MODELLING CHILD CARE SERVICES AND SUBSIDIES

Deborah Schofield, Josh Polette
and Alexis Hardin

STINMOD Technical Paper No. 10
January 1996

National Centre for Social and Economic Modelling

• Faculty of Management • University of Canberra •

The National Centre for Social and Economic Modelling was established on 1 January 1993, following a contract between the University of Canberra and the then Federal Department of Health, Housing, Local Government and Community Services (now Human Services and Health).

NATSEM aims to enhance social and economic policy debate and analysis by developing high quality models, applying them in relevant research and supplying consultancy services.

NATSEM's key area of expertise lies in developing and using microdata and microsimulation models for a range of purposes, including analysing the distributional impact of social and economic policy. The NATSEM models are usually based on individual records of real (but unidentifiable) Australians. This base produces great flexibility, as results can be derived for small subgroups of the population or for all of Australia.

NATSEM ensures that the results of its work are made widely available by publishing details of its products and research findings. Its technical and discussion papers are produced by NATSEM's research staff or visitors to the Centre, are the product of collaborative efforts with other organisations and individuals, or arise from commissioned research (such as conferences). Discussion papers present preliminary research findings and are only lightly refereed.

It must be emphasised that NATSEM does not have views on policy and that all opinions are the authors' own.

Director: Professor Ann Harding

NATSEM

National Centre for Social and Economic Modelling
• Faculty of Management • University of Canberra •

MODELLING CHILD CARE SERVICES AND SUBSIDIES

Deborah Schofield, Josh Polette and Alexis Hardin

STINMOD Technical Paper No. 10

January 1996

ISSN 1323 210X
ISBN 0 85889 511 0

National Centre for Social and Economic Modelling,
GPO Box 563
Canberra ACT 2601
Australia

Phone: +61 6 275 4900 Fax: +61 6 275 4875
E-mail: Client services hotline@natsem.canberra.edu.au
General natsem@natsem.canberra.edu.au

Core funding for NATSEM is provided by the federal Department of Human Services and Health.

About STINMOD

STINMOD is a static microsimulation model that has been developed by the National Centre for Social and Economic Modelling. STINMOD is NATSEM's first publicly available model. It has been developed to provide government and non-government organisations ó as well as academic and other researchers ó with an accessible and practical tool for examining the *immediate* impact of a range of policy changes on family incomes and government expenditure.

STINMOD is a *general-purpose* microsimulation model as it models a broad range of federal government programs. The programs currently modelled in STINMOD are social security pensions, allowances and family payments, Veterans' Affairs pensions, AUSTUDY, the Medicare levy and income tax. Estimates of the cash value of government expenditure on child care, education, public housing and health have also been added to the STINMOD database. In later releases, other government programs will be added to the model to improve the coverage of both cash and non-cash transfers.

As a *static* microsimulation model, STINMOD provides a 'snapshot' of the economic circumstances of the Australian population, both as it was just before the introduction of a new policy and as it would be immediately after a policy is introduced. By examining the changed economic circumstances of the model's population, it is possible to predict the likely first-round effects of a policy change on the real population.

Abstract

Child care is likely to continue to grow into the twenty-first century, and over the next few years the government is committed to continuing the growth in funded child care places.

However, despite the increasing importance of child care, and the corresponding growth in expenditure on child care subsidies, an Australian microsimulation model of child care services and subsidies has never been developed.

This paper describes how microsimulation methods have been applied to modelling Australian child care services and federal government subsidies.

Authors' note

Deborah Schofield and Joshua Polette are Research Fellows at the National Centre for Social and Economic Modelling and at the time the model was developed Alexis Hardin was a Research Officer at NATSEM.

Acknowledgments

The authors would like to thank Helen Moyle from the Australian Institute of Health and Welfare and staff from the Family and Childrenís Services Division of the Department of Human Services and Health for refereeing the paper.

The authors would also like to thank Richard Percival and Simon Lambert for providing helpful comments.

Contents

1. Introduction

The use of child care services by Australian families has grown along with the increasing number of women with children in the workforce. Between 1973 and 1992 the proportion of working age women in the Australian workforce increased from 48 per cent to 63 per cent (OECD 1994). In response to the associated growth in the demand for child care, the Department of Human Services and Health increased the number of funded child care places from 46 000 in 1983 to 208 000 in 1993 (Department of Health, Housing, Local Government and Community Services 1993, p. 69). In 1993, 57 per cent of women with children were working (Department of Human Services and Health 1994a, p. 6) and almost 80 per cent of children from two parent families using long day care, family day care or outside school hours care came from families where the mothers were working (ABS 1993, p. 7).

Recognising the cost to families of child care and its impact on parents' ability to participate in the workforce (particularly women), the federal government through the Department of Human Services and Health provides two major child care subsidies — Childcare Assistance and the Childcare Cash Rebate[1]. Expenditure on Childcare Assistance was an estimated $500 million in 1993-94 (Department of Human Services and Health 1994b, p. 184). The Childcare Cash Rebate was expected to benefit 230 000 families and 345 000 children in the six months after its introduction in July 1994 (Department of Human Services and Health 1994a, p. 8). Estimated expenditure on the rebate was $90 million for 1994-95.

The supply and accessibility of child care places for working parents is expected to remain an issue of critical importance until at least the turn of the century. For the next five years the government has made a commitment to continue the growth in funded child care places.

---

[1] The Department of Human Services and Health also provides a number of smaller subsidies such as the subsidy for care outside school hours. However, these smaller subsidies were considered to be too small to be used in distributional analysis based on a sample survey. In addition to the subsidies that are a direct benefit to parents discussed in this paper, the government provides subsidies for child care places and capital grants.

(Department of Health, Housing, Local Government and Community Services 1993, p. 71).

Despite the increasing social and economic importance of child care a microsimulation model of child care services and subsidies has not been developed in Australia (microsimulation methods are described in appendix A). However, a number of models of child care services and subsidies have been developed overseas. In addition to static models of child care, models have been developed to simulate changes in the demand for child care services related to altered subsidy arrangements (Baekgaard 1993) and to analyse the effect of the US child care tax credit (Garfinkel, Meyer and Wong 1990).

NATSEM's child care model, based on STINMOD's output dataset, is the first Australian microsimulation model to simulate government child care services and subsidies. The child care model is particularly useful for identifying the current distribution of the different child care subsidies. It is also valuable for determining the distributional impact and change in government outlay for child care policy options. Some policy options that the model can simulate include:

- paying the Childcare Cash Rebate in an alternative way such as a tax concession for child care payments;
- paying out of school hours Childcare Assistance at the same rate as long day Childcare Assistance;
- changing the rates of payment or income thresholds for Childcare Assistance or the Childcare Cash Rebate;
- making Childcare Assistance available for the same types of child care services as for the Childcare Cash Rebate;
- adding a means test to the Childcare Cash Rebate; and
- adding a labour force test to Childcare Assistance.

In addition, the simulation of child care subsidies within STINMOD will contribute to a better measurement of what has been referred to as 'full income' (Travers and Richardson 1993) or 'final income' (ABS 1992). Income is often measured as after-tax income or cash income (including cash benefits such as social security payments). Final income, however, includes the value of government cash and non-cash benefits to give a better picture of the redistributive effects of government payments and subsidies.

The remainder of the paper is divided into five chapters. In chapter 2 the growth in demand for child care is discussed and the different Australian child care services and the current Australian child care subsidies are outlined. In chapter 3 existing microsimulation and other types of mathematical models of non-cash benefits and child care services and subsidies are reviewed. The method for modelling child care services and subsidies is described in detail in chapter 4 while chapter 5 presents the results produced by the model.

Finally, in chapter 6 the future directions for child care modelling and analysis are identified.

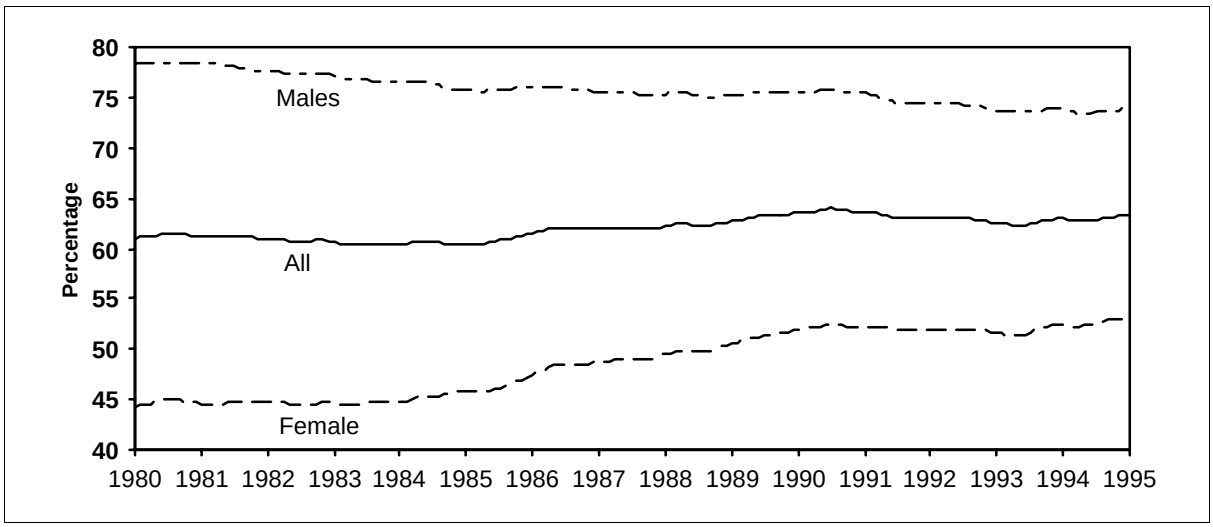
2. Child care in Australia

2.1 The growing demand for child dare

The increasing number of women in the workforce ensures that child care policy will remain an important area for analysis. In the next century there is likely to be even greater participation of women in Australia's paid workforce. Women's participation in the paid workforce has grown rapidly over the past decade (see figure 1) so that even the dramatic growth in the supply of new child care places has not kept pace with increasing demand (Department of Health, Housing, Local Government and Community Services 1993). Over the past five years there has been a 4.5 per cent growth in women's workforce participation and more than 50 per cent of women with young children now participate in the workforce (Department of Human Services and Health 1994a, p. 6).

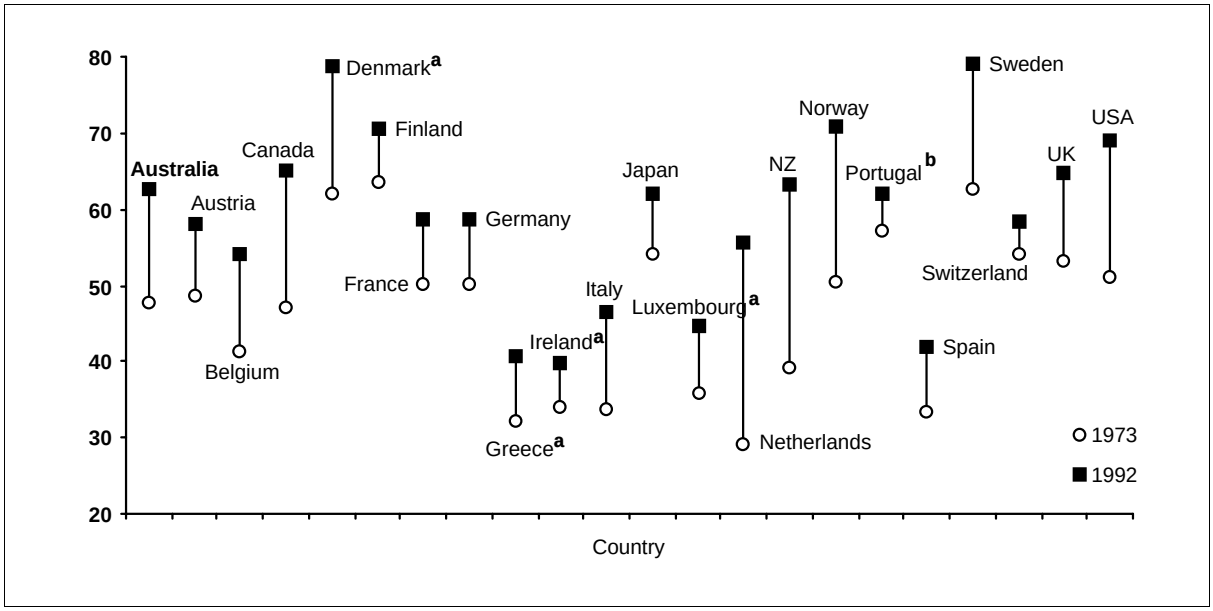
The growth in women's participation in the workforce in Australia has been similar to that in other industrialised nations. Women's workforce participation in Australia is approximately the same as that in other OECD countries such as Canada, Japan and the United Kingdom. However, in 1992 Australian women's workforce participation still lagged considerably behind the Scandinavian countries and the United States (see figure 2).

