

The Effect of Financial Incentives on Labour Supply: Evidence for sole parents from microsimulation and quasi- experimental evaluation*

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Abstract

The aim of this paper is to analyse work-incentive effects from a change in the Australian tax and transfer system on sole parents in July 2000. To evaluate the effect of the total change only microsimulation can be used, but for a subgroup of sole parents a few components of this policy change can be analysed through two alternative approaches: microsimulation and quasi-experimental evaluation. Both approaches examine the effects on the probability of employment and average working hours. The results from microsimulation show that the combined changes introduced in July 2000 —involving reduced withdrawal rates, changed family payments and lower income tax rates— have increased labour supply for sole parents to a moderate extent. The estimated effect on average working hours when using the microsimulation is very close to the effect estimated from a quasi-experimental approach using matching techniques to control for alternative influences.

JEL codes: H31, J22, C21

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1. Introduction

In July 2000, the Australian New Tax System (ANTS) was introduced, in which several reforms were made. These changes were introduced simultaneously with social security reforms, the new 10 per cent Goods and Services Tax (GST) and the abolition of wholesales tax and some of the States' expenditure taxes. The ANTS changes were at least partly meant to offset the increase in net taxes paid through expenditures.¹

As a result of the reform, the financial incentives of labour supply changed. Compared with the pre-reform tax system, around 15 per cent of individuals experienced an increase in their marginal effective tax rate (METR), around 30 per cent had a decrease and the rest remained unchanged. This paper examines the effect of the changes in the Australian tax and social security transfer arrangements on the labour supply of sole parents.² Relative to other groups (and to sole parents in other countries) the labour force participation of sole parents is low, and therefore has the most potential to increase.³ This potential to increase the participation rate by changing financial incentives is of policy interest. However, finding concrete evidence of the success of policies, and attributing it to specific components of a policy, is difficult, due to the interaction of many factors. This paper compares the results from two alternative approaches.

The specific components of the ANTS reform that were relevant to sole parents are a decrease in marginal income tax rates and an increase in the tax-free threshold; a decrease in the withdrawal rate from 50 to 40 per cent for Parenting Payment Single;⁴ and the introduction of Family Tax Benefit (FTB) to replace a range of family assistance schemes existing before ANTS. As part of the latter component, several changes were introduced, such as an increase in the withdrawal-free family income level; replacement of the "sudden death" income test of minimum level family

¹ About 8 of the 10 percentage points of GST replaced the former wholesales Tax and some of the States' expenditure taxes.

² In the analysis, the price changes resulting from higher indirect taxes are taken into account. That is any income changes are discounted by the inflation rate and are therefore expressed in real terms.

³ Independent of the financial incentives introduced, it cannot be expected that the labour supply of married men or singles will increase much. Due to the interaction with their partner's labour supply and response to the policy changes, using a quasi-experimental approach to analyse the effect on the labour supply of married women is extremely complicated.

⁴ Parenting Payment Single is the main income-tested income support payment for sole parents, for which all sole parents with children under the age of 16 are eligible. Sole parents with older children received other, less generous, income support payments.

payments by a 30 per cent withdrawal rate; and a reduction of the 50 per cent withdrawal rate of the maximum level family payments to 30 per cent. Appendix A briefly describes the Australian tax and transfer system and summarises the changes introduced in ANTS.

Even though this paper analyses the effect of a specific Australian policy change, it contributes to the international literature on two fronts. First, the type of reform discussed in this paper is relevant to other countries, which have similar components of social security, such as the U.K. and other European countries with a universal social assistance scheme. Second, on the methodological front, we compare the estimates from two important methods of policy evaluation: microsimulation and quasi-experimental approach.

Microsimulation is a powerful and flexible tool in tax policy evaluation. It has the advantage of being able to provide ex ante evaluation at the policy development stage and to separately predict the effects from different components of a policy change. However, a concern with the microsimulation method of evaluating policy changes is that the results potentially overestimate the actual effects of policy changes. This could be due, for example, to restrictions on the demand side of the labour market which are not taken into account. The quasi-experimental approach does not have the problem of ignoring the demand side of the labour market as long as the comparison group is properly chosen. However, the disadvantage of this approach is that it can only be used ex post and that proper control groups may not always exist. For a subgroup of sole parents, the effect of some of the components of the ANTS policy change on sole parents' labour supply can be analysed using a quasi-experimental difference-in-difference approach. This provides us with the opportunity to compare the predictions from microsimulation with an evaluation based on pre- and post-reform data. This comparison is worthwhile, given the importance of the results for informed policy-making. It allows us to obtain an idea of the sensitivity of the results to the approach chosen. Similar outcomes from these two newly developed and rigorous approaches would reinforce the estimated effect of a reform and build confidence in behavioural microsimulation modelling and quasi-experimental evaluation.

A few papers (for example, Blundell and Hoynes, 2004; Blundell *et al.*, 2004a, Brewer *et al.*, 2006) have made this type of comparison using different evaluation approaches. This paper is different from these three studies, in that extra care has been taken to make

the estimated effects from the two approaches comparable. Blundell and Hoynes (2004) did a direct before-after comparison (which does not account for the potential effect of other changes occurring at the same time). Blundell *et al.* (2004a) employed a difference-in-difference approach implemented using regression models. In this paper, a difference-in-difference approach is also applied but it is implemented using propensity score matching estimators, which are argued to be less dependent on functional form. Brewer *et al.* (2006) compared their microsimulation results based on a structural labour supply model with a range of difference-in-difference studies comparing parents to individuals without children. Given that women with and without children may respond to changes in the economic environment in different ways, which would violate the assumption underlying the difference-in-difference methods, an alternative comparison is proposed here. This paper compares sole parents with 14 and 15 year old children to sole parents with 16 and 17 year old children, who were subject to different policy changes. In addition, to make the two analyses as comparable as possible, the microsimulation results to which the quasi-experimental evaluation outcomes are compared are also based on differences between the two groups of sole parents. This is an advantage compared to Doiron (2004) who compares the outcome of her quasi-experimental evaluation of a policy change for sole parents in Australia in the late 1980s with similar (but not exactly the same) changes reported in separate simulation studies.

However, one should be cautious in interpreting the comparison results because the magnitudes of the estimated effects from the two approaches are not expected to be exactly the same. There are several reasons for differences. First, microsimulation is a partial equilibrium approach not accounting for the potential effect of policy changes on other parts of the economy. For example, labour demand is not taken into account, and although quasi-experimental evaluation is not a general equilibrium approach either, the estimated effects from this approach incorporate labour demand effects. Second, while estimated effects from quasi-experimental evaluation depend on the time-frame used, the results from microsimulation are supposed to reflect the long-run effect. Third, when a policy is actually introduced, other changes affecting labour supply may occur at the same time. While the effects of these changes would be automatically reflected in the quasi-experimental evaluation results, they would not be reflected by the microsimulation results if these changes are not simulated explicitly. Finally, it can be difficult to find the right data to do an appropriate quasi-experimental evaluation. In this

paper to facilitate the comparison, we run specific microsimulation analyses aimed at replicating the change considered by the evaluation approach.

The paper is structured as follows. Section two gives a brief discussion of the effect of the policy change on net incomes and marginal effective tax rates across a range of labour supply levels for some hypothetical sole parents. The data used are described in Section three. The results from simulations of the complete ANTS package and a comparison of the effects of some components of the ANTS package using microsimulation and quasi-experimental evaluation are presented in Section four. Section five concludes.

2. Changed incentives resulting from ANTS

This section discusses the financial incentives to work resulting from the policy changes that are part of ANTS. The effect of reductions in the marginal income tax rates (including the increase in the tax-free threshold) on labour supply is ambiguous because the reductions increase the after tax wage rate of employed people. The increase in the after-tax wage rates implies that workers can take home more income if their working hours remain unchanged, which will reduce labour supply (the income effect). However, the increase in the after-tax wage rates also implies an increase in the opportunity cost of leisure and makes employment more attractive (the substitution effect). The income and substitution effects operate in opposite directions. Therefore, the net effect on labour supply is an empirical issue.

Similarly, the effect of a change in income support benefit thresholds and withdrawal rates results in income and substitution effects working in opposite directions. The proposed changes also cause additional people to be eligible for payments. The labour supply effects for these newly eligible people are different from the effects for those who are eligible under both the old and new policy. While an increase in the withdrawal-free threshold and a decrease in the withdrawal rate in theory have an ambiguous effect on the labour supply of payment recipients (and probably have a positive effect on individuals who are currently out of the labour force), the effect on the newly eligible individuals is unambiguously negative. This is because the newly eligible families are subject to an additional withdrawal rate, resulting in a higher marginal effective tax rate, while at the same time experiencing an increase in net income at the same labour supply level, both of which have a negative effect on labour supply.

Whether the overall effect at the population level is positive or negative depends on the size of the different groups and the size of the effects.

To obtain an idea of the proportion of sole parents in Australia, who experienced a decrease or an increase in the marginal effective tax rates (METRs) at the observed labour supply before the introduction of ANTS, Table 1 presents the changes in the distribution of the METRs based on the 1999-2000 Survey of Income and Housing Cost (SIHC) collected by the Australian Bureau of Statistics (ABS). Comparing the last two rows, the table shows that overall the policy change increases the proportion of sole parents on METRs between 0 and 40 per cent, and to a larger extent, it increases the proportion between 50 and 70 per cent. The increase in the latter group is largely due to the substantial decrease in the group who previously faced a METR over 70 per cent.⁵ Under the new policy, over 80 per cent of the sole parents previously facing a METR over 90 per cent are expected to experience a drop in METR to a level between 60 and 80 per cent. This is a clear improvement in work incentives for these sole parents.

