed cost* | | | | |
| Constant | 2.1369 | 0.0000 | 2.3494 | 0.0000 |
| Live in capital city | 0.0408 | 0.5755 | 0.0434 | 0.5897 |
| Children 0-4 yrs old | 0.0282 | 0.9169 | 0.0470 | 0.8733 |
| Youngest child 5-9 yrs old | -0.2460 | 0.2146 | -0.2682 | 0.2255 |
| Live in NSW | 0.1235 | 0.1759 | 0.1306 | 0.1988 |
| Female | -0.4141 | 0.1877 | -0.4934 | 0.1731 |

*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, …, 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. c) Variables are significant at the 5 per cent level if the p-value is less than 0.05 (which is equivalent to a z-value of 1.96), and variables are significant at the 10 per cent level if the p-value is less than 0.10 (which is equivalent to a z-value of 1.64).

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. The finding 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. The changes for sole parents appear to be larger than for couple families. It should be noted that a small change in parameters after accounting for childcare cost does not mean childcare costs have a small effect on labour supply. The outcomes of the model with respect to changes in childcare cost do not depend on the changed parameters but on changes in net (or disposable) incomes at the different labour supply points as a result of the changed childcare costs.

Comparing the labour supply parameters estimated using the 2002 SIHC with the labour supply parameters estimated using the 1996 SIHC in Doiron and Kalb (2005a), it is found that the results are very similar for couple families. The coefficients based on 2002 data are quite close in size and significance to the coefficients based on 1996 data. For sole parents, similar patterns emerge with regard to education and age, but the actual size of parameters differs substantially. For example, the effect of the age of the youngest child used to be through the linear income terms, but in the 2002 specification it appears that the effect is more through the linear labour supply term, and the effects are very small.

The raw SIHC 2002 data shows smaller differences in labour supply between sole parents with younger and older children than the raw SIHC 1996 data. However, participation is still clearly lower for parents with younger children. In a specification without education, age, gender and fixed cost of working, these patterns are still visible in the estimates of the coefficients on the age of the youngest child. Including the other characteristics of sole parents, the effects nearly disappear, indicating they may have been taken into account through these other characteristics (for example, a sole parent's own age may account for a large part of the variation in the age of the youngest child).

### *4.4 Elasticity of Labour Supply with Respect to Childcare Fees and Costs*

Average predicted labour supply and changes in average predicted labour supply resulting from changes in childcare costs are given in Table 9 for all households with children in the SIHC. These are based on the labour supply model parameter estimates, which take into account the childcare costs estimated from the formal demand/informal costs model. Comparing the predicted and actual values for labour supply in this table with those for 1996 as presented in Doiron and Kalb (2005a), it is clear that labour

supply for sole parents and partnered women with children has increased. A smaller increase is observed for married men, possibly due to the lower unemployment rate in 2002 compared to 1996. Married males' employment rates have increased by about 1 percentage point, married females' employment rates have increased by about 6 percentage points and sole parents' employment rates have increased by about 8 percentage points.

**Table 9: Labour Supply Estimates and Changes for Households with Children[a]**

| | Lone parents | | Couples | | | |
|---|---|---|---|---|---|---|
| | | | Fathers | | Mothers | |
| | Exp hrs | Part. | Exp hrs | Part. | Exp hrs | Part. |
| Initial estimates: | 14.59 | 0.482 | 39.27 | 0.922 | 17.74 | 0.586 |
| Add 10% to net costs: | | | | | | |
| Predicted values | 14.39 | 0.475 | 39.26 | 0.922 | 17.69 | 0.585 |
| Change | -1.4% | -0.7ppt | -0.0% | 0.0ppt | -0.3% | -0.1ppt |
| Add 10% to gross hourly prices (allowing for adjustments in demand): | | | | | | |
| Predicted values | 14.35 | 0.473 | 39.27 | 0.922 | 17.74 | 0.586 |
| Change | -1.6% | -0.9ppt | 0.0% | 0.0ppt | 0.0% | 0.0ppt |

Notes: a) Exp Hrs denotes expected hours of labour supply including zeroes. Part. indicates the participation rate. Ppt indicates percentage points.
b) Net costs are gross costs (gross hourly price of childcare times usage in hours per week) minus the Child Care Benefit for which the household is eligible.