Figure 1 **Labour force participation rates in Australia, 1980–95**



Source: ABS (1995).

Figure 2 **Female labour force participation rates in OECD countries in 1973 and 1992**



a For 1991 not 1992. **b** For 1979 not 1973.

Source: OECD (1994, table J).

With the increase in the number of women in the workforce has come an increasing demand for child care services. In 1993 more than half a million children (over 16 per cent) under the age of 12 years were unable to gain access to sufficient formal child care services (ABS 1993, p. 1). In 1987 only 8 per cent of children in this age group did not have their needs for child care fully met in the week prior to the survey (ABS 1990, p. 1). Most of these children (82 per cent) could not gain access to formal

child care either because none existed in the area or because there were no available places. Other reasons given included high costs, problems with transport or distance, the child being too old or too young for the services available, and the time available being unsuitable. Demand for formal child care has continued to exceed supply despite an increase in the number of child care places available. In 1987 about 455 200 children under the age of 12 years (16 per cent) used formal child care arrangements. This increased to 530 400 children (18 per cent) in 1990 and to 596 200 children (19 per cent) in 1993 (ABS 1990, p. 1; 1993, p. 1).

2.2 Australian child care services

Australian families have the choice of a number of different child care services. These can be categorised as formal and informal care. *Formal care* includes:

- before and after school care programs;
- long day care;
- family day care;
- occasional care;
- preschool; and
- a small number of other formal child care arrangements.

Informal care includes:

- care by siblings;
- care by other relatives; and
- care by non-relatives.

Approximately half of Australian children under the age of 12 years are cared for by individuals other than their parents. The use of child care services by children under 12 years of age at June 1993 is summarised in table 1.

Australian children attend child care services for a variety of reasons. Parents place their children in before and after school care, family day care and long day care mostly for work related reasons — that is, they are working, looking for work or studying. In contrast, about 90 per cent of children who attend preschool do so because their parents feel it is good for their child and / or because it prepares them for school. Parents

who arrange child care for personal reasons — sport, shopping, entertainment, time alone, medical appointments, etc. — primarily use informal care or other forms of child care such as child care centres within shopping centres (ABS 1994).

Table 1 **Use of child care services in Australia by children under 12 years of age, June 1993**

Type of care	Number of children attending	Proportion in formal and informal care
	•'000	%
Formal care		
Before and after school care	85.8	14.4
Long day care centre	146.7	24.6
Family day care	80.7	13.5
Occasional care	50.0	8.4
Preschool	236.9	39.7
Other formal child care	30.0	5.0
Total number who used formal care [a]	**596.2**	**100.0**
Informal care		
Care by siblings	159.1	13.6
Care by other relatives	707.1	60.6
Care by non-relatives	389.1	33.4
Total number who used informal care [a]	**1 166.2**	**100.0**

a Children may use more than one type of formal or informal care. Therefore the categories of care will not add to the total children who used formal and informal care.

Source: ABS (1994, p. 4).

2.3 Australian child care subsidies

The stated objective of the Commonwealth government's Children's Services Program is to 'keep the cost of child care affordable for low and middle income families and to remove child care disincentives to workforce participation for second income earners (usually women) and low income parents entering or re-entering the workforce' (Department of Health, Housing, Local Government and Community Services 1993, p. 254). The government attempts to meet this objective by providing two separate major child care subsidies for families with children under the age of 13 years — Childcare Assistance and the Childcare Cash Rebate (Department of Human Services and Health 1994a, p. 6).

Childcare Assistance is an income-tested subsidy directed at low and middle income earners. The income test threshold is lower for families with more than one child in recognition of the additional cost of having more than one child in care. Childcare Assistance is available for only long day care, family day care and occasional care. The subsidy is paid to the child care centre and is passed on to the family by a corresponding reduction in child care fees.

The newer *Childcare Cash Rebate* was introduced on 1 July 1994 in recognition of child care expenses being a legitimate cost associated with earning an income (Department of Human Service and Health 1994). A cash rebate was introduced in preference to a tax concession for two reasons. First, some families would not be able to carry the cost of child care until they could claim a tax concession. Second, a tax deduction would have provided greater assistance to those on higher incomes and would have meant that families under the tax threshold would have received no benefit at all (Department of Human Services and Health 1994a).

As the Childcare Cash Rebate is paid in recognition of the cost of child care associated with earning an income, it is workforce tested but not income tested — that is, it is paid only to families where both parents (or sole parent) are working, seeking work or studying. The rebate is available for a large range of types of care — outside school hours care programs, long day care, preschool, family day care, occasional care, vacation care and informal care by relatives, friends and babysitters. An important aspect of the Childcare Cash Rebate is that the carer must be registered.

Families receiving Childcare Assistance are also eligible for the Childcare Cash Rebate if their remaining expenditure on child care (after Childcare Assistance) exceeds the minimum rebate payment of $16.00 a week (at January 1995).

3. A survey of child care and related non-cash benefit models

As previously noted, in Australia there has been no reported work undertaken in which microsimulation has been used to model child care services and subsidies, and there have been very few models of these services and subsidies developed overseas. However, it is possible to learn some valuable lessons for modelling child care services and subsidies from other microsimulation models of government services, in particular other non-cash benefits.

Microsimulation models simulating the distribution of non-cash benefits in Australia and overseas have included mostly consumption and expenditure on education, public health services, public housing, and institutional and non-institutional care (ABS 1992; Evandrou et al. 1990, 1992; Percival and Schofield 1995; Propper and Upward 1991; Raskall and Urquhart 1994; Salomaki 1993; Whiteford 1994; Wolfson 1989).

An established method for developing simple microsimulation models is the non-parametric approach of cell based (also called means based) models (ABS 1987, 1992; Propper and Upward 1991). Cell based models impute the use and cost of government subsidised services by calculating the *mean* service use and cost for different subpopulations. Most of these models impute service use at a very aggregated level, using very few variables. Some of the models cited above stratify only the data by *age*, others by *age* and *sex*, with the most complicated being usually by *age*, *sex* and *state*.

Cell based models have two main advantages. First, they are relatively simple to develop and, second, they depend on only a small number of readily available variables.

However, cell based models may be of limited value for modelling non-cash benefits, as the information on the non-cash benefits becomes so aggregated that they can be almost meaningless (Wolinsky 1990)[2] because they rely on only two or three analysis variables. This is a

---

[2] The limitations of cell based models for simulating non-cash benefits are discussed in more detail in Schofield (1996).

serious constraint because in reality a large number of variables are likely to affect the distribution of non-cash benefits.

Another constraint is that cell based models apply an average value for each non-cash benefit to each record, as though all persons or families within quite large subpopulations use the same number (and value) of services. In fact, there is a large variance in the number of services used in even small subpopulations and, further, many families do not benefit from some non-cash services at all. Distributional analysis produced by a cell based model may have limited application because there is no way it is able to identify which families benefit and which families do not.

Cell based models are also unable to provide a measure of the strength of its predictive value. Unlike regression models there is no measure of how much of the variance of the predicted variable has been captured or whether the important determinants have been included in the models.

In an attempt to avoid some of the limitations of cell based models, a small number of researchers have used various parametric methods to impute non-cash benefits for microsimulation models. These were mostly linear regression models, although some specialised non-linear forms of regression, such as logistic, logit and probit models, have also been used (Nelissen 1991; Van der Lann, Koerts and Reichardt 1986). Similar mathematical (although not microsimulation) models have been developed by Mathers (1992) and Wolinsky (1990). The major contribution of these models was to illustrate the large number of variables that significantly affect the use of government subsidised services.

Interestingly, the few microsimulation and other types of mathematical models related to child care cash and non-cash benefits reported in the international literature have generally used regression techniques. Most of these models have been used to examine the tax credit that is applied to child care costs in the United States (Garfinkel, Meyer and Wong 1990; Leibowitz, Klerman and Waite 1991; Leibowitz, Waite and Witsberger 1988; Michalopoulos, Robins and Garfinkel 1991; Robins 1990). These models have been used to demonstrate the inequity of the tax credit on the basis that those with the highest tax rates (and therefore the highest incomes) obtain the greatest benefit and that low income earners cannot afford to carry the annual cost of child care between yearly tax credit payments. A number of these researchers have used the results of their

analysis to endorse a move to a child care refund similar to the Australian Childcare Cash Rebate.

Garfinkel et al. developed a microsimulation model to simulate a number of policy options related to the tax credit. The model was used to determine the impact of altered income from the alternative forms of tax credit on the work behaviour of mothers, the resultant distribution of income and the net cost to the government. Garfinkel et al. used the current population survey as the basic income and workforce data and imputed the child care information from the survey of income and program participation. The model was used to determine the probability of access to free care and to develop regression models of the cost of care for those who paid for child care. The effect of the tax credit policy options on net income were then determined.

Leibowitz et al. developed a number of probit and logit models to simulate mothers' labour force participation and the types of child care they chose. They modelled the effect of the tax credit on labour supply rather than the effect of policy options.

Michalopoulos et al. developed a structural model of labour supply and child care demand. The model was used to simulate the effects and costs of changes in the federal tax credit.

Lehrer (1989) used a multinomial logit model to examine the determinants of the use of four types of child care service, and Connelly (1992) used a probit model to examine the effect of child care costs on women's labour force participation. However, neither Lehrer or Connelly considered the effect of the tax credit.

In Denmark a microsimulation model has been developed to simulate the effect of a series of proposals for child care subsidies on the demand for child care (Baekgaard 1993). Baekgaard argued that the cost of the altered demand for child care associated with child care policy options can outweigh the direct effect on subsidy payments for children already in care. The model relied on a binomial logit equation to predict whether a child was in care.

In Sweden, data from the Swedish household survey were used to develop probit and logit models to analyse the relationship between Sweden's child care subsidies and labour supply (Gustafsson and Stafford 1991). (It is not surprising that the European models of child

care subsidies have been developed in Sweden and Denmark, as these countries have the world's highest female labour force participation rates, well ahead of those in the United States and Australia — see figure 2.)

This survey of other models of government non-cash subsidies would suggest that a statistical model might best capture the distribution of child care services and subsidies in Australia and that variables in addition to age, state and sex might have a significant impact on predicting that distribution. (For a more detailed comparison of the distributional properties of child care models based on mathematical models and cell based techniques, see Schofield, Polette and Hardin 1996). The methodology used to develop NATSEM's child care model is discussed in detail in section 4.2. The child care model described in this paper is similar (although more comprehensive) in purpose and methodology to that developed by Garfinkel, Meyer and Wong in the United States.

4. Modelling child care in STINMOD

4.1 Explanatory variables impacting on child care use

There are many personal, socioeconomic and supply influences that determine what type of care children are in, how many hours they spend in care and how much their child care costs. The results of previous studies, both in Australia and overseas, involving child care use help to identify some of these influences.

Data from the 1993 Australian child care survey (ABS 1993) revealed that the percentage of children who used neither formal or informal care varied markedly according to age. Of the children aged less than 1 year and children aged 6–11 years, 61 per cent used neither formal nor informal care. Among 4 year olds the rate was only 18 per cent (ABS 1993, p. 5).

A study of US child care arrangements and costs by Veum and Gleason (1991) found that the age of the youngest child in a family has a bearing on the type of child care arrangements used by mothers. The type of child care arrangements also depends on the age of the child. For

example, before and after school care is available only to students of school age, while preschool is used by children aged 5 years and under.