Table 1: Change in the distribution of METRs of all sole parents (row percentages)

| | Post-reform | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 | >90 |
|---------------------|-------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| Pre-reform | | | | | | | | | | | |
| 0-10 | 98.78 | 0.79 | 0.27 | 0 | 0 | 0.17 | 0 | 0 | 0 | 0 | 0 |
| 10-20 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20-30 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30-40 | 0 | 0 | 5.65 | 63.37 | 3.17 | 2.35 | 25.47 | 0 | 0 | 0 | 0 |
| 40-50 | 0 | 0 | 0 | 34.17 | 33.21 | 27.42 | 2.8 | 2.41 | 0 | 0 | 0 |
| 50-60 | 0 | 0 | 0 | 0 | 58.44 | 0 | 41.56 | 0 | 0 | 0 | 0 |
| 60-70 | 0 | 0 | 0 | 0 | 0 | 26.56 | 71.23 | 0 | 2.21 | 0 | 0 |
| 70-80 | 0 | 0 | 0 | 0 | 0 | 0 | 77.38 | 22.62 | 0 | 0 | 0 |
| 80-90 | 0 | 0 | 2.09 | 1.92 | 0 | 19.33 | 71.97 | 4.69 | 0 | 0 | 0 |
| >90 | 0 | 0 | 0 | 0 | 0 | 14.09 | 60.70 | 5.90 | 0 | 19.32 | |
| Total (post-reform) | 50.60 | 0.81 | 0.68 | 11.24 | 6.96 | 9.45 | 17.81 | 1.74 | 0.18 | 0.52 | |
| Total (pre-reform) | 51.23 | 0.41 | 0.13 | 6.91 | 19.28 | 0.59 | 7.91 | 3.40 | 7.45 | 2.70 | |

However, Table 1 also shows some increases in METR among those who previously faced a METR lower than 50 per cent. About 25 per cent of sole parents who previously faced a 30 to 40 per cent METR are expected to have a METR between 60 and 70 per cent after the change. These groups of sole parents may have become eligible for income support as a result of more generous withdrawal rates. This new group on income support now falls in the range where the Parenting Payment Single is withdrawn,

⁵ Comparing different age and education groups (results not presented in the paper), METRs decrease most on average for those with higher education levels and for those aged between 35 and 50.

which adds 40 per cent to their METRs. There are some sole parents, who previously faced a 20 to 30 per cent METR but can expect to have this increased to a level between 30 and 40 per cent after the reform, but this is a small group (at only 0.13 per cent).

Because in general, the new policy is expected to reduce the previously very high METRs—in particular for those who were out of the labour force or at low labour supply levels—the overall incentive effect of the new policy is expected to be positive. This assumes that the negative effect on labour supply through the increase of some individuals' METRs is relatively minor.

Gregory, Klug and Thapa (2003) analysed the July 2000 policy changes using the Longitudinal Data Survey (LDS), an administrative data set on social security recipients. They focussed on sole parents who receive income support. Similar to them, we conclude that METRs are still high for some income ranges; however, we believe they have fallen considerably for large ranges of income. Even if these are not incomes at which the majority of sole parents are located, they could improve incentives by making alternatives to non-participation more attractive. Although we agree that the income tax changes are unlikely to have had a large effect on incentives, we believe that these changes are more relevant than they appear to be from Gregory, Klug and Thapa. In contrast to their study, we also include sole parents in our analysis who are not on income support. This group is more likely to benefit (to a larger extent) from the income tax changes and some of the family payment changes,

A few main components of the ANTS package were important in causing these METR changes. First, taking away the accumulation of different payments and rebates related to the presence of dependent children in the household, and replacing it by one payment with one reduced withdrawal rate (Family Tax Benefit part A), decreased METRs for middle-income sole parents. Second, the reduction in the Parenting Payment withdrawal rate for sole parents by 10 per cent was another factor, which lowered METRs. On the other hand, these wider withdrawal ranges also resulted in an increase in METRs for those who were at the high end of the income range and were not eligible for the payment before the introduction of the ANTS package.

The effect of the reform on net income and METRS for a hypothetical sole parent family is illustrated in Figures 1a and 1b. With the introduction of ANTS, net incomes increase at all labour supply levels for all sole parents. For most of the hours range,

METRs are reduced, but for a limited range of incomes there is an increase. Sole parents with a lower wage rate will face similar but more stretched-out budget constraints and METRs. For example, sole parents at a wage of AU\$10 per hour would face the same budget constraint as graphed in Figure 1a between 0 and 20 hours per week, but it would be stretched out over the range between 0 and 50 hours per week. Sole parents at a wage rate of \$25 per hour appear to have the largest increase in net income if they are working close to full-time hours when comparing the pre- and post-reform situation. This indicates that it could be more attractive for sole parents on higher wage rates to work full-time after the reform.

Figure 1a: Budget constraint for sole parents with 1 child aged less than 13, wage rate AU\$25/hour and rent AU\$110/week

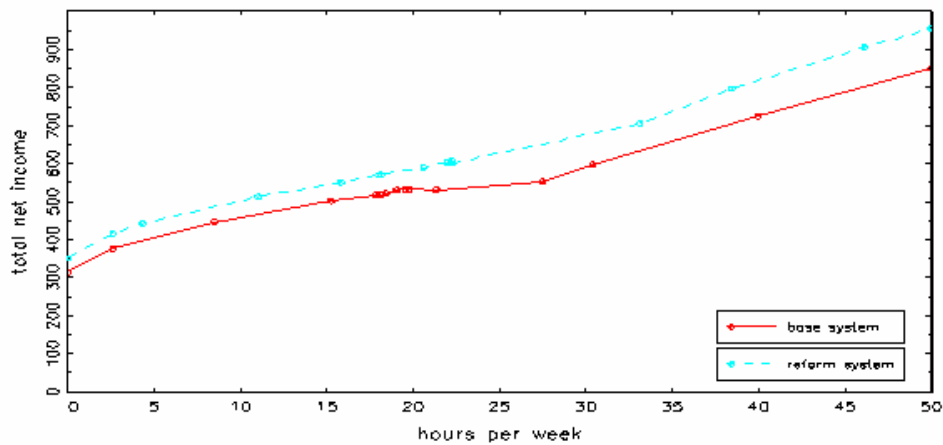
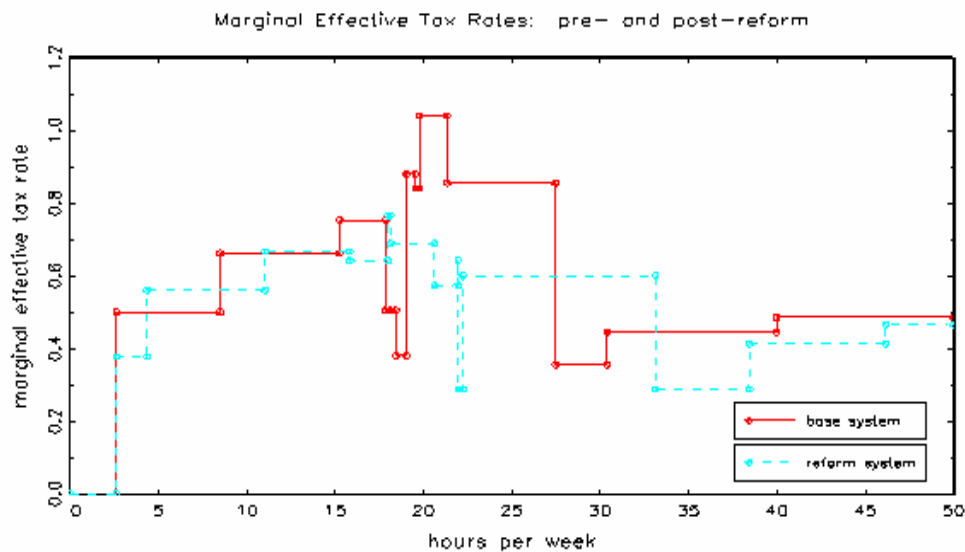


Figure 1b: METR for sole parents with 1 child aged less than 13, wage rate AU\$25/hour and rent AU\$110/week



3. The data

Two different sources of data from years before and after the policy change are used. The Survey of Income and Housing Cost (SIHC) of 1999/2000 and 2000/2001 are used in the microsimulation approach (ABS, 2003b and 2004) and 1 per cent samples from the 1996 and 2001 Census (ABS, 2003a) are used in the quasi-experimental approach. Appendix B provides summary statistics for these four data sets.

The 1999/2000 SIHC was conducted throughout Australia from July 1999 to June 2000 and the 2000/2001 survey was conducted throughout Australia from July 2000 to June 2001. Both surveys obtained detailed information on sources of income, amount of income received and housing costs of persons aged 15 and over, as well as information on a number of demographic and labour force characteristics. The survey collected information by personal interview from usual residents of private dwellings in urban and rural areas of Australia, covering about 98 per cent of the people living in Australia.

The Australian Census is conducted in August every 5 years. It contains basic demographic characteristics and labour force status information. Although census data is not as rich as desired, it is chosen for the analysis using the quasi-experimental approach because of its relatively large sample size.⁶ In the difference-in-difference analyses, the key assumption is that treatment and control groups experience similar trends over time. Therefore, the policy effect can be identified through differencing out the common effect of general economic conditions. In past studies, sole parents have been compared with either single women without children (Blundell *et al.*, 2004a) or married mothers (Doiron, 2004). However, the labour supply elasticity is likely to be affected by the presence of dependent children, the presence of a partner and the partner's income. Therefore, these two groups may be differently affected by time trends compared with the sole parents treatment group. Therefore, in our primary analysis, we compare sole parents who are eligible for Parenting Payment Single against sole parents with slightly older children who are not eligible for Parenting Payment Single.

The main drawback of the census data is that the pre-policy change period is four years prior to the policy change in which we are interested. However, there were no other

⁶ The information in the Census data is not sufficiently detailed with regard to labour supply and income to be used in the microsimulation approach.

relevant policy changes in this period that were applied differently to the treatment and control groups. Therefore, we believe that an analysis using the 1996 and 2001 Census data is informative with regard to analysing the reduction in the withdrawal rate of Parenting Payment Single, and changes to the relative rates of some income support and family payments.

4. Predicted labour supply effects using microsimulation

The results in this section are obtained using the microsimulation approach to evaluate the effects of the ANTS policy changes on sole parents' labour supply. The reforms are evaluated using the Melbourne Institute Tax and Transfer Simulator (MITTS) model, a behavioural microsimulation model, and the 1999/2000 and 2000/2001 Survey of Income and Housing Costs (SIHC) data.⁷ Section 4.1 briefly describes the MITTS model, followed by a discussion of the effect of the total ANTS package in Section 4.2. A comparison with difference-in-difference results is presented in Section 4.3.