In order to facilitate the interpretation of the results in Section 4.3, 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 per cent increase in net costs of childcare. This increases the costs directly and incorporates any changes in the demands. The second experiment is a 10 per cent increase in the price of formal childcare. In this case, demands are expected to adjust downward, resulting in a smaller than 10 per cent increase in total gross costs. In addition, the government subsidies need to be recomputed after the increase in price to calculate the new net costs.[17] Depending on how much subsidy is already received, the percentage increase in this new net cost can be either more or less than the 10 per cent increase in the gross price of childcare. For those already receiving the maximum amount of subsidy, who as a result have relatively low net costs in the starting point, the percentage increase in the new net costs may well be more than the 10 per cent increase in the gross cost. This seems to be the

[17] It is the net cost which affects labour supply in our model. If gross prices increase but are completely counteracted by a reduction in demand and increased subsidies at each labour supply level, this would leave net costs at each level of labour supply exactly the same as before the increase in gross prices and the change in gross prices would have no effect on labour supply.

case for lone parents, where the effect of increasing the gross price by 10 per cent is larger than the effect of increasing the net costs by 10 per cent. This indicates that the percentage increase in net costs associated with a 10 per cent increase in the gross price is more than 10 per cent.

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. For couple families, an increase in costs generates a larger effect than a rise in the price due to adjustments in demands and to subsidies which need to be incorporated after the gross price change.

In Table 10, elasticities are calculated for all married women and sole parents and for subgroups of married women and sole parents. These are compared to the 1996 results. Elasticities are approximated by predicting the average labour supply for a group of parents before and after a 10-per cent increase in net or gross childcare costs. The average labour supply after the increase is subtracted from the average labour supply before the price increase. This difference is expressed as a percentage of labour supply before the increase in cost, and then divided by 10 to obtain the aggregate elasticity. This elasticity is an average over the relevant group.

**Table 10: Elasticity of Hours Worked Estimates for Households with Children in 1996 and 2002**

| | with respect to costs | | with respect to prices | |
|---|---|---|---|---|
| **Married women** | 1996 | 2002 | 1996 | 2002 |
| Total | -0.034 | -0.028 | -0.021 | -0.000 |
| Low wage (partner low wage) | | -0.026 | | -0.013 |
| Low wage (partner high wage) | -0.045 | -0.036 | -0.027 | -0.002 |
| Preschool Child | -0.066 | -0.078 | -0.048 | -0.019 |
| Preschool Child and low wage | -0.079 | -0.075 | -0.053 | -0.030 |
| **Sole parents** | | | | |
| Total | -0.150 | -0.137 | -0.053 | -0.164 |
| Low wages | -0.263 | -0.286 | -0.062 | -0.319 |
| Preschool Child | -0.280 | -0.510 | -0.175 | -0.579 |
| Preschool Child and low wages | -0.054 | -0.637 | -0.216 | -0.931 |

Note: A low wage is defined as a wage below the median wage. For married women this is $14.56 and for married men this is $20.56 per week. For married women and men with preschool children this is $13.93 and $19.77 respectively. For sole parents the median wage is $12.07 ($11.75 for those with preschool children).

The results show that there is substantial variety in elasticities of labour supply with respect to childcare costs depending on the presence of preschool children and the wage of the parents. As expected, the elasticities have larger negative values when preschool

children are present or when the mother's wage is lower, particularly for sole parents. For these groups the cost of childcare is more important when deciding whether or not to participate in the labour force and for how many hours to work in paid employment. Notwithstanding the heterogeneity between groups, within each group, a substantial amount of heterogeneity in the elasticities is expected to remain as well. Further subdivisions of the groups could bring these to light.