The mother's and father's labour force status and the number of hours worked are important factors determining whether a child is in care and, if they are, how many hours a week they spend in care. For most mothers of preschool aged children, the choice of whether to work depends very much on the availability of child care, and for those women who are working, the cost and availability of child care can restrict the amount of time they are able to work (Bloom and Steen 1990). Thus, labour force status and the number of hours worked by a child's parents — and in particular a child's mother — are important determinants of whether a child is in care and how long it spends in care. The 1993 Australian child care survey found that 56 per cent of children whose parents were employed full time used informal care and 26 per cent used formal care. For those children with at least one parent not in the labour force the use of formal and informal care was much lower — 26 per cent used informal care and 15 per cent used formal care.

Veum and Gleason (1991) made a number of interesting findings regarding family income and the use of child care. Women in families with high income levels (above US$50 000 in 1988) are less likely than those in lower income families to have their children cared for by 'other relatives'. The use of child care centres by mothers appears to be directly related to family income. Families in the highest income category are more likely to use child care centres than are families in the other income ranges. Lehrer (1989) found on the basis of data from the United States national longitudinal survey of young women that an increase in a mother's wage raises the odds of relying on centre care rather than on unpaid care. Families in the higher income groups can afford the more expensive forms of care. Higher levels of income may also facilitate access to the desired (and possibly more expensive) mode of care. If centre care is regarded as optimal for children under school age, an increase in a household's resources would be expected to raise the odds of relying on this mode of care as opposed to less expensive arrangements with relatives or babysitters in their homes.

The Australian Bureau of Statistics reports that:

> as weekly family income increases the proportion of children who used formal care increased. For children in families with a weekly family income of less the $160, 11 per cent used formal care compared with 29 per

> cent of children in families with a weekly family income in excess of $1,280 (ABS 1994, p. 3).

Duncan and Hill (1975) and Lehrer and Kawasaki (1985) view the mother's wage primarily as a proxy for the value of the mother's time, and reason that an increase in such value should be associated with decreased reliance on the modes of care that tend to be more intensive of the carer's time (or the carer to child ratio). Hours of work are viewed in the latter study as an indicator of the feasibility of various forms of care. Leibowitz, Klerman and Waite (1991), in a study of the return to work of women in the two years after having a child, found that the lower a woman's wage the earlier her return to work, while a high family income delays a mother's return to work.

The data from the 1993 Australian child care survey show some differences in the use of child care across states and territories. The study by Lehrer (1989) also justified the inclusion of place of residence as a control variable, at least in part, for supply factors. Access to and the cost of different types of child care may differ across states and territories in Australia and, more importantly, between capital cities and areas outside those cities. Thus the state of residence and capital versus the rest of state variables have been included in the regression equations.

Mother's age is also regarded as an important determinant of child care arrangements. Veum and Gleason (1991) found that there are some notable differences in the child care arrangements made by younger and older women. While relatives frequently provide child care for both younger and older women, care by a child's sibling is more common among older women (standardised for the age of the child). The percentage of young women who use child care centres for their infants is almost three times that for older women.

The number of other dependent children in the family is also likely to have a significant effect on child care arrangements. Lehrer (1989) points out that if there are other children in the household also in child care the parents are likely to be less able to use the preferred child care — a day care centre — for the care of a preschooler because their resources of time, energy and money are diluted. The presence of another child needing care also introduces incentives to rely on babysitters or relatives because these modes of care typically involve substantial economies of scale.

The presence of older children in the family may encourage parents to use sibling care for other younger children, especially if one of the parents is working part-time. The type of care a child is attending and the number of hours attended are also likely to depend on whether the child is attending school. School attendance would be a particularly important variable in determining the type and hours of care for children aged 4 and 5 years, as school attendance is not compulsory at these ages.

There are also other reasons why parents place their children in child care. The 1993 child care survey found that one of the major reasons was that formal care benefited children; another was that it gave parents personal time for sport and social activities, a break or time alone. These reasons, while extremely important in determining whether parents use child care and what type of care is used, are not readily measurable or testable within a model of child care.

The characteristics discussed above and summarised in table 2 give a good indication of the variables that should be included in a model to impute child care arrangements. The age of the child, mother's and father's labour force status and hours worked, mother's and father's incomes, other dependants in the family, place of residence, and whether there is an older dependant in the household were all used to predict child care use and cost in NATSEM's child care model.

Table 2: **Predictors of the use, cost and hours of child care arrangements**

Child characteristics	Family characteristics
Age	Father's labour force status
Place of residence	Mother's labour force status
School attendance	Father's income
	Mother's income
	Father's hours worked
	Mother's hours worked
	Number and age of other dependants

4.2 Building a microsimulation model of child care services and subsidies

There are four major steps required to build a model such as NATSEMís microsimulation model of child care services and subsidies. The first is to select the microdata files that contain the most current and detailed information on child care services and the population that uses them and to update the microdata so that it reflects the current world. The second step is to impute missing variables onto the base population[3]. The third step is to model the relationships between socioeconomic and demographic indicators and the type of child care used, the cost of care and the number of hours used. The child care variables are then imputed onto the base population. Finally, the child care subsidies are simulated. The steps in building a microsimulation model of child care services are summarised in figure 3 and discussed in detail now.

Step 1: Choosing and adjusting the data source

The first step in building any microsimulation model is to identify the most suitable data on which it can be based. All microsimulation models start with unit record files. Most start with a representative sample survey of the population or administrative data (such as social security records). The data source must contain comprehensive information about, for example, earnings, family characteristics, labour force status and age in addition to the characteristics that are needed to simulate relevant policies (such as child care variables)[4].

Typically, the variables required to build a model of non-cash benefits (in this case a child care model) are distributed across a number of

---

[3] The base population is the basic dataset for the model onto which other necessary information is generally imputed.

[4] Although the data are based on personal information, it is not necessary to know the identity of any of the individuals surveyed. All that is required are details about their demographic, labour force, income and other characteristics. In response to increasing concern about privacy issues in recent years, stringent measures have been taken by bureaus of statistics or administrative agencies to ensure that individuals within publicly released unit record data cannot be identified (Harding 1993, p. 13).

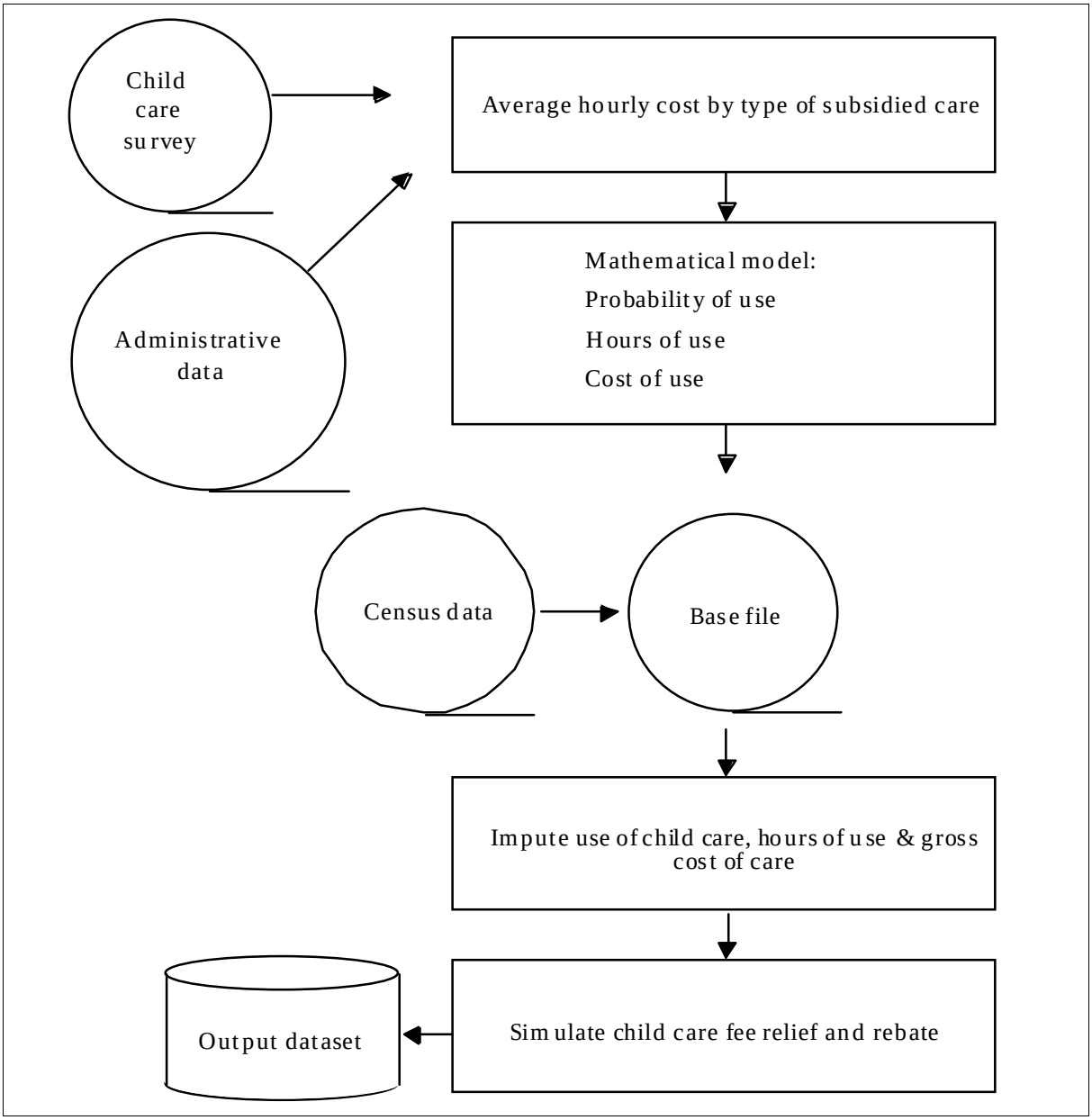
different data sources. Therefore some of the relevant variables must be added onto the primary data file before the services can be modelled.

In this study, the primary data file is an output file from STINMOD. This output file is based on the income distribution survey (ABS 1990), with incomes and weights updated to November 1993 (Percival 1994). The STINMOD/94A social security, veterans' affairs, AUSTUDY and taxation parameters were then applied to the updated survey data to calculate tax liabilities and entitlements to welfare payments based on 1994 rates (Lambert et al. 1994). The STINMOD output file was chosen as the primary data file for the child care model for two reasons: first, it would allow the child care model to be linked to the STINMOD user interface and, second, it would allow analysis of the interaction between child care subsidies and other government programs.

This data file contained most of the variables necessary for the modelling of child care, such as both parents' incomes, labour force status, hours of work, family payments received and whether older children were present in the family. However, some variables such as the ages of children under 15 years (which were aggregated into five year groups) and whether they attended school were not present and needed to be added. The 1986 census (ABS 1986) was used to impute ages for the children and the 1993 child care survey (ABS 1993) was used to impute school attendance. (The method is discussed in step 2.)

Unit record data from the 1993 child care survey were used to impute

Figure 3: **An overview of the microsimulation model for Child Care**



whether child care was used, the type of care, the hours of care and the cost of care (except for outside school hours care, long day care and family day care). (The method is discussed in step 3.) The child care survey was selected because it contained the important socioeconomic and demographic explanatory variables identified in section 4.1.

There was no need to update the child care survey as it was undertaken in 1993. However, the number of hours spent in long day care was adjusted in the child care model because the Department of Human Services and Health pays its Childcare Assistance on the basis of the total hours the parent pays for rather than the hours the child actually attends. For example, parents who need only part-time long day care are sometimes required to pay for full days or full weeks to secure a child care place. Therefore, hours of long day care used were adjusted to represent the total hours paid for, using an inflation factor supplied by the Department of Human Services and Health.

The department's administrative data were used to estimate the hourly cost of outside school hours care, long day care and family day care. These were average hourly costs by state for each of these three types of care, and were used in preference to the 1993 child care survey because the survey reports only the cost to parents net of any government subsidy. The department's data include information on both the cost to parents and any federal government subsidy for child care.

Step 2: Imputing missing variables onto STINMOD

Age and attendance at school are two variables identified as being important indicators of the use of child care services. However, they are not present on the STINMOD output dataset. Therefore, for age and school attendance to be used as explanatory variables for imputing child care use variables, they had to be added for all children aged 0–11 years. Following is a brief description of the methodology used to impute single years of age and school attendance.