4.1 The MITTS model

We use MITTS to calculate the effect of the July 2000 policy change. The expected effects presented in this paper are based on estimated parameters for a structural labour supply and welfare participation model, which is described in more detail in Kalb and Buddelmeyer (2005). That is, the labour supply effects are not actually observed but based on simulations. A more detailed general description of the behavioural microsimulation modelling approach used in this analysis can be found in Creedy and Kalb (2005, 2006) and specific information on MITTS can be found in Creedy *et al.* (2002, 2004).

4.1.1 Details on the simulation

The microsimulation is based on a sample of representative Australian households in the 1999/2000 SIHC. Using the weights provided by the ABS, the sample is weighted to obtain population amounts. This is a survey of the Australian population at the time of the policy change of interest. Detailed information is available on each household and on the individuals in the households. This allows us to replicate the social security payments received and income tax paid for each individual and household according to

⁷ This model is similar, for example, to the Institute for Fiscal Studies' TAXBEN model for the UK, which combined with the IFS labour supply model, Simulation Package for the Analysis of Incentives (SPAIN), is also used as a behavioural microsimulation model.

the income tax and social security rules at any point in time or according to a hypothetical set of rules.

A static simulation of the effects involves the use of alternative budget constraints in the pre- and post-reform situation. The budget constraints incorporate all main tax and transfer programs—in this paper, as they were in January 2000 (pre-reform) and in July 2000 (post-reform)—and are computed using MITTS. Assuming unchanged labour supply, MITTS calculates the net income of each individual before and after the change together with the social security payments which are received and income tax which is paid. From these individual amounts, aggregate expenditure and revenue are computed using the ABS-provided weights to inflate sample totals into population totals.

In the behavioural simulation, in which labour supply and welfare participation are allowed to change in response to a policy change, MITTS calculates net incomes for each household at all predetermined discrete labour supply points based on the wage rates of individuals (either observed in the data or imputed, using the estimated wage equations as described in Kalb and Scutella (2002)), other income, and some individual and household characteristics. As in the static simulation, the net incomes are calculated imposing different tax and transfer systems, allowing hypothetical and real policy changes to be analysed. Together with the net incomes at all labour supply points, the estimated parameters from the structural labour supply and welfare participation model are key inputs in the behavioural component of the microsimulation model. They allow us to simulate the labour supply and welfare participation responses of the policy change. The behavioural responses presented in this paper are based on a quadratic utility function with preference parameters which are allowed to vary with an individual's characteristics. The approach follows the discrete choice approach taken by Van Soest (1995) and Blundell *et al.* (2000).⁸ See Appendix C for a brief, more detailed description.

The behavioural simulation begins by recording the discrete hours level for each

⁸ As Blundell *et al.* note, the discrete choice labour supply model has become increasingly popular. Given the aim of simulating policy changes with regard to the tax and transfer system and assessing its effect on labour supply, a discrete model specification of labour supply choice is chosen to enable us to deal with the full detail of the tax and transfer system. In other regards, the model has been kept relatively simple; for example no explicit home production is included.

individual that is closest to their observed hours level.⁹ Then, given the parameter estimates of the utility function (which vary according to a range of demographic characteristics), a random draw is taken from the distribution of the ‘error’ term. This draw is rejected if it results in an optimal hours level that differs from the discretised value observed before the reform, otherwise the draw is accepted.¹⁰ The accepted drawings are then used to determine the optimal hours level after the policy change. A total of 100 ‘successful draws’ (that is, drawings which generate the observed hours as the optimal value under the base system for the individual) are produced. Conditional on this set of random draws, a probability distribution over the set of discrete hours for each individual under the new tax and transfer structure is generated.¹¹ Thus the same error terms, representing the random utility component which is for example due to unobserved factors, are used before and after the reform. However, the tax and transfer system is changed in the reform, which changes net household incomes, and as a result changes the deterministic utility levels. The labour supply after the reform is calculated as the average outcome across all draws of the error terms.

4.1.2 Assumptions underlying the analysis

MITTS is a partial-equilibrium supply-side model and thus the behavioural changes do not account for any changes in labour demand. If individuals prefer to work more hours after a reform then they can only do so if there is a demand for their labour. In MITTS it is assumed that the probability of employment at the individual level, although dependent on individual characteristics, remains the same after the policy change. That is, an increase in labour supply does not decrease the probability of employment. This is a reasonable assumption to make for Australia in the current situation of historically low unemployment (which was decreasing over the time period of interest). However, there still may be a mismatch of skills between the additional workers and the available vacancies.

4.2 Effect of the total ANTS package on all sole parents

The aggregate labour supply responses to the introduction of ANTS are presented in the

⁹ Labour supply is kept constant for some groups who are expected to differ in their responses (that is, be less responsive) compared to the average working-age individual. These groups are the self-employed, those on disability payments, full-time students and people over 65 years of age.

¹⁰ The optimal hours level is the labour supply where the utility of an individual is at a maximum.

¹¹ See Creedy and Kalb (2005) for a detailed description of the estimation, specification and simulation in behavioural microsimulation modelling.

first column of Table 2. The policy change leads to a net increase in the expected labour supply for sole parents. Although the policy reform causes some people to reduce their labour supply, this is outweighed by those who would like to increase their labour supply. The results also show that among those who already worked under the old system, the proportion who increases working hours dominates those who reduce working hours, producing an overall increase in average working hours. Due to the increased generosity of the social security system, welfare participation is expected to increase. However, the proportion of sole parents who receive welfare while participating in the labour force increases at the same time and to a larger extent.

Table 2: Summary of simulated labour supply responses (total ANTS package)

| | SIHC 1999/2000 ^b | SIHC 2000/2001 ^c |
|---|-----------------------------|-----------------------------|
| wage & salary workers (% in pre-reform period) ^(a) | 47.05 | 42.75 |
| Average hours in pre-reform period | 13.50 | 13.28 |
| non-work to work transition (in percentage points) | 1.43 | 0.87 |
| Work to non-work transition (in percentage points) | 0.88 | 1.24 |
| workers working more (in percentage points) | 1.79 | 0.89 |
| workers working less (in percentage points) | 1.17 | 1.84 |
| average hours change (in hours) | 0.43 | -0.32 |

Note (a): This excludes the self-employed for whom no hours of work are observed. Before the reform, the percentage of all workers in the sole parent population in 1999/2000 and 2000/2001 is 51.9 and 49.6 per cent respectively. Given the small number of sole parents, labour supply in the two years cannot be compared directly.

(b) Before the reform 61.80 per cent of all sole parents are participating in welfare, whereas after the reform 63.51 per cent are participating, due to the increased generosity of the payment. The proportion combining welfare and work is expected to increase from 16.73 to 19.63 per cent.

(c) Before the reform 61.47 per cent of all sole parents are participating in welfare, whereas after the reform 60.22 per cent are participating, due to the decreased generosity of the payment. The proportion combining welfare and work is expected to decrease from 14.57 to 13.36 per cent.

Cai *et al.* (2005) examined the separate components of the policy change.¹² They found that the income tax changes, the reduction in pension taper rate and the introduction of Family Tax Benefit part A were each predicted to have a positive effect, but the introduction of Family Tax Benefit part B was expected to have a large negative effect. The latter is likely to have been caused by the replacement of a rebate, which could only be received while paying tax (for which most sole parents would need to be employed), by additional fortnightly payments to all sole parents. As a result being out of the labour force has become more attractive.

In addition to the forward simulation results in the first column in Table 2, using

¹² The results presented in Cai *et al.* are based on an earlier version of the microsimulation model, including a different specification for the labour supply model. Therefore, the predicted outcomes are different from those presented in this paper.

1999/2000 SIHC data, for which the January 2000 tax and transfer system is used as the base (or pre-reform) system and ANTS as the post-reform system, a backward simulation is carried out. This simulation uses 2000/2001 SIHC data, where we reverse the policy changes. That is, in the backward simulation, ANTS is used as the pre-reform system and the January 2000 system as the post-reform system. The backward simulation serves a confirmation purpose only. Given the small number of sole parents in the SIHC, observed labour supply in the two years cannot be directly compared.¹³ We expect the two simulations to produce opposite effects of a similar size and this is indeed the case. When the policy changes are reversed, the simulated labour supply falls. These results confirm the finding by Kalb, Kew and Scutella (2005), an earlier study based on the SIHC 1997/1998, that ANTS has a positive effect on labour supply of sole parents.¹⁴ The magnitudes of their simulated effects are similar to the results in Table 2. The results in Table 2 appear to be consistent with the budget constraints for sole parents, outlined in Section 2, where it was found that the incentive to enter the labour force for non-participating sole parents, who are mostly on low wages, might be smaller than the incentive for part-time workers on medium wages to increase their labour supply. It also appears that the substitution effect dominates the income effect, with more workers increasing labour supply than decreasing labour supply.

4.3 Comparison of the microsimulation approach with the difference-in-difference approach

In this subsection we aim to “validate” the results obtained in Section 4.2, by using a difference-in-difference approach as an alternative method and design a microsimulation analysis in such a way that these two approaches are directly comparable. The comparison can be made in this paper, because the policy change of interest was introduced a sufficiently long time ago, so that pre- and post-change data are now available. The strength of microsimulation lies in the fact that results can be produced ex ante any change. However, this is only useful if the results are believed to be informative with regard to the actual outcome. Confidence in the information value of microsimulation results can be increased by comparing with results obtained ex-post

¹³ Due to the small sample size, the post-reform labour force participation in the forward simulation cannot be directly compared with the pre-reform participation in the backward simulation. For example, characteristics such as education level or age may differ to some extent in the two samples.

¹⁴ Kalb, Kew and Scutella (2005) used the 1997/1998 SIHC data and updated these data to represent January 2000, because the more recent data were not available at that time.

on a regular basis. This section discusses an explicit comparison of the two approaches.