Similar to the results in Table 9, for sole parents, the elasticities with respect to gross prices are larger than the elasticities with respect to net cost. This is in particular the case for sole parents on low wages with preschool children. This supports the explanation given before that this is caused by a large proportion of sole parents already receiving the maximum amount of subsidies in the current situation. As a result a 10 per cent increase in gross price is translated into a larger than 10 per cent increase in net cost.[18]

The patterns of 1996 are mostly very similar to those for 2002, as are the overall average values for the elasticity with respect to costs. However, the elasticities for subgroups, in particular for sole parents and for the elasticities with respect to prices, are quite different. To gain a better understanding of the reasons underlying this result for sole parents, we have tried to identify whether it is the data, the policies or the estimated parameters which cause the differences. Using 2002 data and parameters, but applying the 1996 policies (expressed in 2002 dollar values) to the 2002 households, the predicted elasticities for sole parents are quite similar to those presented in Table 10. There is a very small increase in the elasticity for single parents with preschool children (mostly so for those on low wages) when applying the 1996 policies and a very small decrease in the elasticities of the others. This is consistent with the observation that the 2002 childcare subsidies appear somewhat more targeted towards those with high cost and low wages. It does not appear that changes in policies between 1996 and 2002 are driving the results in Table 10 for sole parents. However, when using the 1996 labour supply parameters with the 2002 data and the 2002 labour supply parameters with the 1996 data to calculate an alternative set of elasticities, we find that these two alternative sets of elasticities are closer to each other than in Table 10. This implies that both the

[18] Comparing the average predicted childcare costs at each of the labour supply points there is evidence for this in the 2002 sample of sole parents but not in the 1996 sample. This explains why the elasticities with respect to prices are mostly higher than the elasticities with respect to costs for sole parents in 2002, but not in 1996.

data and the parameters appear responsible for the difference. Comparing the different sets of elasticities, we find that changing the parameters from one year to the other year explains a smaller proportion of the difference than changing the data from one year to the other year.

In addition, from comparing the average childcare costs at each labour supply point, it is clear that those at lower hours pay relatively less in 2002 than in 1996 whereas those at the higher hours levels pay more in real terms. This is caused by an increase in the childcare cost with more than the Consumer Price Index and by a more targeted childcare subsidy. A 10 per cent increase in childcare costs will therefore lead to different results in 2002 compared to 1996.

# 5. Conclusion

Using the demand for childcare models, the cost of childcare is imputed for each household in the 2002 SIHC data so these costs can be taken into account when estimating labour supply for families with children. Although labour supply parameter estimates based on 1996 data currently exist in the literature (Doiron and Kalb, 2005a), it is important to periodically update results using the most recent demographic data. That is, effects of policies may change over time with demographics and results from the past may no longer be applicable today. For example, comparing the labour supply of partnered women and sole parents in 1996 and 2002 it was found that labour supply had increased over time for both groups.

Compared to the model estimated by Doiron and Kalb (2005a) based on 1996 SIHC data, the labour supply parameter estimates, taking into account childcare costs, change only slightly for couple families, while parameters for sole parent families change somewhat more. Using the labour supply parameters, the effect of increases in childcare costs is assessed. They are found to be similar to those observed using the 1996 SIHC and remain at the lower end of the range of elasticities found in the international literature.

Although the price elasticities are on average relatively low, it is also clear that there is a large amount of heterogeneity in these elasticities. As a result the effects of potential policies can vary substantially, depending on which groups are targeted by the policy change.

# Appendix A

## Calculation of Marginal Effects

For continuous variables, these are based on the average effect across the relevant sample of an infinitely small change in the characteristics. This is computed by taking the first derivative with regard to the characteristics weighted by the probability of the demand for formal and informal childcare being non-zero at the observed values. For characteristics represented by dummy variables, which can only take the value of zero or one, a different approach is taken. First, the demand for childcare is predicted for each individual with the dummy variable set at zero, followed by a prediction for the demand of childcare with the dummy variable set at one. Then the marginal effect of the characteristic is calculated by taking the average difference in predicted childcare between these two over all individuals.