Age

The STINMOD output dataset indicates the number of children in a family that belong to an age *group* (0–4 years, 5–9 years, etc.). However, single year ages for each child are required. Simple linear interpolation

using 1986 census data was used to distribute children in a given age group to a single year of age (for a detailed discussion on interpolation methods see Maddala 1977). The results of this interpolation, given in table 3, show that this method is quite accurate. This methodology could be further improved by interpolation with regard to personal characteristics such as mother's and father's ages and labour force characteristics, and the number of children in the family. For our purposes, and limited time frame for the development of the child care model, simple linear interpolation of single years of age has proved to be adequate.

The STINMOD output data file contains three variables that identify the number children in the family. The first contains the number of children aged 0–4 years, the second the number aged 5–9 years and the final the number aged 10–12 years. The interpolation methodology was used to break these variables up into individual ages for each child in the family.

School attendance

All children in the STINMOD output dataset aged 6–11 years were assumed to be attending school, as school attendance is required by law in Australia for all children in this age group. Further, the number of

Table 3: **Interpolation results for imputing single year ages**

Age	Proportion of age group in single years of ages (ABS 1986)	Results of interpolation (STINMOD)	Percentage point difference
Years	%	%	%
0	18.94	19.57	-0.62
1	19.39	19.54	-0.15
2	20.75	20.32	0.43
3	19.67	20.00	-0.33
4	21.25	20.57	0.67
5	18.36	20.25	-1.89
6	19.20	19.60	-0.40
7	20.10	19.72	0.38
8	20.48	20.54	-0.06
9	21.87	19.90	1.97
10	32.34	32.26	0.08
11	33.00	32.97	0.03
12	34.66	34.77	-0.11

children in this age group who do not attend school is too insignificant to model.

Similarly, children aged under 4 years were assumed to be not attending school. No children aged under 4 years in the 1993 child care survey were recorded as attending school.

However, children aged 4 and 5 years presented a problem. Australian states do not have a uniform starting age for school. In some states the education systems also give parents a choice as to when their child starts school based on the time of year the child was born. Because of these differences, school attendance was imputed, based on age and state, for children aged 4 and 5 years. The probabilities for these imputations were determined using the 1993 child care survey. Table 4 shows the probabilities used in the imputation.

Table 4: **Probabilities for imputing school attendance for 4–5 year olds**

	Probability of being in school	
	Age 4 years	Age 5 years
New South Wales	0.0709	0.8889
Victoria	0.0543	0.8708
Queensland	0.0239	0.4994
South Australia	0.0366	0.8818
Western Australia	0.0131	0.4907
Tasmania	0.2330	0.9178
Australian Capital Territory & Northern Territory	0.0635	0.8482

Step 3: Imputing child care variables onto the base population

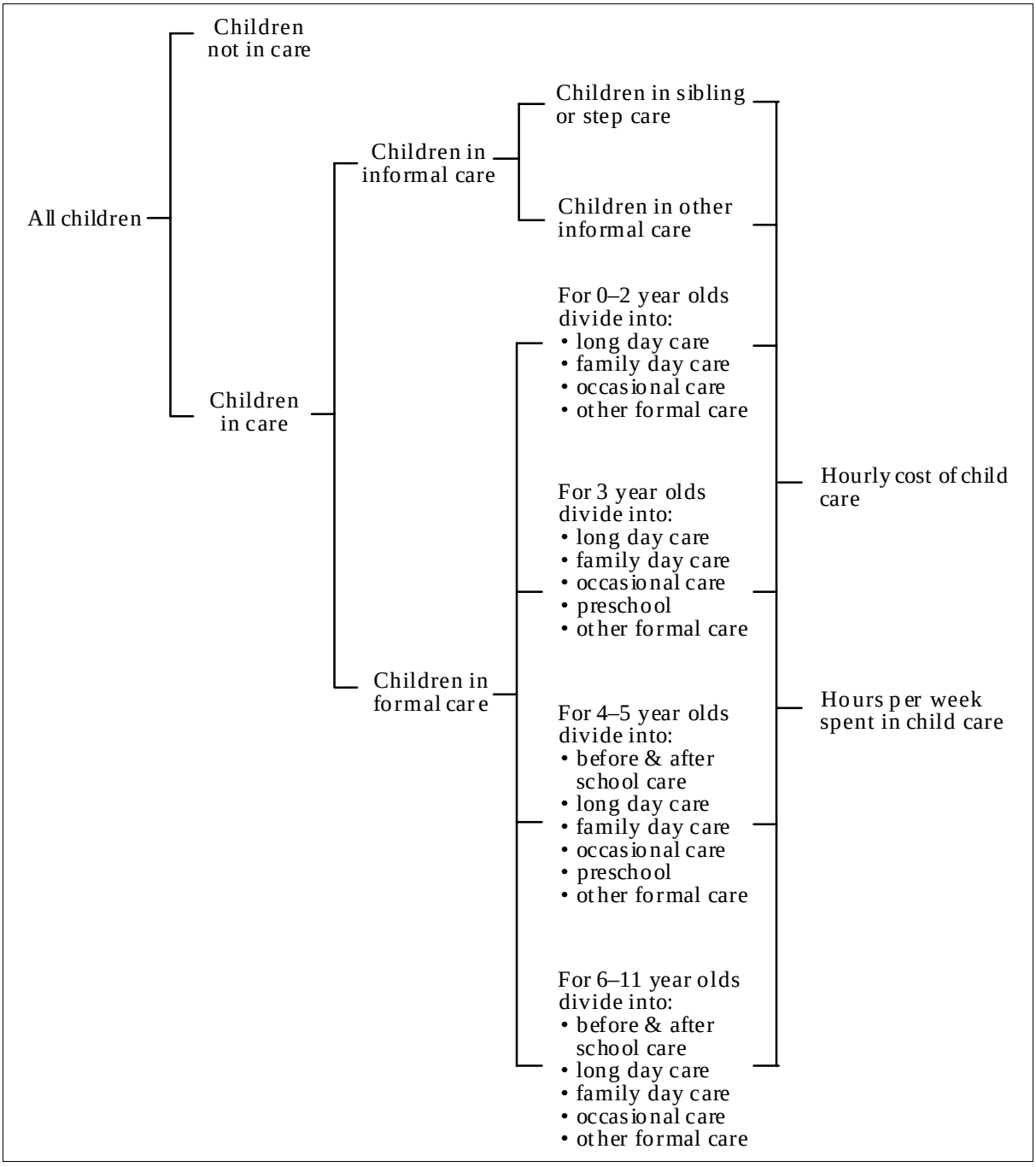
The simulation of child care subsidies required certain variables that were not present on the STINMOD output dataset. These variables were:

- the type of child care a child is attending (including children not in care);
- the number of hours per week a child spends in care; and
- the hourly cost of care for each child.

As previously noted, these variables were imputed onto the STINMOD output dataset using data from the 1993 child care survey and administrative data from the Department of Human Services and Health.

Modelling the child care variables involved the development of equations to simulate the use of child care at a number of different stages. These stages are illustrated in figure 4.

Figure 4: **Stages in predicting child care use**



Eleven separate regressions were estimated to impute the variables needed to model child care subsidies in the STINMOD output dataset. Ordinary least squares (OLS), binomial and multinomial logit models were used for this estimation process.

OLS is used when predicting a continuous variable such as hours spent in care and the hourly cost of care. This method of modelling is straightforward and widely used and accepted (see Greene 1991 for a more detailed discussion of OLS). The modelling of discrete (that is, categorical rather than continuous) outcomes, such as the type of care a child is attending, requires the use of models with discrete dependent variables. Binomial and multinomial logit models were used for this purpose.

A binomial logit model is a model where the dependent variable has only two possible outcomes, and the multinomial logit model is one where the dependent variable has more than two discrete outcomes. The resulting coefficient estimates from the regression are transformed into probabilities for each individual's set of characteristics using the logistic distribution. The logit constrains these probabilities to a zero–one interval, this being the main benefit of its use. These probabilities are then compared with a random number between zero and one to decide an individual's outcome. For example, if the calculated probability from a binomial logit (where the dependent variable was either *in child care* or *not in child care*) was 0.80, children's records that had been allocated a random number of less than 0.80 would be predicted to be in care.

There are great differences in the computer running time of binomial and multinomial logit models. A binomial logit model may take a few minutes, while a multinomial logit model may take hours. For this reason, sometimes a series of binomial logits have been used where one multinomial logit model may have been used (for a discussion of the construction and estimation of logit models see Greene 1991).

A brief description of each of the regressions estimated follows. The regression results are given in appendix B and the definitions of the variables are given in appendix C.

In child care or not in care

A binomial logit model was estimated to predict whether each child under the age of 13 years on the STINMOD output dataset is in some form of child care. Mother's and father's incomes, attendance at school, hours worked by both parents and the age of the child have the most significant effects on determining whether a child is in child care. As expected, the higher the mother's and the father's incomes the greater the likelihood of a child being in child care. It was also found that until a child entered school, the older the child, the greater the likelihood of attending child care. Attendance at school reduces a child's probability of attending child care. Children with mothers working a low number of hours per week are less likely to be in child care. Interestingly, children with fathers working a high number of hours per week are also less likely to be in child care.

In addition to error from the logit model, differences between the two datasets (that is, between the child care survey used to derive the equations, and the STINMOD data file to which they were applied — particularly those relating to the distribution of hours worked, labour force status, and income) resulted in approximately a 9 per cent under-estimation of the total number of children in care. To account for this difference, the random number on each child's record was reduced by a similar percentage.

Formal or informal care

In the current model, only the type of care in which a child spends the most hours has been modelled (also referred to as the main or primary form of care).

A binomial choice logit model was estimated for predicting whether children imputed to be in child care were in formal or informal child care. The variables that appear to be most significant in determining whether a child is attending formal or informal care are mother's and father's incomes, school attendance, state of residence and whether the child is living in a capital city. Also significant are the child's age, whether the child has siblings that are 12 years old or over, and the father's hours of work — interestingly, not the mother's hours of work.

Higher levels of mother's and father's incomes were found to increase the chance of a child attending formal care, as did residing in a capital city. Children living in Victoria, New South Wales, South Australia and Western Australia were found to be less likely to attend formal care, as were children attending school. As expected, children who have a sibling aged 12 years or more are less likely to be in formal care, as sibling care is defined as informal.

Type of informal care

A binomial logit model was developed to predict whether each child attending informal care was in sibling or step-sibling care or some other type of informal care. The most significant variable determining the type of informal care was whether the child had a sibling aged 12 years or over. As expected, if a child does have such a sibling, he or she is more likely to be in sibling care than a child who does not. Children attending school are also more likely to be in sibling or step care. The higher the father's income, the greater the likelihood of the child being in some other type of informal care.

Type of formal care

A multinomial logit model was estimated for four different age groups to predict the type of formal care each child attends. Four regressions were developed for four different age groups to capture the fact that children of different ages may not be eligible to attend some types of formal care. For example, children aged 2 years and under attended all types of care except before and after school care. The age groups and types of formal care that children are eligible to attend are listed in table 5.

The likelihood ratio tests from the four regressions indicate that they are all well determined. However, there was a significant overestimation of the number of children in the two types of care with the smallest number of children attending — occasional care and other formal care. To overcome this problem, 20 per cent of children imputed to attend occasional care and 60 per cent imputed to attend other formal care were randomly redefined as not in care.

Table 5: **Types of child care attended by children in different age groups**

Age group	Type of care eligible to attend
0–2 years	Long day care Family day care Occasional care Other formal care
3 years	Long day care Family day care Occasional care Other formal care Preschool
4–5 years	Long day care Family day care Occasional care Other formal care Preschool Before and after school care
6–11 years	Before and after school care Long day care Family day care Occasional care Other formal care

Hourly costs of care

The hourly costs of the types of care that attracted a federal government subsidy in 1993 — outside school hours care, long day care and family day care — were estimated on the basis of data provided by the Department of Human Services and Health. These were average hourly costs by state for each of these three types of care. Unfortunately, the use of average costs of care did not capture the variance in child care costs. (As a result, families who in the real world use child care that costs less than the state average, might be simulated as having higher than their actual out-of-pocket costs.) These data was used in preference to the 1993 child care survey because the survey reports only the cost to parents net of any government subsidy. The departmental data include both the cost to parents and the value of any federal government subsidy.