4.3.1 Estimating policy effects using the difference-in-difference approach

This subsection evaluates the actual employment and labour supply change in response to the change in the Parenting Payment Single withdrawal rate and some of the relative rates of family payments, rebates and pensions. A quasi-experimental evaluation approach, based on data observed before and after the policy reform, is used for the analysis.

In this ex-post evaluation, a difference-in-difference method is applied to identify the effect of this change in financial incentives for sole parents. The difference-in-difference approach identifies the treatment effect as the difference in the labour force outcome for a treatment group between post- and pre-policy change periods minus the difference in the outcome for a control group between post- and pre-policy change periods, conditional on other observed characteristics.

We use alternative control and treatment groups to explore the sensitivity of the results to our choice. The treatment group is defined as all sole parents with children less than 16 years of age, because they are in principle eligible for Parenting Payment Single. Although only individuals in this group with income not exceeding a certain threshold are eligible for this sole parent pension, all of them are subject to this policy change irrespective of their income. This is due to income being at least partly determined by labour supply behaviour, and labour supply could be affected by the reduction in withdrawal rates. Therefore, all sole parents with children aged under 16 are potentially eligible for sole parent payments as long as they do not have a sufficient amount of income from non-labour sources rendering them ineligible for the income support payment.

Starting with the most comparable, but therefore smallest control group, we select sole parents whose youngest child is 16 or 17 years old and who are therefore ineligible for the sole parent pension. The difference-in-difference method is based on the assumption that the treatment and control groups have similar time effects (including a cyclical effect and a general time trend) when their circumstances are the same. However, we suspect that sole parents with very young children may have a different time trend compared with the comparison group, possibly due to the different demands on the mother with regard to the required child-caring time. Moreover, the effect of changes in

childcare cost and availability over time may vary by the age of children. To avoid this problem, we restrict the treatment group sample to sole parents whose youngest child is aged 14 or 15. Since the youngest children in the households in the restricted treatment and control groups are all of secondary school age, it is likely that the time effects are similar between these two groups. Appendix table D1 presents summary statistics of individuals' characteristics by treatment and control group. As expected, average characteristics are fairly similar between the two groups.

Due to the sample restriction, the parameter estimated here is not the effect of treatment on the treated in general. Instead, it is the effect of treatment for those whose youngest child is aged 14 or 15. It is important to note that those with younger children (that is children under 14) are likely to have different treatment effects from the group evaluated in this section. The results from the microsimulation approach suggest that the policy effects are smaller for sole parents with children under school age.

A second difference-in-difference analysis compares the complete group of sole parents with children younger than 16 years to single persons aged 59 or less (one of the matching variables is gender of the sole parent and the single person).¹⁵ This approach follows for example Blundell *et al.* (2004a) who select single women as a comparison group for single mothers. These two groups are likely to be more different than the treatment and control group in the first analysis. Finally, in a third analysis, we compare the complete group of sole parents with children younger than 16 years to married mothers (following Doiron, 2004).

The outcomes of interest include an individual's labour force participation status, employment status, full time employment status and working hours. We implement difference-in-difference estimators through two different econometric methods — conventional regression and matching methods (Blundell and Costa Dias, 2000). Both methods operate under the assumption that the time effects are the same between treatment and control group.

For the binary outcome variables a probit model is applied. The explanatory variables include individuals' characteristics, a post policy period dummy, a treatment dummy and the interaction of post policy and treatment dummies (for details on explanatory variables and functional forms, see Appendix table D2). The difference-in-difference

¹⁵ This cut-off age was chosen since it was the age of the oldest sole parent in our sample.

predicted effect resulting from belonging to a particular group on the probability of being in a particular outcome state is averaged across all observations. Working hours, a continuous variable, is only available in fairly large categories in the census data; therefore, interval regression is used in the analysis. Again, the difference-in-difference predicted effect is averaged across all observations.

The difference-in-difference method can also be applied in combination with a matching method (Blundell *et al.*, 2004b). The intuition behind the matching difference-in-difference is to reweight the three non-treated groups (post-policy control group for the first matching, and pre-policy treatment and control groups for the second and third matching respectively) so that they have similar observed characteristics as the treated group. The weights for non-treated groups are obtained using a matching algorithm.

To implement the matching method we use a Propensity Score Model (PSM) approach. This involves matching treated and non-treated observations on the basis of the predicted probability of being in the treated group (Rosenbaum and Rubin, 1983). In this paper, linear predictions from a probit equation (LP) instead of the normal distribution transformed propensity score are used. The covariates used in the probit model are the same as the control variables used in the regression method. To find an appropriate functional form of the probit model for treatment participation a balancing test is used (see Dehejia and Wahba, 1999, 2002; and Smith and Todd, 2005).¹⁶

Different matching algorithms can be applied to generate the weights for the matched control groups in the above equation. We applied local linear matching, as used in Borland and Tseng (2007), as the basic procedure.¹⁷ This procedure was developed based on Heckman, Ichimura and Todd (1997, p.631).¹⁸

¹⁶ The test was implemented by (i) dividing treated and non-treated observations into 10 groups each (to give an equal number of treatment observations in each group); (ii) performing a Hotelling test for the joint null hypothesis of equal means for all covariates between treated and non-treated groups; and (iii) adjust the number of groups or change functional form until it is not possible to reject the joint null for the Hotelling test.

¹⁷ In addition, two alternative matching algorithms are applied—nearest neighbour matching and kernel matching—as a sensitivity analysis. For detailed steps of these two matching procedures, see Borland and Tseng (2007). The results across the different matching approaches are found to be quite similar, therefore only the local linear matching results are presented in the results. See Smith and Todd (2005) for comparisons of matching estimators, and for the advantages of local linear Smoothers, which underlie the local linear matching estimator, see Fan (1992a, b).

¹⁸ For the outcome measure of working hours (using midpoints of the categories), an OLS regression is applied instead of interval regression. We did not use the latter for two reasons: 1) interval regression is much more demanding than OLS in terms of computation time, which would increase the already considerable amount of time required to apply the local linear matching approach; and 2) the number of

Compared with traditional regression methods, the matching method has the advantage that it is a semi-parametric approach, which avoids imposing the functional form restrictions implicit in a linear regression. Smith and Todd (2005) suggest that avoiding these functional form restrictions can be important in reducing bias. Although the results of regressions could be improved by adding higher-order terms and interaction terms, this is not often done.

Table 3 shows the difference-in-difference estimates of policy effects in the form of changes in four different outcome measures. These are the participation rate, the employment rate, the full-time employment rate and average working hours. In the first analysis, these effects apply only to sole parents whose youngest child is aged 14 or 15 years. The policy changes may have had different effects for sole parents with children younger than 14 years.

Table 3: Estimated effects of the policy changes

| | In labour force (in ppt) | Employed (in ppt) | Full-time employed (in ppt) | Working hours per week |
|---|-----------------------------|----------------------|--------------------------------|---------------------------|
| <i>Sole parents with a youngest child of 14 or 15 vs. sole parents with a youngest child of 16 or 17¹⁹</i> | | | | |
| Matching approach | 6.281 (4.344) | 2.184 (4.847) | 5.896 (5.081) | 2.418 (2.682) |
| Regression approach | 6.695 (3.823) | 2.970 (4.321) | 3.392 (4.410) | 2.192 (2.017) |
| <i>Estimated effects using the matching approach for different comparison groups</i> | | | | |
| Sole parents vs. single persons | 1.505 (1.405) | -0.099 (1.485) | 1.856 (1.357) | 0.312 (8.222) |
| Sole parents vs. married mothers | -1.132 (1.513) | -1.438 (1.527) | -0.408 (1.172) | -0.168 (0.806) |

- Notes: a. Standard errors in parentheses are obtained through bootstrapping with 400 replications.
b. For the binary outcome variables, the policy changes are presented as changes in percentage points (ppt) in the proportion of employed, full-time employed (working 35 hours or more) and not in labour force.
c. See appendix D for the coefficients of the probit and interval estimations. The results of the propensity score probit model estimation are available from the authors on request.

The first row in the table presents the results from the matching approach. It indicates that the policy change increased the participation rate by 6.3 percentage points. The employment rate and full-time employment rate were raised by 2.2 and 5.9 percentage

control observations that fall into the callipers of some treatment observations is small, thus interval regression may not be suitable.

¹⁹ Similar results are obtained when the treatment group is extended to all sole parents with a youngest child aged between 13 and 15 years of age.

points respectively and this translated into an increase in average working hours by 2.4 hours. The higher increase in participation rate than in employment rate implies that the change in financial incentive has increased labour supply but not all sole parents, who want to move into work, have found a job in the short period of time the data allows since the change. Similar results are found using the regression approach. However, all policy effects are statistically insignificant, with only the participation rate being close to significance at the 10 per cent level.²⁰

The assumption that the time effects of the treatment and control group are the same (on which the difference-in-difference approach is based) can be tested indirectly using data from two pre-policy-change periods. If the assumption is true, we should find a zero difference-in-difference outcome in the absence of policy changes. Based on the Census 1991 and the Census 1996, a relatively small increase in the participation rate is found compared to the result in Table 3. The other outcomes have decreased from 1991 to 1996 for sole parents with younger children relative to those with older children. We also perform the test using the SIHC data, pooling two samples for the first pre-policy-change period (1995/1996 and 1996/1997 SIHC) and two samples for the second pre-policy-change period (1997/1998 and 1999/2000 SIHC). Due to the small sample size, the test is applied using regression only. None of the estimated difference-in-difference outcomes are significantly different from zero and the estimated parameters are relatively small.