Each characteristic is changed separately, with all other characteristics left at the observed values, to isolate the effect of each characteristic on the demand for childcare. All parameters involving this characteristic are taken into account in the calculation. For example, consider hours worked: this appears as a linear term, as a quadratic term and as several interactions with the number of children in different age groups. All these components of the marginal effect are included. Similarly, when examining the shift from non-employed to employed, we adjust the hours of work at the same time, setting them to the average hours of work amongst workers of the same family type, distinguishing between fathers and mothers in couple families.

The marginal effect is calculated separately for each household in the sample rather than for a hypothetical average person. Hypothetical persons are usually unrealistic representations of an individual, due to indicator variables being represented by a proportion representing the number of times the indicator variable has the value of one in the sample.[19]

[19] We do not use the standard command in Stata to calculate marginal effects, because this is calculated for a hypothetical person with average values on all characteristics. In addition, interaction effects would not be properly taken into account.

# Appendix B

## Results for Demand for Formal and Informal Childcare Models

### Table B.1: Demand for Formal and Informal Childcare in Couple Families (1,277 Observations)

| | Formal care in hours per week | | | Informal care in hours per week | | |
|---|---|---|---|---|---|---|
| | Coeff. | z-value[a] | Marg. Eff. | Coeff. | z-value[a] | Marg. Eff. |
| *Number of children:* | | | | | | |
| Aged <1 | 20.914 | 0.27 | 0.622 | 15.267 | 0.29 | 2.525 |
| Aged 1 | 34.456 | 0.44 | 3.906 | 14.104 | 0.27 | 2.054 |
| Aged 2 | 41.641 | 0.54 | 5.648 | 17.817 | 0.34 | 3.558 |
| Aged 3–4 | -191.513 | -1.98 | 4.025 | 15.774 | 0.27 | 5.303 |
| Aged 5–9 | 8.388 | 0.32 | 0.654 | -6.481 | -0.41 | 1.168 |
| Aged 10-11 | -1.333 | -0.05 | -1.703 | -8.565 | -0.54 | 0.324 |
| Aged >11 | -70.020 | -1.53 | -2.437 | -5.984 | -0.25 | -0.669 |
| Hours of work: mother | 0.584 | 1.71 | 0.201 | 0.623 | 2.89 | 0.181 |
| Hours of work: father | 0.284 | 0.86 | -0.022 | 0.283 | 1.34 | 0.005 |
| Hours of work squared: mother | -0.005 | -0.78 | | -0.012 | -3.11 | |
| Hours of work squared: father | -0.005 | -0.91 | | -0.004 | -0.98 | |
| Minimum hrs of both parents * No. ch: 0–2 | 0.496 | 3.80 | | 0.198 | 2.23 | |
| Minimum hrs of both parents * No. ch: 3-4 | 0.486 | 3.40 | | 0.266 | 2.72 | |
| Minimum hrs of both parents * No. ch: 5-11 | -0.014 | -0.17 | | 0.142 | 2.64 | |
| Min. hrs of both parents * No. ch: 12 plus | 0.113 | 0.64 | | -0.021 | -0.22 | |
| Income of mother | -0.002 | -0.55 | -0.001 | 0.003 | 1.64 | 0.001 |
| Income of father | 0.000 | -0.14 | -0.000 | 0.001 | 0.92 | 0.000 |
| Fees * No.ch: aged 0–2 | -14.116 | -1.02 | -5.289 | 13.817 | 1.49 | 6.973 |
| Fees * No.ch: aged 3–4 | 2.552 | 0.16 | 0.997 | -6.388 | -0.55 | -3.650 |
| Fees * No.ch: aged 5-11 | -6.573 | -1.58 | -2.079 | 3.730 | 1.52 | 2.215 |
| Fees * No.ch: aged 12+ | 11.471 | 1.20 | 1.350 | 3.092 | 0.63 | 1.212 |
| Number of other adults | -8.711 | -3.02 | -2.112 | 1.422 | 1.02 | 0.576 |
| *Region* | | | | | | |
| Capital city | 3.396 | 1.35 | 0.818 | 3.514 | 2.21 | 1.413 |
| Inner region | 0.502 | 0.10 | 0.123 | 5.732 | 1.93 | 2.548 |
| Australian Capital territory | 18.402 | 1.38 | 6.083 | -20.878 | -2.22 | -5.475 |
| *Work characteristics* | | | | | | |
| Flexible work – mother | 3.550 | 1.15 | 0.863 | 0.568 | 0.29 | 0.230 |
| Flexible work – father | 1.635 | 0.66 | 0.394 | 1.919 | 1.22 | 0.771 |
| Mother works in non-regular shifts | -5.406 | -1.79 | -1.234 | -0.857 | -0.45 | -0.343 |
| Father works in non-regular shifts | -5.067 | -1.87 | -1.170 | -0.006 | 0.00 | -0.003 |
| Proportion of qual. Staff * No. ch: aged 0–2 | 0.222 | 0.18 | 0.083 | -0.667 | -0.81 | -0.337 |
| Proportion of qual. Staff * No. ch: aged 3–4 | 2.150 | 1.93 | 0.840 | 0.134 | 0.19 | 0.077 |
| Proportion of qual. Staff * No. ch: aged 5+ | 0.187 | 0.64 | 0.066 | -0.021 | -0.12 | -0.015 |
| Proportion of exp. staff * No. ch: aged 0–2 | 0.870 | 0.37 | 0.326 | -1.447 | -0.91 | -0.730 |
| Proportion of exp. staff * No. ch: aged 3–4 | 2.509 | 1.32 | 0.981 | 0.530 | 0.43 | 0.303 |
| Proportion of exp. staff * No. ch: aged 5+ | 0.363 | 0.60 | 0.127 | -0.338 | -1.00 | -0.242 |