The child care survey was, however, used to develop regression models to estimate the cost of all other types of care. Two separate OLS regressions were estimated for the hourly cost of care — one for formal care and one for informal care — to capture more easily the difference in cost between the two different categories of care. Children living in capital cities were found to have a higher hourly cost of care compared with their rural counterparts. The hourly cost of care was found to increase as mother's and father's incomes increased. Having dependent children aged 12 years or more reduced the hourly cost of formal and informal care, while using sibling care significantly reduced the cost of informal care. Generally, the older the child, the lower the hourly cost of both informal and formal care.

Hours spent in care

Two OLS regressions were estimated to predict the hours per week spent in care — again, one for formal care and one for informal care. Children living in capital cities spent more hours per week in care. The higher a child's mother's income the more hours the child spent in care. The father's income was insignificant in determining how many hours a child spent in formal care, and significantly reduced the number of hours a child spent in informal care. Children attending school spent significantly fewer hours in care. More hours per week were spent in long day care and family day care than other types of formal care, and more hours per week were spent in other informal care than sibling care.

After the hours of care were imputed using the OLS models, long day care hours were uprated as Childcare Assistance is paid for the total hours the parent pays for rather than the hours the child actually attends. This is because parents who need only part-time long day care are sometimes required to pay for full days or full weeks to secure a child care place. To reflect this method of payment, hours of long day care used were adjusted to represent the total hours paid for, using an inflation factor (for the total hours of care) supplied by the Department of Human Services and Health based on their child care census.

Differences between data sources

There were some fairly significant differences between the child care survey and the STINMOD output file for the distribution of some variables. These differences between the data sources used in the model

may be a significant form of error for the imputation of child care variables from the regression models. The variables that had the largest differences were the total income received by the parents and the hours worked by the parents.

For example, in the child care survey 35.7 per cent of children either had no mother or their mother earned less than $80 per week. In comparison, only 24.4 per cent of children on the STINMOD data file had the same value. The STINMOD data file had a greater proportion of mothers earning incomes in the higher income ranges than did the child care survey. The STINMOD data file also had a greater proportion of fathers in the higher income ranges, but also had more fathers with incomes between $80 and $160 per week (10.6 per cent of all fathers compared with only 2.7 per cent in the child care survey).

The differences for fathers can be explained partly by the change in the social security allowances (for example, the job search allowance and the Newstart allowance) in September 1994. At the time the child care survey was conducted, allowances for married couples were almost exclusively paid to the male partner. However, in September 1994 the allowance payments structure was changed so that the payment was split between the members of a couple. This would have resulted in a large reduction in total income for many unemployed men, while increasing the income of women.

The increase in income for women would have occurred at a higher weekly income range such as the $240 to $400 range. The reason for this is that mothers continued to be the primary recipient of social security family payments. For example, only 21.8 per cent of children had mothers with incomes between $240 and $400 a week at the time of the child care survey. In comparison, the STINMOD output file had 27.6 per cent of children with mothers with incomes in this range.

The proportion of children with parents working close to or above full-time hours on the STINMOD output file was higher than in the child care survey. For example, 57.7 per cent of children had fathers working more than 40 hours on the STINMOD output file; only 51.8 per cent of children had fathers in the same category in the child care survey. As would be expected this result meant that the proportion of children with fathers not working or in low hours of work was lower on the STINMOD output file than in the child care survey. Only 11.7 per cent of

children had fathers who were unemployed or working fewer than 9 hours a week on the STINMOD output file; 15.7 per cent of children were in the same category in the child care survey. This trend was apparent for mothers also.

Part of the reason for this difference can by explained by the age of the income distribution survey. This survey was conducted in 1990, which means that the distribution of hours worked reflects this date. Although the STINMOD output file has been reweighted to November 1993, this reweighting process did not include hours worked as a factor (Percival 1994). However, the data were reweighted by the labour force status of the person (that is, unemployed, full-time wage and salary earner, part-time wage and salary earner, etc.). This ensures that hours worked were at least implicitly included in the reweighting process.

Step 4: Simulating child care subsidies

As already mentioned there are two main types of child care subsidies — Childcare Assistance and the Childcare Cash Rebate. Childcare Assistance is paid as a subsidy to the child care centre whereas the Childcare Cash Rebate is paid directly to the parents. Childcare Assistance can be broken down into two types — the standard type, which is available to parents with children in long day care, family day care and occasional care, and a non-standard type, which is available to parents with children in outside school hours care. Both of these types of Childcare Assistance are means tested.

Childcare Assistance — standard type

In January 1995 parents were eligible for a subsidy of up to $2.20 per hour of care. The subsidy was calculated for each child in care. This amount was means tested, based on the parents' combined family income. However, the basic family payment, the additional family payment, the pharmaceutical allowance and the pensioner education supplement are excluded from the definition of income.

If a family had one child in an eligible type of care (that is, long day care, family day care or occasional care) they were required to pay the first $16 of the cost of care for the child before any subsidy was provided. This is called the *minimum fee*. For people with two or more children in

an eligible type of care this threshold was $18.50 for each child. Once expenditure on child care exceeded the minimum fee a subsidy may then have been payable.

To determine the amount of Childcare Assistance available, the following steps were used in the model.

- The *adjusted family income* was calculated. This is simply the weekly assessable income of the family less $30 for each child defined as a dependant for social security family payment purposes. The family does not need to be receiving family payment for a child to be defined as a dependant.

- Next, the *income fee* was calculated using the following formula:

  [(adjusted family income – $445) * withdrawal rate] + minimum fee

  where the *withdrawal rate* is 0.138 for families with one child in an eligible type of care or 0.225 for families with two or more children in an eligible type of care, and the minimum fee is as described above.

- The Childcare Assistance *percentage* was then calculated using the formula:

$$\left(\frac{(50 * 2.20* \text{ number of children}) \; - \; \text{income fee}}{(50 * 2.20 * \text{number of children})}\right) * 100$$

  where the *number of children* is the number of children in an eligible type of care and the income fee is as defined above.

- Finally, the rate of Childcare Assistance paid is equal to:

$$\frac{\text{hours of care} \; * \; \text{cost}}{100} * \text{percentage}$$

  where the *hours of care* is the number of hours paid for in an eligible type of care and the *cost* is the minimum of $2.20 and the hourly cost of care.

Families whose out-of-pocket expenses exceeded $16.00 a week after Childcare Assistance could also claim the Childcare Cash Rebate.

Childcare Assistance — outside school hours care

This subsidy is available to parents who have one or more children in outside school hours care. For families receiving the maximum rate of the additional family payment, this subsidy was $0.68 for each hour of care. Families receiving a part rate of the additional family payment received $0.36 for each hour of care. Other families received no subsidy.

Childcare Cash Rebate

The rebate is provided to families where both parents (or the parent) are either employed, studying or looking for work. Where a family is eligible for Childcare Assistance, the rebate can be claimed for any remaining out-of-pocket child care costs. All types of care are eligible for this subsidy, but the carer must be registered in the scheme. The rebate is paid directly to the family and is based on their *actual expenditure* on child care. In 1995 the rebate subsidised only approximately 30 per cent of net costs (that is, after Childcare Assistance costs) to the family of up to $110 per week for families with one child in care and $220 for families with two or more children in care

The amount of rebate paid to a family was calculated using the following formula:

$$(\text{cost} - \text{minimum fee}) * 0.30$$

The *cost* is the lesser of the net cost of care to the family for all children and the maximum cost covered by the rebate (that is, $110 for families with one child in care and $220 for families with two or more children in care). The *minimum fee* is $16 per week. The *cost* variable in the above formula is the amount actually paid by the family. For example, if the gross cost of care was $100 per week, but the family received a subsidy of $30 by way of Childcare Assistance, the *cost* variable would be $70 per week.

The maximum rebate was $28.20 per week for families with one child and $61.20 per week for families with two or more children.

5. Validating the child care model

The accuracy of the child care model has been tested by comparing its results with the 1993 child care survey and administrative figures supplied by the Department of Human Services and Health. The outcomes of these comparisons are shown below.

5.1 Type of care

In the current model, only the type of care in which a child spends the most hours (main type of care) was imputed. The child care model provides a highly accurate estimate of the total number of children in their main type of care and of whether the main type of care is formal or informal (see tables 6 and 7 respectively).

Table 6: **Number of children in care**

	1993 child care survey	Child care model	Difference
	no.	no.	%
Not in care	1 580 978	1 587 757	0.43
In care	1 503 613	1 504 680	0.07

Sources: ABS (1993); NATSEM child care model.

Table 7: **Number of children in formal and informal care**

	1993 child care survey	Child care model	Difference
	no.	no.	%
Formal care	482 664	448 550	-7.07
Informal care	1 020 949	1 056 130	3.45
All	1 503 613	1 504 680	0.07

Sources: ABS (1993); NATSEM child care model.

The total number of children predicted in each type of care is less accurately predicted (see tables 8 and 9). The numbers in outside school hours care and sibling care were the most seriously underestimated. This is due in part to the relatively small sample sizes for some types of care and the limited number of predictive variables able to be included in the multinomial logit models.

Compared with administrative data supplied by the Department of Human Services and Health, the child care model simulates fewer children in outside school hours care, long day care and family day care. This is mainly because the child care model simulates only the main form of care, but also because sample data never exactly match administrative data due to sampling and non-sampling error.

Table 8: **Number of children by type of formal care**

	1993 child care survey	Child care model	Difference	Department of Human Services and Health (30 June 1993)
	no.	no.	%	
Outside school hours	63 220	49 729	-21.34	53 750
Long day care	127 241	127 084	-0.12	190 197
Family day care	67 519	72 302	7.08	78 170
Occasional care	28 198	29 513	4.66	28 080
Preschool	182 737	156 064	-14.60	
Other formal	13 749	13 858	0.79	
All	482 664	448 550	-7.07	

Sources: ABS (1993); NATSEM child care model.

Table 9: **Number of children by type of informal care**

	1993 child care survey	Child care model	Difference
	no.	no.	%
Sibling	120 799	91 127	-24.56
Other informal	900 150	965 003	7.20
All	1 020 949	1 056 130	3.45

Sources: ABS (1993); NATSEM child care model.

5.2 Hours spent in care

The total hours of care were accurately predicted for most types of care except occasional care and sibling care (see table 10). The underestimation of sibling care is a direct result of the underestimation of the number of children in this type of care. The overestimation of the total hours spent in occasional care is probably related to the relatively small sample size of this group.

Table 10: **Total weekly hours of care by type of care**

	1993 child care survey	Child care model	Difference	Department of Human Services and Health (30 June 1993)
	'000 hr	'000 hr	%	'000 hr
Outside school hours	539	479	-11.13	364
Long day care	3 217	4 269	*	3 642
Family day care	1 556	1 723	10.73	1 475
Occasional care	171	207	21.05	114
Preschool	2 383	2 295	-3.69	
Other formal	99	88	-11.11	
Sibling	651	453	-30.41	
Other informal	13 709	14 196	3.55	

* Long day care hours were inflated to represent 'booked' rather than 'used' hours of care. Therefore, they are not directly comparable with the 1993 child care survey.

Sources: ABS (1993); NATSEM child care model.

The total hours in care were reasonably close to those reported in the Department of Human Services and Health administrative data for the larger types of formal care. This is because, although only the main type of care was modelled, total hours of care were simulated for each child. The larger differences for the less frequently used types of care are typical of the differences between administrative data and sample surveys for small populations.

The average hours spent in care were reasonably accurately predicted for all types of care (see table 11). However, the average hours of care were higher than those reported in Department of Human Services and Health administrative data for all types of care, primarily because only the type of care in which children spent the most time were simulated in the child care model and the total hours each child spent in care were attributed to their main type of care.

5.3 Cost of care

The cost of care was fairly accurately predicted for most types of care. The predictions for the group with the smallest aggregate cost (sibling care) was the least accurate (see table 12). This is typical of models that attempt to estimate effects for very small subpopulations (or in this case, where a large proportion of siblings who cared for their brothers and sisters were reported as not being paid).

Table 11: **Average weekly hours in care by type of care**

	1993 child care survey	Child care model	Difference	Department of Human Services and Health (30 June 1993)
	hr	hr	%	hr
Outside school hours	8.53	9.63	12.90	6.77
Long day care	25.28	33.59	*	19.15
Family day care	23.05	23.84	3.43	18.8
Occasional care	6.07	6.79	11.86	4.07
Preschool	13.04	14.71	12.81	
Other formal	7.22	6.32	-12.47	
Sibling	5.39	4.92	-8.72	
Other informal	15.23	14.51	-4.73	

* Long day care hours were inflated to represent 'booked' rather than 'used' hours of care. Therefore, they are not directly comparable with the 1993 child care survey.