In the second difference-in-difference analysis, comparing all sole parents to single persons, the predicted effects are much smaller and remain insignificant. This could be due to the larger heterogeneity in policy effects for the complete group of sole parents. For example, it appears that the effects for sole parents with young children are smaller than for those with older children. Further evidence of heterogeneity in policy effects across the groups was found in a sensitivity analysis, in which policy effects were

²⁰ In an alternative specification, variables are included in the propensity score probit regression to control for other household income. The income variables in the Census are measured in broad categories and are therefore difficult to correct for inflation. To circumvent this problem, only a dummy when employment of children and other relatives is over 15 hours per week is included. The relative magnitude of the predicted effects on labour supply remains similar. The additional employment dummies are potentially endogenous, if sole parents' incomes would influence their children's or relatives' employment as well. This endogeneity is expected to bias the predicted labour supply effects downwards, and indeed, the labour supply responses in the alternative specification are somewhat below those presented in Table 3. An additional variable of interest is the State of residence, but in 1996 this variable appears unreliably observed in the Census. However, our analysis includes a dummy variable distinguishing rural and urban areas.

calculated by educational attainment.²¹ The policy change appears to have a significant positive effect on the participation rate of sole parents without post-school qualifications but a negative (insignificant) effect for those with post-school qualifications. Overall, sole parents without qualifications have a larger positive response to the policy changes than those with qualifications and this is reflected in the larger increase in their average working hours. Similarly, differences are found by age group, although the average effects are all positive for both age groups. However, larger positive effects are found for the full-time employment rate of younger sole parents and for the participation rate of older sole parents.

Finally, in the third analysis, comparing sole parents to married mothers, only negative effects are found. Comparing the change in budget constraints of sole parents (in Section 2) to the change for single persons and married mothers with full-time working partners (in Appendix E), it is clear that single persons were much less affected by the policy change than married mothers. As a result, singles are a much more suitable comparison group than married mothers who can be expected to have had their own labour supply response to the policy changes.²²

4.3.2 Setting up a comparable microsimulation

In the previous subsection, quasi-experimental evaluation methods were used to assess the effect of the ANTS package for sole parents with children under 16 years of age relative to other demographic groups. This provides us with the opportunity to compare the predictions from microsimulation with an evaluation based on pre- and post-reform data. The microsimulation results in Section 4.2 relate to the effect of all components of the ANTS package on the labour supply of sole parents. However, the ANTS package has also affected the other demographic groups. This means that in the quasi-experimental evaluation, family payments are likely to have changed (although to a different extent) for both the control and treatment group, as have the relative levels of the different income support payments. For example, the budget constraint and METRs of single persons changed, although much less than those of sole parents. As a result, the difference-in-difference analyses do not capture the effect of the full ANTS package.

²¹ The results were estimated by applying the difference-in-difference method separately for different target groups. These results are available from the authors on request.

²² In the microsimulation, married mothers are found to have larger positive labour supply responses than sole parents.

Therefore, to enable a proper comparison of the microsimulation and quasi-experimental evaluation results, we use microsimulation to replicate the exact analyses of Section 4.3.1.²³ We simulate the effect for each of the treatment and control groups selected in the previous section, and then compute the difference in the effects. This provides an indication of how similar the difference in predicted changes by the microsimulation model is to the observed relative changes after the reform, as calculated in the difference-in-difference approach. Table 4 presents these results using the SIHC 1999/2000, and the results are confirmed by also simulating the effect of the full ANTS package backwards, starting from the SIHC 2000/2001. This gives similar results to the forward simulation for single persons and the sole parent group with older children providing confirmation of the results. However, the results from the reverse simulation for sole parents with a 14 or 15 year old child are not consistent with the other results. This appears to be due to a few observations, and for the group of sole parents with a 13 or 14 year old child the results are as expected. Due to the small sample sizes for the sole parents subgroups, the results can be easily affected by outliers.²⁴

Both simulations confirm that the effect of the policy change is larger for the subgroup of sole parents with children aged 14 or 15 years than for the overall group of sole parents. Labour force participation before the change is clearly higher as well in this group with older children. However, further increasing the age of the children shows that the overall effect for sole parents with dependent children over 15 years is much smaller than for the group of sole parents with younger children. The effect is slightly negative, whereas the pre-reform level of labour force participation is higher than for sole parents with a youngest child of 14 or 15 years old.

The effects for singles are relatively small, but positive. This is consistent with the results found in the quasi-experimental evaluations when comparing sole parents with single persons. The effects were smaller compared to the effects found when using the two sole parents groups with differently aged youngest children. This appears to be due to the smaller effect for all sole parents with children under 16 years of age (compared

²³ Except for the matching component in the analysis, which attaches different weights to observations in the control group depending on the similarity in characteristics to observations in the treatment group.

²⁴ The group of single parents with a 14 or 15 year old child as the youngest child only has 51 observations in 1999/2000 and 57 observations in 2000/2001. The group of single parents with a 16 or 17 year old child as the youngest child only has 29 observations in 1999/2000 and 38 observations in 2000/2001.

to those with a youngest child aged 14 or 15), and to the small positive effect for single persons (compared to the small negative effect for sole parents with a youngest child aged 16 or 17 years of age).

Table 4 Summary of labour supply responses for sole parents and single persons

| | Single parent with 14 or 15 year old child | Single parent with 16 or 17 year old child | Single women aged 20 to 59 | Single men aged 20 to 59 |
|---|--|--|-------------------------------|-----------------------------|
| Full ANTS package | | | | |
| Wage & salary workers (% in pre-reform period) ^a | 58.87 | 59.68 | 72.31 | 68.31 |
| Wage & salary workers (% in post-reform period) ^a | 60.48 | 58.40 | 72.66 | 68.36 |
| non-work to work (%) | 2.74 | 0.17 | 0.39 | 0.10 |
| work to non-work (%) | 1.13 | 1.45 | 0.04 | 0.05 |
| workers working more | 2.17 | 2.56 | 0.42 | 0.38 |
| workers working less | 2.49 | 0.19 | 0.31 | 0.22 |
| Average hours (pre-reform) | 19.23 | 21.64 | 27.08 | 26.70 |
| average hours change | 0.68 | -0.16 | 0.12 | 0.05 |
| Full ANTS backward simulation | | | | |
| Wage & salary workers (% in pre-reform period) ^a | 52.26 (54.82) ^b | 64.80 | 72.64 | 65.83 |
| Wage & salary workers (% in post-reform period) ^a | 51.99 (53.71) | 65.02 | 72.38 | 65.66 |
| non-work to work (%) | 0.67 (0.90) | 0.22 | 0.01 | 0.01 |
| Work to non-work (%) | 0.94 (2.01) | 0.00 | 0.27 | 0.18 |
| workers working more | 1.65 (2.00) | 0.19 | 0.29 | 0.13 |
| workers working less | 2.14 (3.48) | 1.30 | 0.59 | 0.41 |
| Average hours (pre-reform) | 15.80 (19.13) | 23.37 | 26.64 | 26.41 |
| average hours change | -0.20 (-0.68) | -0.13 | -0.14 | -0.12 |

Note (a): This excludes the self-employed for whom no hours of work are observed.

(b): In the reverse simulation, unusual results are obtained for the group of parents with a youngest child of 15 years of age. That is, the labour market outcomes compared to those with a youngest child aged 14 years are lower than expected. For this reason, we also look at the group of parents with a youngest child aged 13 or 14 years (presented in parentheses in column 1). This group contains 55 sole parents.

For each of the simulations, we calculate the same measures as used in the evaluation approaches, except for the separate labour force participation. Table 5 compares the results from the different MITTS simulations with the results from local linear matching in the previous subsection. In addition, alternative local linear matching results are presented to allow for fixing the labour supply response to zero for self employed sole parents in the microsimulation. This alternative sets the effect for self employed to zero. The difference in simulation results for sole parents with a youngest child of 14 or 15 years old versus sole parents with a youngest child of 16 or 17 years old, and all sole parents versus single women is presented in the rows in italics. For the results from the evaluation and the microsimulation approach to support each other, the results in the

row in bold italics have to be close to the corresponding local linear matching results in the row above in a bold font.

Table 5 Comparison of the estimated effects for different treatment and control groups

| Change in: | Average hours (per week) | Probability of employment (in percentage points) | Probability of full-time emp. (in percentage points) |
|--|--------------------------|--|--|
| Local Linear Matching: sole parents with youngest child of 14-15 versus sole parents with youngest child of 16-17^a | 2.4 | 2.2 | 5.9 |
| <i>Local Linear Matching setting the labour response of the self employed to zero^a</i> | 1.5 | 2.5 | 5.2 |
| Effect of full ANTS package for sole parents with youngest child of 14-15 (a) | 0.7 | 1.6 | 0.5 |
| Effect of full ANTS package for sole parents with youngest child of 16-17 (b) | -0.2 | -1.3 | 0.0 |
| <i>Difference in full effect (a – b)</i> | 0.9 | 2.9 | 0.5 |
| Local Linear Matching: all sole parents versus single persons^a | 0.3 | -0.1 | 1.9 |
| Effect of full ANTS package for all single parents (c) | 0.4 | 0.6 | 0.4 |
| Effect of full ANTS package for single women (d) | 0.1 | 0.4 | 0.2 |
| <i>Difference in full effect (c – d)</i> | 0.3 | 0.2 | 0.2 |
| Effect of full ANTS package for all single parents (e) | 0.4 | 0.6 | 0.4 |
| Effect of full ANTS package for single men (f) | 0.0 | 0.1 | 0.1 |
| <i>Difference in full effect (e – f)</i> | 0.4 | 0.5 | 0.3 |

Note a: None of the effects from the Local Linear Matching approach are statistically significant.

The results on average hours are very close to the results from local linear matching. Regarding the labour force participation measures, a lower probability of full-time employment, a higher probability of part-time employment (the evaluation approach shows a decrease in part-time participation), and a higher overall probability of employment are predicted using microsimulation. This might be due to a limited number of part-time jobs being available in the labour market. That is, even if some sole parents prefer a part-time job they may not be able to find one and decide not to participate in the labour force or to work full-time. Although individuals are expected to adjust their working hours towards their preferred hours over time as reported in Headey, Warren and Harding (2006), this takes time.²⁵ The 2001 Census used in this paper was collected one year after the policy changes, which only allowed limited time for sole parents to adjust towards their preferred hours of labour supply.

²⁵ Headey, Warren and Harding found that nearly 40 per cent of full-time workers who preferred to work fewer hours in 2001 had moved to their preferred hours by 2003.

A concern with behavioural microsimulation is often that it may overestimate the actual effect. However, Table 5 shows that the overall labour supply results from the simulation and evaluation approaches are in the same direction and of similar magnitude. Similar conclusions were drawn by Doiron (2004). When she compared the results from her evaluation study of the late 1980s changes to payments for sole parents to the effects of comparable (but not the same) changes to the tax and transfer system, as published in Duncan and Harris (2002) and Creedy, Kalb and Kew (2003), she found that the quasi-experimental evaluation approach seemed to estimate similar but somewhat larger effects than obtained from behavioural microsimulation for comparable hypothetical policy changes.