**Table B.1 (continued)**

| | Formal care in hours per week | | | Informal care in hours per week | | |
|---|---|---|---|---|---|---|
| | Coeff. | z-value[a] | Marg. Eff. | Coeff. | z-value[a] | Marg. Eff. |
| Age of mother: 15–24 | | | | -0.984 | -0.18 | -0.384 |
| Age of father: 15–24 | | | | 0.848 | 0.12 | 0.347 |
| Age of mother: 25–34 | | | | 1.355 | 0.65 | 0.554 |
| Age of father: 25–34 | | | | 0.573 | 0.27 | 0.233 |
| Constant | -36.044 | -5.23 | | -27.126 | -6.12 | |
| Sigma | 28.280 | 22.07 | | 21.366 | 31.25 | |
| Correlation in error terms (mean, z-value) | | | (-0.087, | -2.050) | | |
| Observed mean, expected value | 5.067 | 5.150 | | 6.255 | 7.045 | |
| Proportion at 0: observed, predicted | 0.757 | 0.758 | | 0.557 | 0.595 | |
| Correlation of predicted and observed | 0.504 | | | 0.394 | | |
| Log likelihood value | | | -4718.905 | | | |
| $\chi^2$ p-value, pseudo $R^2$ | | | 0.000, 0.0539 | | | |

Note: Variables are significant at the 5 per cent level if the z-value is over 1.96 or under -1.96, and variables are significant at the 10 per cent level if the z-value is over 1.64 or under -1.64.