Sources: ABS (1993); NATSEM child care model.

Table 12: **Total weekly cost of care by type of care**

	1993 child care survey	Child care model	Difference
	$'000	$'000	%
Outside school hours	**na**	1 352	
Long day care	**na**	110 309	
Family day care	**na**	4 862	
Occasional care	376	385	2.39
Preschool	2 732	3 184	16.54
Other formal	104	120	15.38
Sibling	70	113	61.43
Other informal	7 388	7 657	3.64

na Not available; the child care survey reports only the cost to parents net of government subsidy.

Note: The child care survey includes only 0–11 year olds, whereas STINMOD includes 0–12 year olds.

Sources: ABS (1993); NATSEM child care model.

5.4 Receipt of federal government subsidy for child care

All three federal government subsidies for child care were modelled. These were:

- Childcare Assistance for children in long day care, family day care, and occasional care;
- Childcare Assistance for children in outside school hours care; and

- the Childcare Cash Rebate.

The number of standard Childcare Assistance recipients imputed and the outlay for Childcare Assistance is underreported (see table 13). This is primarily because the child care model represents only the type of care in which a child spends the most time. Therefore, where children use long day care, family day care or occasional care as their secondary form of care, this secondary arrangement is not captured in the model, and therefore no subsidy for this secondary type of care is imputed. This effect is reduced somewhat because children spend less time in secondary forms of care than in their primary forms of care.

Table 13: **Receipt of child care subsidies by type of subsidy**

	Department of Human Services and Health (30 June 1993)		Child care model		Difference	
					no.	$'000
	no.	$'000 pw	no.	$'000 pw	%	%
Childcare Assistance — standard	211 908	7 309	179 342	6 133	-15.37	-16.09
Childcare Assistance — outside school hours	9 695	27.91	10 620	28.86	9.54	3.40
Childcare Cash Rebate	*	*	327	2 846		

* The Childcare Cash Rebate was introduced in mid-1994 and the results represent families eligible for the rebate.

Note: Number refers to the number of children for Childcare Assistance and number of families for the Childcare Cash Rebate in accordance with the manner in which each subsidy is calculated.

Sources: Department of Human Services and Health unpublished data; NATSEM child care model.

There are, in fact, quite a large number of children who use the forms of care that attract a government subsidy as their second or third type of care (see table 14). About 75 per cent of these children spend most of their time in 'other informal' care.

As some families do not take up the subsidy to which they are entitled (because the outside school hours subsidy is so small) it was assumed that only 75 per cent of children eligible for the outside school hours subsidy took it up. The issue of take-up is also likely to apply to the Childcare Cash Rebate. However, at the time the model was developed, a large number of families were still registering and it was unclear what proportion of eligible families would take up the Childcare Cash Rebate. Therefore, no attempt was made to model the take-up of the rebate but it

Table 14: **Number of children who used a subsidised secondary form of care**

	1993 child care survey			
	Main type of care	Other care	Total	Other care as a percentage of total
	no.	no.	no.	%
Outside school hours	63 220	17 786	81 006	21.96
Long day care	127 241	52 350	179 591	29.15
Family day care	67 519	27 012	94 531	28.57
Occasional care	28 198	6 115	34 313	17.82
All	286 178	103 263	389 441	26.52

Source: ABS (1993).

could be modelled in a later date, on the basis of a projected level of take-up or after the total number of claimants has stabilised.

The average Child Assistance payment simulated in the child care model was close to the payments reported by the Department of Human Services and Health (see table 15). The average subsidy for outside school hours care was significantly less than the average payment reported by the department. This is because the 25 per cent of families who where assumed not to take up the payment were randomly selected. In reality, families who are entitled to the lowest amount of subsidy are probably less likely to take up their payment. Figures were unavailable to implement this form of take-up in the child care model.

Table 15: **Average weekly subsidy by type of care**

	Department of Human Services and Health (April–June 1994)	Child care model	Difference
	$	$	%
Outside school hours	4.47	2.72	-39.15
Long day care	43.06	41.88	-2.74
Family day care	34.44	29.66	-13.88

Sources: Department of Human Services and Health unpublished data; NATSEM child care model.

6. Conclusions and future directions

The child care model described in this paper was developed to simulate the major child care subsidies provided in Australia. The model was based on a series of mathematical models and this method has proved to be relatively effective for simulating the use of child care services and eligibility for child care subsidies.

The child care model can be used to analyse the distribution of current child care subsidies and to determine the distributional impact of a number of child care policy options.

There are some improvements and additions to the child care model that staff at NATSEM are currently investigating:

- updating the child care variables to 1994-95;
- improving the accuracy of the model by minimising the impact of the differences between STINMOD's base population and the 1993 child care survey;
- including a measure of take-up of the Childcare Cash Rebate;
- including multiple types of care for each child to overcome the aggregate underestimation of child care subsidies; and
- using more detailed data from the Department of Human Services and Health to improve the accuracy of the model for imputing, for example, the cost of subsidised child care.

Appendix A: What is microsimulation?

Microsimulation is a means of modelling socioeconomic systems by simulating the behaviour of individual units within the system. It is a technique that is particularly suitable for systems where the decision making occurs at the level of the individual unit and where the interactions within the system are so complex that it is difficult to find an exact solution. The major advantage of microsimulation models in relation to social and economic policy analysis is that they produce results that can be analysed at the individual level. Thus, the distributional impact of a policy measure across different types of families or different geographical regions can be assessed. At the same time, estimates of the aggregate outcomes can still be easily derived by summing the individual results. It is these features that led a recent exhaustive review of microsimulation in the United States to conclude 'that no other type of model can match microsimulation in its potential for flexible, fine-grained analysis of proposed policy changes' (Citro and Hanushek 1991, p. 115).

The starting point for microsimulation models is a unit record file, which provides comprehensive information on such things as earnings, family characteristics, labour force status, education and housing status for every individual on the file. Typically, adjustments need to be made to this base data file to ensure that it reflects as fully as possible the population that is being modelled and includes all of the variables that will be needed. Percival (1994) provides a detailed description of the process of preparing the base population dataset for use in STINMOD.

Microsimulation models can be static or dynamic. Static models take a cross-section of the population at a specified point in time and apply program rules to the individual units to measure the instantaneous or 'morning after' effects of policy changes, before individuals have had time to adjust their behaviour to the changes. Generally, these models allow the analyst to vary the rules of eligibility or liability, and produce output showing the gains or losses both to individuals and in aggregate from the policy change. Dynamic models, on the other hand, age the original unit records on the basis of probabilities of different real life events occurring. This allows the original population to be projected forward in time while maintaining the detailed information on the

individuals within the simulation. The child care model described in this paper is a static microsimulation model.

During the past decade, static microsimulation models have become an important tool in the development of cash transfer and taxation policy in most industrialised countries and have sometimes played a decisive role in determining whether a proposed new policy measure is implemented. In the United States, for example, Congress will not consider any social security or tax legislation without closely examining the distributional outcomes predicted by microsimulation models (Citro and Hanushek 1991).

Appendix B: Regression results

In child care or not

Regressor	Beta	T-ratio
VIC	0.0430	0.3401
QLD	-0.0530	-0.4168
NSW	-0.0908	-0.7336
SA	0.1674	1.2034
WA	0.0792	0.5859
TAS	-0.0768	-0.4640
CAPITAL	-0.0618	-1.4281
MINC	0.0015	10.1070
FINC	0.0007	7.4888
SCHOOL	-2.3778	-27.5860
MAGE1	0.2893	1.9798
MAGE2	-0.0147	-0.1247
MAGE3	0.0898	0.7866
SMALL	0.0037	4.3718
NODEP	-0.1669	-7.3780
FHRS0	-1.1832	-13.6010
FHRS10	-0.8573	-6.5313
FHRS19	-1.1832	-6.7532
FHRS29	-1.1372	-8.0895
FHRS39	-0.7774	-8.1202
FHRS40	-0.8103	-9.1910
MHRS0	-1.5723	-6.8634
MHRS10	-0.7660	-3.2373
MHRS19	-0.6930	-2.9151
MHRS29	-0.4063	-1.6866
MHRS39	-0.1599	-0.6533
MHRS40	-0.4619	-1.8769
DEP12	-0.0215	-0.3958
AGE	0.7186	24.7830
AGE2	-0.0489	-23.6080
CONSTANT	0.7738	3.0176

Diagnostic	value
McFadden R-square	0.17112
Log Likelihood	-7600
LR Test	3137.89
Sample Size	13246
Obs at one	6335
Obs at zero	6911

Formal or informal care

Regressor	Beta	T-ratio
VIC	-0.7192	-3.6801
QLD	-0.3375	-1.7256
NSW	-0.3741	-1.9815
SA	-0.4913	-2.2761
WA	-0.8609	-4.0585
TAS	-0.2638	-0.9538
CAPITAL	0.4338	5.8352
MINC	0.0006	2.5029
FINC	0.0003	1.8877
SCHOOL	-3.6151	-25.7870
MAGE1	-0.9495	-3.6753
MAGE2	-0.4916	-2.2790
MAGE3	-0.3113	-1.4725
SMALL	0.0003	0.2412
NODEP	-0.0016	-0.0389
FNLF	0.8777	3.6991
MNLF	0.0743	0.4463
FHRS0	-0.4176	-2.3668
FHRS10	-0.0042	-0.0186
FHRS19	-0.3849	-1.2280
FHRS29	-0.3172	-1.2875
FHRS39	-0.2591	-1.6525
FHRS40	-0.2017	-1.3827
MHRS0	0.1815	0.4127
MHRS10	0.0157	0.0368
MHRS19	0.0096	0.0224
MHRS29	0.1940	0.4513
MHRS39	0.4144	0.9602
MHRS40	0.2128	0.4854
DEP12	-0.5763	-5.6108
AGE	1.3121	24.5970
AGE2	-0.0888	-20.0930
CONSTANT	-2.5139	-5.5956

Diagnostic	value
McFadden R-square	0.25597
Log Likelihood	-2899.4
LR Test	1995
Sample Size	6420
Obs at one	1897
Obs at zero	4523

Type of informal care

Regressor	Beta	T-ratio
VIC	-0.6946	-2.1100
QLD	-0.3764	-1.1344
NSW	-0.5415	-1.6906
SA	-0.4722	-1.2574
WA	-0.4290	-1.1971
TAS	-0.8954	-1.8999
CAPITAL	-0.0781	-0.6067
MINC	-0.0002	-0.3790
FINC	-0.0014	-5.5968
SCHOOL	0.7547	1.9197
MAGE1	-3.4010	-2.9715
MAGE2	-1.3242	-4.9254
MAGE3	-0.6461	-2.7418
SMALL	-0.0064	-2.2299
NODEP	-0.0628	-0.8306
FHRS0	1.3682	4.9291
FHRS10	1.4010	3.6776
FHRS19	1.3297	2.2972
FHRS29	1.4582	3.0053
FHRS39	1.5337	5.4161
FHRS40	1.3086	5.0213
MHRS0	2.1145	3.2471
MHRS10	1.8398	2.7574
MHRS19	1.4252	2.1063
MHRS29	2.0183	2.9965
MHRS39	1.9612	2.8917
MHRS40	1.8000	2.6391
DEP12	2.9473	19.8970
AGE	-0.2221	-1.5958
AGE2	0.0183	2.1423
CONSTANT	-4.2102	-5.3596

Diagnostic	Value
McFadden R-square	0.3992
Log Likelihood	-984.27
LR Test	1307.92
Sample Size	4506
Obs at zero	533
Obs at one	3973

Type of formal care

The models used for formal care type were broken up into four age groups. Each was a multinomial logit model. The following tables contain the 'betas' that were used to calculate the probabilities of being in the types of care relevant to the age group being modelled.