6 Conclusion

The main aim of this paper was to evaluate the effects of a recent policy change on labour supply and compare the estimated effects using two different approaches. For a subgroup of sole parents this paper has made a meaningful comparison between results using two different approaches and different data. The results obtained using behavioural microsimulation based on SIHC 1999/2000 data, where labour supply responses are predicted using structural modelling, are comparable to the quasi-experimental evaluation results based on a reduced form approach using 1996 and 2001 Census data.

Although the effects found are not large, the combined policy changes seem to have had modest positive effects on labour supply. We found, both from behavioural microsimulation and from the quasi-experimental evaluation (using different comparison groups), that the income tax changes, the reduced pension withdrawal rate and changed family payments had resulted in a moderate increase in employment. In addition, the point estimates for the effects on average hours are remarkably close to the results found for the same subgroup of sole parents through microsimulation using MITTS. The quasi-experimental evaluation approach resulted in larger estimates of full-time employment increases, but lower estimates of total employment increases compared to the effects predicted by MITTS. This might be due to the relatively low number of part-time jobs available causing sole parents, who would like to work part time, to stay out of the labour force or to work full time instead. Although individuals are expected to adjust their working hours towards their preferred hours over time, this

takes time (Headey, Warren and Harding, 2006). It would be interesting to investigate whether the estimates from the two different approaches would be more similar if data from the last Census in 2006 (which are not yet available) were used. The 2001 Census used in this paper was collected one year after the policy changes, which only allowed limited time for adjustments to sole parents' preferred hours of labour supply.

The consistency of the two sets of results for sole parents with older children and for all sole parents increases our confidence in the conclusion that the policy change of July 2000 had a modest positive effect on sole parents' labour supply in Australia, as predicted by the microsimulation analysis for all sole parents. The use of two different approaches to evaluate the effect of a policy change enables the drawing of firmer conclusions, although the lack of clearly significant results from the difference-in-difference analysis means we need to remain cautious. In addition, repeated comparisons of outcomes of policy reforms between alternative approaches can increase confidence in a method, if the outcomes using the method of interest repeatedly coincide with outcomes obtained using other rigorous methods.

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Appendix A: Details of the Australian tax and social security system pre- and post-reform (in Australian dollars)

The most relevant features of the pre-reform and post-reform systems are described in this appendix. They include information on personal income taxes, the family assistance schemes, allowances and pensions.

In order to compensate for increased indirect taxes through the newly introduced GST, personal income taxes were decreased at the same time. Table A1 shows the increase in income thresholds and the lowering of the taxation rates. This change affects the largest number of individuals, given that Family allowances and social security benefits are only paid to a limited proportion of the population, whereas nearly all income earners pay tax.

Table A1 Taxation rates

| 1999/2000 | | 2000/2001 | |
|------------------------------------|-----------------|------------------------------------|-----------------|
| Income range in \$ per week | Tax rate | Income range in \$ per week | Tax rate |
| 0 – 103.56 | Nil | 0 – 115.07 | nil |
| 103.57 – 396.99 | 0.20 | 115.08 – 383.56 | 0.17 |
| 397.00 – 728.77 | 0.34 | 383.57 – 958.90 | 0.30 |
| 728.78 – 958.90 | 0.43 | 958.91 – 1150.68 | 0.42 |
| More than 958.90 | 0.47 | More than 1150.68 | 0.47 |

Table A.2 summarizes the changes that have taken place in the allowances paid to unemployed individuals (sole parents with children over 15 years of age were eligible for this payment). They mainly involve increases of the maximum payment rate and the threshold incomes. Table A.2 further shows that the rates and income thresholds of pensions (including Parenting Payment single for sole parents with a child under 15 years of age) have also increased somewhat in July 2000, but the most important change has been the decrease of the taper rate by ten percentage points for incomes greater than the free area.

Before July 2000, family assistance consisted of a range of separate schemes, several of them with their own withdrawal rate. From July 2000 onwards these schemes are combined in the new Family Tax Assistance part A and part B, resulting in fewer different payments at a higher level with only two withdrawal rates. Table A.3 provides

a comprehensive overview of the family assistance schemes in place before and after July 2000.

Table A.2 Weekly Allowances, Pensions and Parenting Payment Single ^a

| January 2000 | | July 2000 | |
|---|-------------------------------------|---|-------------------------------------|
| <i>Allowances</i> | | | |
| Maximum rate sole parent | \$176.70 | Maximum rate sole parent | \$186.50 |
| Free area for income below | \$30.00 | Free area for income below | \$31.00 |
| Withdrawal rate of 0.5 for income < | \$70.00 | Withdrawal rate of 0.5 for income < | \$72.00 |
| Withdrawal rate of 0.7 for income < | \$70.00 | Withdrawal rate of 0.7 for income > | \$72.00 |
| <i>Youth allowances (for 16-20 yr olds and 16-24 yr old students)</i> | | | |
| Maximum rate for 16-20 yr old singles with children | \$177.05 | Maximum rate for 16-20 yr old singles with children | \$184.15 |
| Free area for income below | \$30.00 | Free area for income below | \$31.00 |
| Withdrawal rate of 0.5 for income < | \$70.00 | Withdrawal rate of 0.5 for income < | \$71.00 |
| Withdrawal rate of 0.7 for income > | \$70.00 | Withdrawal rate of 0.7 for income > | \$71.00 |
| <i>Pensions and Parenting Payment Single</i> | | | |
| Maximum rate single | \$183.25 | Maximum rate single | \$193.45 |
| Free area for income below | \$51.00+ \$12.00×nc ^b | Free area for income below | \$53.00+\$12.30× nc ^b |
| Withdrawal rate for income over the free area | 0.5 | Withdrawal rate for income over the free area | 0.4 |

Notes a: As a comparison, average weekly earnings for women in August 2000 were \$514.10 and average weekly earnings for women working full time were \$728.50 (ABS, 2005).

b: nc = the number of dependent children in the household

The most important changes are, that the “sudden death” income test of family payments at the minimum level has been replaced with a 0.3 withdrawal rate; the free area for the maximum level of family payments has increased from \$23,550 per year to \$28,200; and the withdrawal rate of the maximum level family payments for income over \$28,200 per year has decreased from 0.5 to 0.3. A large number of families are affected by these changes, given the high level of income at which families still qualify for a payment from the family assistance scheme. However, the absolute amount by which net incomes of middle-income families have changed is small.

Table A.3 Weekly family Assistance

| January 2000 | | July 2000 | |
|---|--|--|--------------------------------------|
| For all families with children | | | |
| <i>Family Allowance</i> | | <i>Family Tax Assistance part A</i> | |
| Minimum rate | \$12.00 | Minimum rate (0-17 yr old) | \$18.69 |
| | | Minimum rate (18-24 yr old) | \$25.06 |
| Large family supplement for fourth and each subsequent child | \$3.95 | Large family supplement for fourth and each subsequent child | \$4.00 |
| Maximum basic rates: | | Maximum basic rates: | |
| for 0-12 yr old | \$50.80 | for 0-12 yr old | \$58.10 |
| for 13-15 yr old | \$66.10 | for 13-15 yr old | \$73.64 |
| for 16-17 yr old | \$12.00 | for 16-17 yr old | \$18.69 |
| for 18-24 yr old | \$25.00 | for 18-24 yr old | \$25.06 |
| Minimum rate payable for annual income below | $\$67,134 + \$3,359 \times (nc - 1)$ | Minimum rate payable for annual income below | $\$73,000 + \$3,000 \times (nc - 1)$ |
| Maximum rate payable for annual income below | $\$23,800 + \$624 \times (nc - 1)$ | Maximum rate payable for annual income below | \$28,200 |
| Withdrawal rates for: | | Withdrawal rates for: | |
| minimum rate | “Sudden death” | both payments | 0.3 |
| more-than-minimum rate | 0.5 | | |
| <i>Family Tax Payment part A</i> | | | |
| Rate per child per week | \$3.85 | | |
| Payable to families who receive Family Allowance | at the more-than-minimum rate | | |
| <i>Family Tax Initiative part A</i> | | | |
| Annual tax free threshold increases by | $\$1000 \times nc$ | | |
| if annual income is under | $\$70,000 + \$3,000 \times nc$ | | |
| For single-income families with children (payments per family) | | | |
| <i>Family Tax Payment part B (child < 5 years)</i> | | <i>Family Tax Assistance part B</i> | |
| Maximum rate: | | Maximum rate: | |
| if youngest child 0-4 yrs old | \$9.62 | if youngest child 5-18 yrs old | \$34.79 |
| No income test for sole parents | | if youngest child 0-4 yrs old | \$49.91 |
| | | No income test for sole parents | |
| <i>Guardian Allowance</i> | | | |
| Maximum rate | \$18.35 | | |
| Payable to sole parents who | get more-than-minimum Family Allowance | | |
| <i>Sole Parent Rebate</i> | | | |
| Maximum annual rate | \$1243 | | |

Note a: nc = the number of dependent children in the household

Appendix B: Summary Statistics for the SIHC 1999/2000 and 2000/2001 and the Census Data 1996 and 2001

Table B.1 Age of the mother (in %)

| | SIHC | | Census | |
|-------------------|-----------|-----------|--------|-------|
| | 1999/2000 | 2000/2001 | 1996 | 2001 |
| Number of persons | 555 | 598 | 4,369 | 5,149 |
| 15-19 | 0.18 | 1.17 | 1.72 | 1.11 |
| 20-24 | 6.67 | 6.52 | 8.70 | 5.67 |
| 25-29 | 12.97 | 12.37 | 12.36 | 11.44 |
| 30-34 | 18.38 | 17.73 | 17.67 | 16.00 |
| 35-39 | 22.16 | 18.73 | 19.75 | 19.36 |
| 40-44 | 20.18 | 20.40 | 19.27 | 21.69 |
| 45-49 | 11.35 | 13.88 | 12.95 | 13.28 |
| 50-54 | 5.95 | 6.69 | 4.90 | 7.77 |
| 55-59 | 1.44 | 1.67 | 1.60 | 2.00 |
| 60-64 | 0.36 | 0.50 | 0.46 | 0.87 |
| 65plus | 0.36 | 0.33 | 0.62 | 0.80 |