**Table B.2: Demand for Formal and Informal Care in Sole Parent Families (361 Observations)**

| | Formal care in hours per week | | | Informal care in hours per week | | |
|---|---|---|---|---|---|---|
| | Coeff. | z-value[a] | Marg. Eff. | Coeff. | z-value[a] | Marg. Eff. |
| *Number of children:* | | | | | | |
| Aged <1 | 7.412 | 0.91 | 1.623 | 6.222 | 0.96 | 6.361 |
| Aged 1 | 22.941 | 1.97 | 5.865 | 0.160 | 0.02 | 3.749 |
| Aged 2 | 32.296 | 2.92 | 8.421 | 1.868 | 0.27 | 4.485 |
| Aged 3–4 | -63.231 | -1.98 | -3.995 | 10.540 | 0.82 | 6.062 |
| Aged 5–9 | 6.814 | 1.82 | 1.248 | -0.471 | -0.17 | 1.169 |
| Aged 10-11 | -2.820 | -0.53 | -1.384 | 6.179 | 1.68 | 4.035 |
| Aged >11 | -26.180 | -1.05 | -3.144 | -4.343 | -0.46 | -1.112 |
| Hours of work | 0.676 | 1.37 | 0.217 | 1.157 | 3.20 | 0.299 |
| Hours of work squared | -0.009 | -1.03 | | -0.019 | -2.91 | |
| Hours of work * No. ch: 0–2 | 0.645 | 2.61 | | 0.326 | 1.65 | |
| Hours of work * No. ch: 3-4 | 0.094 | 0.39 | | 0.224 | 1.23 | |
| Hours of work * No. ch: 5-11 | 0.244 | 1.74 | | 0.158 | 1.43 | |
| Hours of work * No. ch: 12 plus | 0.121 | 0.40 | | 0.142 | 0.86 | |
| Income | -0.002 | -0.55 | -0.001 | 0.000 | 0.16 | 0.000 |
| Fees * Ch: aged 0–2 | -5.373 | -1.80 | -1.800 | 0.573 | 0.29 | 0.241 |
| Fees * Ch: aged 3–4 | 20.577 | 2.42 | 9.404 | -0.436 | -0.12 | -0.243 |
| Fees * Ch: aged 5-11 | -5.298 | -2.95 | -1.184 | -0.125 | -0.09 | -0.053 |
| Fees * Ch: aged 12+ | 3.807 | 0.49 | 0.488 | -0.408 | -0.13 | -0.136 |
| Number of other adults | -7.736 | -2.58 | -2.113 | 0.882 | 0.47 | 0.380 |
| *Region* | | | | | | |
| Capital city | 4.251 | 1.17 | 1.153 | -1.036 | -0.40 | -0.447 |
| Inner region | -8.408 | -1.10 | -1.986 | -0.078 | -0.02 | -0.034 |
| *Parent's work characteristics* | | | | | | |
| Flexible work | 8.339 | 1.85 | 2.363 | -1.761 | -0.56 | -0.752 |
| Non-regular shifts | -3.593 | -0.74 | -0.934 | 6.084 | 1.80 | 2.853 |
| Parent is male | -15.044 | -2.42 | -3.223 | -5.282 | -1.25 | -2.094 |
| *Age of parent* | | | | | | |
| Aged 15-24 | | | | 2.129 | 0.40 | 0.837 |
| Aged 25-34 | | | | 7.773 | 2.48 | 3.425 |
| Constant | -18.679 | -2.61 | | -21.374 | -3.77 | |
| Sigma | 22.281 | 12.80 | | 18.881 | 16.73 | |
| Correlation in error terms (mean, z-value) | | | (-0.233, | -2.79) | | |
| Observed mean, expected value | 5.247 | 5.338 | | 7.133 | 7.432 | |
| Proportion at 0: observed, predicted | 0.729, | 0.727 | | 0.546, | 0.569 | |
| Correlation of predicted and observed | 0.628 | | | | 0.483 | |
| Log likelihood value | | | -1338.165 | | | |
| $\chi^2$ p-value, pseudo $R^2$ | | | 0.000, 0.090 | | | |

Note: Variables are significant at the 5 per cent level if the z-value is over 1.96 or under -1.96, and variables are significant at the 10 per cent level if the z-value is over 1.64 or under -1.64.

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