Children aged 0–2 years

REGRESSOR	BETA	T-RATIO
Long Day Care		
CONSTANT	3.9391	3.7092
MINC	7.31E-03	4.2638
FAMINC	-1.86E-03	-2.7318
QLD	-0.10001	-0.1567
AGE	0.73107	2.7602
WA	-1.3939	-2.2927
MHRS0	-1.751	-3.2207
NOAGE5	-0.78694	-2.4591
VIC	-0.77493	-1.319
NTACT	-2.0327	-2.5239
Family Care		
CONSTANT	4.6146	4.2493
MINC	6.91E-03	3.9872
FAMINC	-1.88E-03	-2.6937
QLD	-1.22	-1.8243
AGE	0.31953	1.1575
WA	-1.83	-2.8339
MHRS0	-2.1881	-3.8942
NOAGE5	-0.80904	-2.4272
VIC	-1.1679	-1.9034
NTACT	-2.0378	-2.5006
Occasional		
CONSTANT	2.224	1.9387
MINC	2.10E-03	1.1019
FAMINC	-8.08E-04	-1.0819
QLD	-1.2108	-1.5715
AGE	0.6912	2.3223
WA	-1.4255	-2.0925
MHRS0	-0.62434	-1.0032
NOAGE5	-0.72834	-2.0513
VIC	-3.86E-02	-6.34E-02
NTACT	-0.88026	-1.0848

Children aged 3 years

REGRESSOR	BETA	T-RATIO
Long Day Care		
CONSTANT	3.6465	3.2343
MINC	2.05E-03	1.0755
FINC	-1.28E-03	-1.4757
QLD	0.40403	0.67262
NSW	1.0637	1.021
WA	0.10171	9.43E-02
MEMP	0.23276	0.41334
NOAGE5	-0.74375	-1.8256
Family Care		
CONSTANT	2.4302	2.0573
MINC	2.46E-03	1.2735
FINC	-6.50E-04	-0.69353
QLD	-0.55293	-0.81325
NSW	0.91482	0.85754
WA	0.29066	0.2598
MEMP	0.80333	1.282
NOAGE5	-0.90099	-2.0717
Occasional		
CONSTANT	4.2678	3.616
MINC	-1.94E-03	-0.86303
FINC	-9.74E-04	-1.0104
QLD	-2.0283	-2.5442
NSW	3.57E-02	3.21E-02
WA	-1.8821	-1.3254
MEMP	-0.44464	-0.6978
NOAGE5	-0.88533	-1.9504
Preschool		
CONSTANT	2.9659	2.6047
MINC	-1.19E-03	-0.5918
FINC	2.40E-04	0.26484
QLD	-1.0129	-1.5237
NSW	2.305	2.2119
WA	1.3783	1.3007
MEMP	-0.99856	-1.713
NOAGE5	-0.4189	-1.0122

Other type of care is 'Other formal'.

Children aged 4–5 years

REGRESSOR	BETA	T-RATIO
B/A School		
CONSTANT	2.9615	0.96977
MINC	2.88E-03	1.4423
AGE	-0.31261	-0.47192
MEMP	1.6817	2.383
QLD	-0.33025	-0.59416
FAMINC	-2.93E-03	-2.9163
NOAGE5	1.3086	1.982
Long Day Care		
CONSTANT	-1.2198	-0.38857
MINC	3.44E-03	1.6644
AGE	0.37166	0.53893
MEMP	1.9314	2.6033
QLD	-1.1109	-1.7928
FAMINC	-2.77E-03	-2.7095
NOAGE5	1.4926	2.213
Family Care		
CONSTANT	0.84681	0.21948
MINC	2.48E-03	0.9385
AGE	-0.25893	-0.2989
MEMP	-0.65574	-0.63841
QLD	-0.72251	-0.95668
FAMINC	-3.27E-03	-2.4035
NOAGE5	1.9381	2.7013
Occasional		
CONSTANT	2.508	0.85857
MINC	-4.86E-04	-0.25064
AGE	0.29495	0.46604
MEMP	0.90457	1.3289
QLD	-0.94962	-1.8089
FAMINC	-2.34E-03	-2.4233
NOAGE5	1.5906	2.4768
Preschool		
CONSTANT	-15.463	-4.0699
MINC	3.06E-03	1.5006
AGE	3.3493	4.3292
MEMP	2.2048	2.5701
QLD	-2.3842	-3.4573
FAMINC	-2.07E-03	-1.9419
NOAGE5	1.1366	1.5418

Children aged 6–11 years

REGRESSOR	BETA	T-RATIO
B/A School		
CONSTANT	4.5336	1.3527
MINC	3.40E-03	0.97135
AGE	-0.35491	-0.93943
MEMP	0.29491	0.17476
QLD	-37.069	-2.20E-05
FAMINC	-1.65E-03	-0.96153
NOAGE5	-0.23501	-0.33863
Long Day Care		
CONSTANT	4.621	1.5064
MINC	4.30E-04	0.14739
AGE	-9.57E-02	-0.29866
MEMP	1.3401	0.92561
QLD	-1.8806	-1.7877
FAMINC	-1.43E-03	-0.93294
NOAGE5	-0.52095	-0.84684
Family Care		
CONSTANT	4.379	1.2349
MINC	-3.15E-03	-0.89479
AGE	-0.3521	-0.92421
MEMP	3.031	1.6728
QLD	-31.123	-2.39E-05
FAMINC	-3.93E-04	-0.22454
NOAGE5	-2.5325	-2.315
Occasional		
CONSTANT	4.5685	1.496
MINC	1.05E-03	0.36795
AGE	-1.94E-02	-6.05E-02
MEMP	2.2702	1.5894
QLD	-2.0569	-2.0114
FAMINC	-1.05E-03	-0.69565
NOAGE5	-1.3406	-2.2529

Other type of care is ‘Other formal’.

Hourly cost of care

	Hourly Cost of Formal Care		Horly Cost of Informal Care	
Regressor	**Beta**	**T-ratio**	**Beta**	**T-ratio**
VIC	-0.4459	-2.9920	-0.4547	-4.1060
QLD	-0.6726	-4.5980	-0.3467	-3.0740
NSW	0.0989	0.6880	-0.3691	-3.4060
SA	-0.6359	-3.8930	-0.4325	-3.5230
WA	-0.7744	-4.8110	-0.2431	-2.0300
TAS	-0.4046	-1.8770	-0.4514	-2.9980
CAPITAL	0.2064	3.5190	0.0822	2.0450
MINC	0.0007	4.0120	0.0010	7.5030
FINC	0.0010	8.9080	0.0006	6.7370
SCHOOL	0.0451	0.2762	-0.0078	-0.0945
MAGE1	0.0893	0.4255	-0.4312	-3.1660
MAGE2	0.2555	1.3960	-0.1198	-1.0530
MAGE3	0.4564	2.5070	0.0518	0.4737
SMALL	-0.0014	-1.2760	0.0011	1.3680
NODEP	-0.2266	-6.8200	-0.0121	-0.5409
FHRS0	0.0900	0.7902	-0.0490	-0.5707
FHRS10	-0.0189	-0.1124	0.0039	0.0308
FHRS19	0.2712	1.1260	0.0857	0.4947
FHRS29	0.5841	3.1910	-0.1175	-0.8729
FHRS39	0.2019	1.7130	-0.1676	-1.9300
FHRS40	0.4072	3.6830	-0.0888	-1.0940
MHRS0	-0.5955	-1.7030	-0.2724	-1.2940
MHRS10	-0.4587	-1.2770	-0.1040	-0.4811
MHRS19	-0.4064	-1.1360	0.1191	0.5486
MHRS29	-0.6928	-1.9230	0.0530	0.2421
MHRS39	-0.3785	-1.0460	0.0868	0.3937
MHRS40	-0.7415	-2.0130	0.0281	0.1261
BASCHL	1.0903	5.3350	-	-
LONGDAY	0.9351	5.7670	-	-
FAMDAY	0.7879	4.6590	-	-
OCCLCARE	1.2323	6.7040	-	-
PRESCHL	0.3517	2.1320	-	-
SIBCARE	-	-	-0.3335	-4.8740
DEP12	-0.1431	-1.6710	-0.2221	-3.9420
AGE	-0.0951	-2.1330	-0.0319	-1.1550
AGE2	0.0072	1.7840	0.0002	0.0851
CONSTANT	1.2921	3.2030	0.7232	3.1520
Diagnostic	**Value**		**Value**	
R-square adjusted	0.3300		0.1051	
Log Likelihood	-3457.52		-7479.99	
Sample Size	2152.00		4506.00	

Hours per week in care

	Hours per week in Formal Care		Hours per week in Informal Care	
Regressor	**Beta**	**T-ratio**	**Beta**	**T-ratio**
VIC	-1.4097	-1.2300	-1.2792	-0.7518
QLD	-1.5050	-1.3380	-0.4547	-0.2624
NSW	-0.8173	-0.7397	1.7629	1.0590
SA	-3.3283	-2.6510	-0.4986	-0.2644
WA	-1.5292	-1.2360	-1.1963	-0.6503
TAS	-2.4229	-1.4620	0.5110	0.2209
CAPITAL	1.8415	4.0850	0.6685	1.0830
MINC	0.0059	4.0760	0.0043	2.1760
FINC	0.0001	0.1374	-0.0039	-2.9780
SCHOOL	-11.6420	-9.2820	-11.0040	-8.6890
MAGE1	-0.8108	-0.5025	-1.5659	-0.7485
MAGE2	-1.2448	-0.8848	-1.4197	-0.8122
MAGE3	-1.0909	-0.7795	-1.1885	-0.7075
SMALL	0.0127	1.4720	0.0370	3.0430
NODEP	-0.4512	-1.7660	0.7449	2.1660
FHRS0	-2.5079	-2.8640	-6.7581	-5.1250
FHRS10	-1.6829	-1.3020	-4.5547	-2.3670
FHRS19	-5.5273	-2.9860	-6.6999	-2.5190
FHRS29	-6.7703	-4.8130	-1.1811	-0.5712
FHRS39	-3.3641	-3.7120	-5.2242	-3.9150
FHRS40	-3.6558	-4.3020	-4.9943	-4.0040
MHRS0	-12.6350	-4.7000	-20.4940	-6.3360
MHRS10	-13.5230	-4.9000	-23.7250	-7.1460
MHRS19	-10.7150	-3.8970	-20.5000	-6.1480
MHRS29	-7.9980	-2.8890	-17.9390	-5.3370
MHRS39	-0.8579	-0.3083	-16.0900	-4.7510
MHRS40	0.9489	0.3351	-13.0610	-3.8200
BASCHL	-0.4443	-0.2828	-	-
LONGDAY	11.5450	9.2640	-	-
FAMDAY	9.6956	7.4590	-	-
OCCLCARE	-2.7908	-1.9750	-	-
PRESCHL	2.6668	2.1030	-	-
OTHERINF	-	-	9.0970	8.6560
DEP12	1.3126	1.9950	3.4512	3.9880
AGE	1.2173	3.5520	2.4445	5.7670
AGE2	-0.0658	-2.1130	-0.1590	-5.2890
CONSTANT	21.7070	7.0000	26.4610	7.1940
Diagnostic	**Value**		**Value**	
R-square adjusted	0.4978		0.1123	
Log Likelihood	-7846.42		-19790.20	
Sample Size	2152.00		4506.00	

Appendix C: Variable definitions

VIC	=	1 if place of residence is Victoria,
	=	0 otherwise;
QLD	=	1 if place of residence is Queensland,
	=	0 otherwise;
NSW	=	1 if place of residence is NSW,
	=	0 otherwise;
SA	=	1 if place of residence is South Australia,
	=	0 otherwise;
WA	=	1 if place of residence is Western Australia,
	=	0 otherwise;
TAS	=	1 if place of residence is Tasmania,
	=	0 otherwise;
CAPITAL	=	1 if place of residence is in a capital city,
	=	0 otherwise;
MINC	=	midpoint of income category;
FINC	=	midpoint of income category;
SCHOOL	=	1 if attending school,
	=	0 otherwise;
MAGE1	=	1 if mother's age is in category 15–24 years,
	=	0 otherwise;
MAGE2	=	1 if mother's age is in category 25–34 years,
	=	0 otherwise;
MAGE3	=	1 if mother's age is in category 35–44 years,
	=	0 otherwise;
SMALL	=	proportion of dependent children in family aged less than 6 years;

NODEP = number of dependent children in family;

FHRS0 = 1 if father works 0 hours per week,
= 0 otherwise;

FHRS10 = 1 if father works 1–9 hours per week,
= 0 otherwise;

FHRS19 = 1 if father works 10–19 hours per week,
= 0 otherwise;

FHRS29 = 1 if father works 20–29 hours per week,
= 0 otherwise;

FHRS39 = 1 if father works 30–39 hours per week,
= 0 otherwise;

FHRS40 = 1 if father works 40 or more hours per week,
= 0 otherwise;

MHRS0 = 1 if mother works 0 hours per week,
= 0 otherwise;

MHRS10 = 1 if mother works 1–9 hours per week,
= 0 otherwise;

MHRS19 = 1 if mother works 10–19 hours per week,
= 0 otherwise;

MHRS29 = 1 if mother works 20–29 hours per week,
= 0 otherwise;

MHRS39 = 1 if mother works 30–39 hours per week,
= 0 otherwise;

MHRS40 = 1 if mother works 40 or more hours per week,
= 0 otherwise;

DEP12 = 1 if there are dependent children in family aged 12 years or more,
= 0 otherwise;

AGE	=	age of child;
AGE2	=	child's age squared;
FNLF	=	1 if father is not in the labour force,
	=	0 otherwise;
MNLF	=	1 if mother is not in the labour force,
	=	0 otherwise;
BASCHL	=	1 if child is in before and / or after school care,
	=	0 otherwise;
LONGDAY	=	1 if child is in long day care,
	=	0 otherwise;
FAMDAY	=	1 if child is in family day care,
	=	0 otherwise;
OCCLCARE	=	1 if child is in occasional care,
	=	0 otherwise;
PRESCHL	=	1 if child is in preschool,
	=	0 otherwise;
SIBCARE	=	1 if child is in sibling care,
	=	0 otherwise; and
OTHERINF	=	1 if child is in other informal care,
		0 otherwise.