Table B.2 Children's characteristics

| | SIHC | | Census | |
|---------------------------------------|-----------|-----------|--------|-------|
| | 1999/2000 | 2000/2001 | 1996 | 2001 |
| Number of persons | 555 | 598 | 4,369 | 5,149 |
| Number of dependent children (in %) | | | | |
| 1 | 48.65 | 51.68 | 52.90 | 51.12 |
| 2 | 34.59 | 32.61 | 31.61 | 33.09 |
| 3 | 12.43 | 11.37 | 11.86 | 12.06 |
| 4 | 4.32 | 4.35 | 3.64 | 3.73 |
| Average number of dependent children | 1.72 | 1.68 | 1.68 | 1.69 |
| <i>standard deviation</i> | 0.84 | 0.84 | 0.88 | 0.85 |
| Age of youngest child under 15 (in %) | | | | |
| 0-2 | 20.00 | 16.72 | 19.36 | 16.55 |
| 3-4 | 11.35 | 12.21 | 12.73 | 11.63 |
| 5-9 | 29.73 | 27.76 | 26.09 | 27.83 |
| 10-14 | 23.42 | 25.42 | 25.34 | 26.22 |
| 15 | 4.86 | 5.18 | 4.53 | 5.03 |
| 16-plus | 10.63 | 12.71 | 11.95 | 12.74 |

Table B.3 Highest qualification (in %)

| | SIHC | | Census | |
|---------------------------------|-----------|-----------|--------|-------|
| | 1999/2000 | 2000/2001 | 1996 | 2001 |
| Number of persons | 555 | 598 | 4,369 | 5,149 |
| Still at school | 0.18 | 0.17 | 0.85 | 0.58 |
| Degree and higher | 10.81 | 14.05 | 8.61 | 10.8 |
| Other post-school qualification | 32.43 | 32.11 | 25.66 | 27.79 |
| No qualification | 56.58 | 53.68 | 64.89 | 60.83 |

Table B.4 Labour market status by age of the youngest child (row percentage)

SIHC 1999/2000

| Age of youngest child | full-time | part-time | unemployed | non-participation | total |
|-----------------------|-----------|-----------|------------|-------------------|-------|
| 0-2 | 7.21 | 25.23 | 9.91 | 57.66 | 100 |
| 3-4 | 19.05 | 19.05 | 4.76 | 57.14 | 100 |
| 5-9 | 26.06 | 32.12 | 7.88 | 33.94 | 100 |
| 10-14 | 36.92 | 24.62 | 6.92 | 31.54 | 100 |
| 15 | 33.33 | 40.74 | 3.70 | 22.22 | 100 |
| 16plus | 50.85 | 16.95 | 3.39 | 28.81 | 100 |
| All | 27.03 | 26.31 | 7.03 | 39.64 | 100 |

SIHC 2000/2001

| Age of youngest child | full-time | part-time | unemployed | non-participation | total |
|-----------------------|-----------|-----------|------------|-------------------|-------|
| 0-2 | 55.26 | 19.74 | 5.26 | 19.74 | 100 |
| 3-4 | 7.00 | 15.00 | 12.00 | 66.00 | 100 |
| 5-9 | 15.07 | 15.07 | 8.22 | 61.64 | 100 |
| 10-14 | 32.53 | 24.70 | 12.65 | 30.12 | 100 |
| 15 | 37.50 | 22.37 | 8.55 | 31.58 | 100 |
| 16plus | 19.35 | 29.03 | 25.81 | 25.81 | 100 |
| All | 29.60 | 20.90 | 10.70 | 38.80 | 100 |

Census 1996

| Age of youngest child | full-time | part-time | unemployed | non-participation | total |
|-----------------------|-----------|-----------|------------|-------------------|-------|
| 0-2 | 6.55 | 14.91 | 8.12 | 70.42 | 100 |
| 3-4 | 12.55 | 24.17 | 9.59 | 53.69 | 100 |
| 5-9 | 21.28 | 27.86 | 11.27 | 39.59 | 100 |
| 10-14 | 31.86 | 26.48 | 9.71 | 31.95 | 100 |
| 15 | 40.93 | 22.8 | 8.81 | 27.46 | 100 |
| 16plus | 47.74 | 20.63 | 9.63 | 22.00 | 100 |
| All | 24.02 | 23.43 | 9.74 | 42.82 | 100 |

Census 2001

| Age of youngest child | full-time | part-time | unemployed | non-participation | total |
|-----------------------|-----------|-----------|------------|-------------------|-------|
| 0-2 | 9.06 | 16.45 | 7.99 | 66.51 | 100 |
| 3-4 | 12.56 | 23.26 | 11.38 | 52.80 | 100 |
| 5-9 | 21.17 | 28.23 | 10.05 | 40.56 | 100 |
| 10-14 | 27.82 | 29.80 | 8.95 | 33.43 | 100 |
| 15 | 39.13 | 30.04 | 6.32 | 24.51 | 100 |
| 16plus | 44.13 | 23.94 | 7.04 | 24.88 | 100 |
| All | 23.70 | 25.64 | 9.00 | 41.65 | 100 |

Table B.5 Sources and amount of income for sole parents as observed in the SIHC

| | SIHC 1999/2000 | SIHC 2000/2001 |
|--|----------------|----------------|
| Number of persons | 555 | 598 |
| Principal sources of current (weekly) income | | |
| Personal income (%) | | |
| not applicable | 0.72 | 0.67 |
| wage/salary | 36.94 | 36.62 |
| own business | 1.98 | 2.84 |
| Government pension/allowance | 55.32 | 56.86 |
| superannuation | 1.08 | 0.17 |
| property | 0.54 | 1.17 |
| other | 3.42 | 1.67 |
| Average income in AU\$ (current weekly) | | |
| Personal income in AU\$ (current weekly) | | |
| wage/salary | 231.97 | 250.24 |
| <i>standard deviation</i> | <i>331.74</i> | <i>368.15</i> |
| total earned income | 241.83 | 265.11 |
| <i>standard deviation</i> | <i>340.93</i> | <i>375.30</i> |
| Government pension/allowance | 184.91 | 205.14 |
| <i>standard deviation</i> | <i>130.86</i> | <i>140.34</i> |
| total income | 477.13 | 512.42 |
| <i>standard deviation</i> | <i>289.10</i> | <i>311.08</i> |

Appendix C: The Labour Supply and Welfare Participation Model

The labour supply and welfare participation model is described in detail in Kalb and Buddelmeyer (2005).²⁶ Here, we provide an overview only. The approach follows most of the literature in adopting a neoclassical framework: utility is maximised conditional on the total amount of time available and a household budget constraint. It is expected that utility increases with an increase in leisure and home production time (referred to as leisure for convenience) and income (consumption of all other goods). Households maximise utility by choosing leisure (and hence labour supply).²⁷ The labour supply value is an endogenous variable in the model. Wage rates, non-labour income (other than taxes and transfers), household composition and other household attributes are exogenous. Specifically, exogenous factors include the number and ages of children, the age and education level of the adult, and components of income other than labour earnings, transfers and taxes. The rules of the taxation and social security systems are used to obtain the net income of the household arising from its choice of labour supply. This basic labour supply model is extended by including a “stigma” parameter for welfare reciprocity in the utility function and by adding welfare participation to the choice set of individuals when they are eligible for a non-zero amount of benefits. We follow the specification of, for example, Moffitt (1983), Hoynes (1996) or Keane and Moffitt (1998). In addition, the model is extended by allowing for involuntary unemployment through the use of observations on looking for full-time or part-time work for those who are not employed.

The purpose of extending the discrete choice labour supply model with a welfare participation choice is to allow individuals in the population to forego welfare payments for which they would be in theory eligible. For example, a household may be eligible for \$2 in benefits per week. It seems reasonable to assume that this household may consider the cost of applying for this benefit to be too high compared to the level of payment that is expected. A simultaneous welfare participation and labour supply model takes this into account by allowing for the possibility of a disutility (negative effect on

²⁶ The parameters presented in Kalb and Buddelmeyer have been updated, based on SIHC data from 1999/2000 up to 2003/2004. Updated results are available from the authors.

²⁷ It is assumed that all non-employed are voluntarily not working and that participants are at their preferred labour supply points.

utility) arising from welfare participation. This disutility can result from a financial (or time) cost of applying for payments or from a stigma attached to the receipt of welfare payments.

Turning to the choice of functional form, the labour supply function is modelled as a discrete choice. Restricting the number of possible working hours to a limited set of discrete values is done in many other studies (for example, Van Soest, 1995; Keane and Moffitt, 1998). The advantage of using a discrete choice framework is that it allows more complex modelling of the budget constraint. For single-adult households, the labour supply is derived from the following:

$$\max U(x, l, wp) \tag{C.1}$$

subject to a time constraint:

$$l + h = T \tag{C.2}$$

$$(h, wp) \in \mathcal{A} \times \mathcal{B}$$

and subject to a budget constraint:

$$x = wh + y + wp B(c, wh + y) - \tau(B, wh + y, c) \tag{C.3}$$

where $U(\cdot)$ is the utility function of a one-adult household; l indicates the leisure hours (including home production) per week; h represents the hours of work; wp indicates whether the household takes up welfare or not; \mathcal{A} and \mathcal{B} are the sets of discrete points from which values can be chosen for h and wp ; T is the total time available; x indicates net income per week, which is assumed equal to household consumption; w is the gross wage rate; y is the non-labour income; c is a set of household attributes; $B(\cdot)$ is the amount of benefit a household is eligible for given their household characteristics c and household income; and τ is the tax function that indicates the amount of tax to be paid.