References

ABS (Australian Bureau of Statistics) 1986, *1986 Census of Population and Housing*, Canberra, unit record tape.

—— 1987, *Household Expenditure Survey, Australia — The Effects of Government Benefits and Taxes on Household Income*, Canberra.

—— 1990, *Survey of Income and Housing Costs and Amenities*, Canberra, unit record tape.

—— 1992, *Household Expenditure Survey, Australia — The Effects of Government Benefits and Taxes on Household Income*, Canberra.

—— 1993, *1993 Child Care Survey*, Canberra, unit record tape.

—— 1994, *Child Care Australia, June 1993*, Canberra.

—— 1995, *Monthly Labour Force Statistics (AUSTATS)*, Canberra (and previous issues).

Baekgaard, H. 1993, A microsimulation approach to the demand for day care in Denmark. Paper presented at the Conference on Microsimulation and Public Policy, Canberra, December.

Bloom, D.E. and Steen, T.P. 1990, 'The labour force implications of expanding the child care industry', *Population Research and Policy Review*, vol. 9, pp. 25–44.

Citro, C.F. and Hanushek, E.A. (eds) 1991, *The Uses of Microsimulation Modelling*, vol. 1, *Review and Recommendations*, National Academy Press, Washington, DC.

Connelly, R. 1992, 'The effect of child care costs on married women's labour force participation', *Review of Economics and Statistics*, pp. 83–90.

Department of Health, Housing, Local Government and Community Services 1993, *Annual Report 1992-93*, AGPS , Canberra.

Department of Human Services and Health 1994a, *Childcare Cash Rebate: Matters of Interest*, AGPS , Canberra.

—— 1994b, *Annual Report 1993-94*, AGPS, Canberra.

Duncan, G.J. and Hill, C.R. 1975, 'Modal choice in child care arrangements', in Duncan, G.J. and Morgan, J.N. (eds), *Five Thousand American Families — Patterns of Economic Progress*, vol. 5, Institute of Social Research, Ann Arbor, pp. 379–88.

Eason, R. 1993, Microsimulation for direct taxation and fiscal policy in the United Kingdom, Paper presented at the Conference on Microsimulation and Public Policy, Canberra, December.

Evandrou, M., Falkingham, J., Le Grand, J. and Winter, D. 1990, *Equity in Health and Social Care*, Discussion Paper no. 52, Welfare State Programs, London School of Economics.

Evandrou, M., Falkingham, J., Hills, J. and Le Grand, J. 1992, *The Distribution of Benefits in Kind*, Discussion Paper no. 68, Welfare State Programs, London School of Economics.

Garfinkel, I., Meyer, D. and Wong, P. 1990, 'The potential of child care tax credits to reduce poverty and welfare recipiency', *Population Research and Policy Review*, vol. 9, pp. 45–63.

Greene, W.H. 1991, *Econometric Analysis*, Macmillan, New York.

Gustafsson, S. and Stafford, F. 1991, 'Child care subsidies and labour supply in Sweden', *Journal of Human Resources*, vol. 27, no. 1, pp. 204–30.

Harding, A. 1993, *Lifetime Income Distribution and Redistribution — Applications of a Microsimulation Model*, North-Holland, Amsterdam.

Lambert, S., Percival, R., Schofield, D. and Paul, S. 1994, *An Introduction to STINMOD: A Static Microsimulation Model*, STINMOD Technical Paper no. 1, National Centre for Social and Economic Modelling, University of Canberra.

Lehrer, E. 1989, 'Preschoolers with working mothers: an analysis of the determinants of child care arrangements', *Journal of Population Economics*, vol. 1, pp. 251–68.

—— and Kawasaki, S. 1985, 'Child care arrangements and fertility: an analysis of two-earner households', *Demography*, vol. 22, no. 4, pp. 499–513.

Leibowitz, A., Klerman, J. and Waite, L. 1991, 'Employment of new mothers and child care choice: differences by children's age', *Journal of Human Resources*, vol. 27, no. 1, pp. 112–34.

Leibowitz, A.L., Waite, L.J. and Witsberger, C. 1988, 'Child care for preschoolers: differences by child's age', *Demography*, vol. 25, no. 2, pp. 205–20.

Maddala, G.S. 1977, *Econometrics*, McGraw-Hill, New York.

Mathers, C. 1992, *Enough to Make You Sick: How Income and Environment Affect Health*, Research Paper no. 1, National Health Strategy, Canberra.

Michalopoulos, C., Robins, P. and Garfinkel, I. 1991, 'A structural model of labour supply and child care demand', *Journal of Human Resources*, vol. 27, no. 1, pp. 165–203.

Nelissen, J. 1991, The Health Care Sector in the Microsimulation Model NEDYMAS, Working Paper Series no. 62, Tilberg University.

OECD 1994, *Employment Outlook*, Paris, July.

Percival, R. 1994, *Building STINMOD's Base Population*, STINMOD Technical Paper no. 2, National Centre for Social and Economic Modelling, University of Canberra.

—— and Schofield, D. 1995, *Modelling Government Expenditure on Health Services*, STINMOD Technical Paper no. 8, National Centre for Social and Economic Modelling, University of Canberra.

Propper, C. and Upward, R. 1991, *Forecasting Health Care Expenditure Using a Micro-simulation Model*, Working Paper 93, University of Bristol.

Raskall, P. and Urquhart, R. 1994, *Inequality, Living Standards and the Social Wage During the 1980's*, Study of Social and Economic Inequalities Monograph no. 3, Social Policy Research Centre, University of Sydney.

Robins, P. 1990, 'Federal financing of child care: alternative approaches and economic implications', *Population Research and Policy Review*, vol. 9, pp. 65–90.

Salomaki, A. 1993, Including consumption expenditure and welfare services in a microsimulation model, Paper presented at the Conference on Microsimulation and Public Policy, Canberra, December.

Schofield, D. 1996, *Using Microsimulation to Model Health Services*, Discussion Paper, National Centre for Social and Economic Modelling, University of Canberra.

Schofield, D., Polette, J. and Hardin, A. 1996, *A Comparison of Two Methodologies for Modelling Child Care Services and Subsidies*, STINMOD Technical Paper, National Centre for Social and Economic Modelling, University of Canberra (forthcoming).

Travers, P. and Richardson, S. 1993, *Living Decently: Material Well-being in Australia*, Oxford University Press, Melbourne.

Van der Lann B., Koerts, J. and Reichardt, J. 1986, *A Statistical Model for the Expenses for Medical Services During a Year*, Report 8635/A, Econometric Institute, Erasmus University, Rotterdam.

Veum, J.R. and Gleason, P.M. 1991, 'Child care: arrangements and costs', *Monthly Labor Review*, October, pp. 10–17.

Whiteford, P. 1994, The impact of non-cash benefits on the elderly, Paper presented at the Department of Social Security, Canberra, 4 November.

Wolfson, M. 1989, The CEPHID project: Canada's elderly — projecting health, income and demography, Statistics Canada, Ottawa, February.

Wolinsky, F. 1990, *Health and Health Behaviour Among Elderly Americans: An Age-Stratification Perspective*, Springer Publishing Co., New York.

NATSEM publications

Copies of NATSEM publications and information about NATSEM may be obtained from:

Ms Lynne Simpson
Publications Officer
National Centre for Social and Economic Modelling
University of Canberra
GPO Box 563
Canberra City ACT 2601
Australia

Ph: + 61 6 275 4900 Fax: + 61 6 275 4875
E-mail: natsem@natsem.canberra.edu.au

Periodic publications

NATSEM News keeps the general community up to date with the developments and activities at NATSEM, including product and publication releases, staffing and major events such as conferences. This newsletter is produced twice a year.

The ***Income Distribution Report* (*IDR*)**, which is also produced twice a year, provides information and comment on the average incomes of Australian families, covering the incidence of taxation for different family types, the income support provided by the government and how different family groups are faring. The *IDR*, which is available on subscription, presents this information in a simple, easy-to-follow format.

NATSEM's ***Annual Report*** gives the reader an historical perspective of Centre and its achievements for the year.

STINMOD/94B

STINMOD is an easy-to-use microsimulation model for better understanding the impact of social and economic change on Australian families. It is a cutting edge tool for exploring the distributional impact of possible government policy changes. Microsimulation models are built from the bottom up, using samples of microdata based on real Australians. From such a foundation, projections can then be made for the wider community.

The second release of STINMOD is available. This release incorporates changes to social security payments announced in the White Paper on Employment and Growth, and enables users to make cash payments universal and undertake more detailed levels of analysis.

STINMOD Technical Paper series

No.	Authors	Title
1	Lambert, S., Percival, R., Schofield, D. and Paul, S.	An Introduction to STINMOD: A Static Microsimulation Model, October 1994
2	Percival, R.	Building STINMOD's Base Population, November 1994
3	Schofield, D. and Paul, S.	Modelling Social Security and Veterans' Payments, December 1994
4	Lambert, S.	Modelling Income Tax and the Medicare Levy, December 1994
5	Percival, R.	Modelling AUSTUDY, December 1994
6	Landt, J.	Modelling Housing Costs and Benefits, December 1994
7	Schofield, D.	Designing a User Interface for a Microsimulation Model, March 1995
8	Percival, R. and Schofield, D.	Modelling Australian Public Health Expenditure, May 1995
9	Paul, S.	Modelling Government Education Outlays, September 1995

DYNAMOD Technical Paper series

No.	Authors	Title
1	Antcliff, S.	An Introduction to DYNAMOD: A Dynamic Microsimulation Model, September 1993

Discussion Paper series

No.	Authors	Title
1	Harding, A.	Lifetime Repayment Patterns for HECS and AUSTUDY Loans, July 1993
2	Mitchell, D. and Harding, A.	Changes in Poverty among Families during the 1980s: Poverty Gap versus Poverty Head-count Approaches, October 1993
3	Landt, J., Harding, A., Percival, R. and Sadkowsky, K.	Reweighting a Base Population for a Microsimulation Model, January 1994
4	Harding, A.	Income Inequality in Australian from 1982 to 1993: An Assessment of the Impact of Family, Demographic and Labour Force Change, November 1994
5	Landt, J., Percival, R., Schofield, D. and Wilson, D.	Income Inequality in Australia: The Impact of Non-Cash Subsidies for Health and Housing, March 1995
6	Polette, J.	Distribution of Effective Marginal Tax Rates Across the Australian Labour Force, August 1995
7	Harding, A.	The Impact of Health, Education and Housing Outlays on Income Distribution in Australia in the 1990s, August 1995
8	Beer, G.	Impact of Changes in the Personal Income Tax and Family Payment Systems on Australian Families: 1964 to 1994, September 1995
9	Paul, S. and Percival, R.	Distribution of Non-Cash Education Subsidies in Australia in 1994, September 1995