In the discrete choice case, the budget constraint is defined on a discrete set of points $wp \in \mathcal{B} = \{0, 1\}$, and $h \in \mathcal{A} = \{0, h_1, h_2, \dots, h_m\}$ on the interval $[0, T]$, instead of being defined on a continuous set of working hours $[0, T]$.²⁸ Using these sets, net income x is calculated without welfare participation for all $(m+1)$ values of h , and with welfare participation for those values of h at which the household is eligible for income support

²⁸ $0, h_1, h_2$, etc represent the discrete values that labour supply can take. Here we have chosen 0, 5, 10, 15, ..., 50 hours of labour supply for sole parents and singles.

B(.). For this limited set of hours, the level of utility generated by each possible combination of hours is calculated. Depending on the choice of utility function, different interactions between household income and labour supply can be modelled.

To deal with unobserved market wages for people who are not working, we estimate their potential wage using a wage equation estimated on workers.²⁹ A two-stage selection model is used to correct for possible selection bias. Separate wage equations are estimated for single men, single women and sole parents (see Kalb and Scutella, 2002).³⁰

Based on the assumption of utility maximisation for each household and assuming households behave independently, the likelihood function becomes:

$$\prod_i \Pr(U(x((h_i, wp_i)_r), (h_i, wp_i)_r, \varepsilon_{ir}) \geq U(x((h_i, wp_i)_s), (h_i, wp_i)_s, \varepsilon_{is}) \text{ for all } s) \quad (C.4)$$

where r stands for the combination h and wp that is preferred; s stands for all possible combinations that can be made, given the discrete choice sets for hours worked and welfare participation; and ε_r and ε_s represent error terms. Adding an error term to the utility function prevents contributions to the likelihood of any data point from becoming zero, by allowing for optimisation errors. Choosing an extreme value specification for the error term in (C.4) results in a multinomial logit model.

However, in the case of involuntary unemployment, instead of knowing the exact hours of labour supply, it is only known whether an individual prefers to work part time (less than 35 hours) or full time (35 hours or more). As a result the contribution to (C.4) changes into:

$$\begin{aligned} & \Pr([U(x((h_i, wp_i)_{r_1}), (h_i, wp_i)_{r_1}) + \varepsilon_{ir_1} \geq U(x((h_i, wp_i)_s), (h_i, wp_i)_s) + \varepsilon_{is}] \text{ or} \\ & [U(x((h_i, wp_i)_{r_2}), (h_i, wp_i)_{r_2}) + \varepsilon_{ir_2} \geq U(x((h_i, wp_i)_s), (h_i, wp_i)_s) + \varepsilon_{is}] \text{ or} \\ & \dots \\ & [U(x((h_i, wp_i)_{r_n}), (h_i, wp_i)_{r_n}) + \varepsilon_{ir_n} \geq U(x((h_i, wp_i)_s), (h_i, wp_i)_s) + \varepsilon_{is}], \text{ for all } s) \end{aligned} \quad (C.5)$$

where indices r_j ($j=1, \dots, n$) represent the range of possible preferred labour supply and welfare participation values. For those preferring full-time work, h could be 35, 40, 45 or 50 hours per week.

²⁹ This follows the approach used by Van Soest (1995) and many others in the area.

³⁰ In this paper, an updated set of parameters, based on SIHC data from 1999/2000 to 2003/2004, is used.

The likelihood contribution further consists of the probability of employment for those who are not voluntarily unemployed. The employment equation is a probit with being employed as the dependent variable. Independent variables are education, age, state of residence and living in a capital city. Employment equations are included to take the demand side of the labour market into account, so that using preferred labour supply, actual labour supply can still be estimated. This is important when using the parameters in a microsimulation environment. Note that the employment equation can only be included in the likelihood function for those who want to be employed. Although involuntary unemployment has now been taken into account, people who are employed are still assumed to be working at their preferred hours.

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

$$U(x, h, wp) = \beta_x(x - \gamma) + \beta_1 h + \alpha_{xx}(x - \gamma)^2 + \alpha_{11} h^2 + \alpha_{x1}(x - \gamma)h - \phi wp \quad (C.6)$$

where $\alpha_{..}$ and $\beta_{.}$ are preference parameters, ϕ is a parameter for the stigma or cost associated with welfare participation wp , γ is the fixed cost of working parameter to be estimated. The fixed cost is zero when the person is not working.

We include observed heterogeneity by allowing β_1 , β_x and γ to depend on the personal and household characteristics listed above. Unobserved heterogeneity is added to β_1 , β_x and γ , in the form of a normally distributed error term with zero mean and unknown variance. Finally, the model is estimated using simulated maximum likelihood. In estimation, the unobserved heterogeneity parameters were found to be insignificant and were dropped.

Appendix D: Additional Tables for Section 5

Table D1: Summary statistics for the Census 1996 and 2001

| | <i>Census 2001 (post-policy change)</i> | | | | <i>Census 1996 (pre- policy change)</i> | | | |
|------------------------|---|---------|----------------|---------|---|---------|----------------|---------|
| | <i>Treatment</i> | | <i>Control</i> | | <i>Treatment</i> | | <i>Control</i> | |
| | mean | std err | mean | Std err | mean | std err | mean | std err |
| Male | 0.209 | 0.017 | 0.235 | 0.020 | 0.180 | 0.018 | 0.218 | 0.021 |
| age <40 | 0.203 | 0.017 | 0.083 | 0.013 | 0.252 | 0.021 | 0.122 | 0.017 |
| age 40-44 | 0.348 | 0.020 | 0.303 | 0.021 | 0.350 | 0.023 | 0.324 | 0.024 |
| age 45-49 | 0.264 | 0.019 | 0.322 | 0.022 | 0.269 | 0.021 | 0.329 | 0.024 |
| age >=50 | 0.185 | 0.016 | 0.292 | 0.021 | 0.129 | 0.016 | 0.225 | 0.021 |
| Degree | 0.114 | 0.013 | 0.154 | 0.017 | 0.120 | 0.015 | 0.137 | 0.018 |
| Qualification | 0.285 | 0.019 | 0.267 | 0.020 | 0.252 | 0.021 | 0.293 | 0.023 |
| no qualification | 0.601 | 0.021 | 0.580 | 0.023 | 0.628 | 0.023 | 0.570 | 0.025 |
| Australian born | 0.677 | 0.020 | 0.689 | 0.021 | 0.693 | 0.022 | 0.674 | 0.024 |
| born in ESC | 0.178 | 0.016 | 0.160 | 0.017 | 0.171 | 0.018 | 0.189 | 0.020 |
| born in NESC | 0.144 | 0.015 | 0.151 | 0.017 | 0.136 | 0.016 | 0.137 | 0.018 |
| Major urban | 0.586 | 0.021 | 0.603 | 0.023 | 0.646 | 0.023 | 0.635 | 0.025 |
| Home: fully owned | 0.203 | 0.017 | 0.262 | 0.020 | 0.225 | 0.020 | 0.272 | 0.023 |
| Home: purchased | 0.317 | 0.020 | 0.316 | 0.021 | 0.323 | 0.022 | 0.295 | 0.023 |
| private rental | 0.280 | 0.019 | 0.245 | 0.020 | 0.274 | 0.021 | 0.241 | 0.022 |
| Government rental | 0.200 | 0.017 | 0.177 | 0.018 | 0.178 | 0.018 | 0.192 | 0.020 |
| lives with relatives | 0.050 | 0.009 | 0.051 | 0.010 | 0.056 | 0.011 | 0.054 | 0.012 |
| has other children | 0.465 | 0.021 | 0.405 | 0.023 | 0.488 | 0.024 | 0.396 | 0.025 |
| Employed | 0.642 | 0.020 | 0.682 | 0.022 | 0.621 | 0.023 | 0.687 | 0.024 |
| Employed FT | 0.351 | 0.020 | 0.418 | 0.023 | 0.363 | 0.023 | 0.456 | 0.025 |
| In labour force | 0.733 | 0.019 | 0.785 | 0.019 | 0.706 | 0.022 | 0.821 | 0.020 |
| Average hours | 20.270 | 0.826 | 22.762 | 0.927 | 19.878 | 0.897 | 24.070 | 0.998 |
| Number of observations | 561 | | 469 | | 449 | | 386 | |

Table D2: Probit and interval regression estimation results using Census 1996 and 2001

| | In the labour force | | Employed | | Full-time employed | | Hours of work | |
|-------------------------|---------------------|----------|----------|----------|--------------------|----------|------------------|----------|
| | (Probit) | | (Probit) | | (Probit) | | (Interval Regr.) | |
| | Coef. | Std. err | Coef. | Std. err | Coef. | Std. err | Coef. | Std. err |
| Male | -0.050 | 0.591 | -0.187 | 0.596 | 0.656 | 0.586 | 2.332 | 14.081 |
| Age 35-39 | -0.435 | 0.269 | -0.483** | 0.243 | -0.330 | 0.220 | -11.848** | 4.755 |
| Age 40-44 | -0.351 | 0.266 | -0.391 | 0.239 | -0.231 | 0.213 | -9.283** | 4.593 |
| Age 45-49 | -0.581** | 0.267 | -0.542** | 0.241 | -0.256 | 0.215 | -11.652** | 4.649 |
| Age 50-54 | -0.740** | 0.276 | -0.622** | 0.250 | -0.471** | 0.226 | -14.341** | 4.902 |
| Age 55+ | -1.164** | 0.323 | -1.080** | 0.301 | -0.864** | 0.318 | -28.209** | 6.569 |
| Degree | 0.787** | 0.141 | 0.682** | 0.120 | 0.454** | 0.104 | 15.296** | 2.180 |
| Qualification | 0.462** | 0.095 | 0.427** | 0.087 | 0.195** | 0.084 | 9.028** | 1.786 |
| Male × age 35-39 | 0.161 | 0.640 | 0.510 | 0.646 | -0.243 | 0.631 | 8.103 | 15.295 |
| Male × age 40-44 | 0.508 | 0.617 | 0.495 | 0.619 | -0.122 | 0.605 | 9.571 | 14.542 |
| Male × age 45-49 | 0.446 | 0.615 | 0.605 | 0.623 | -0.104 | 0.609 | 12.765 | 14.655 |
| Male × age 50-54 | 0.361 | 0.629 | 0.494 | 0.636 | -0.106 | 0.622 | 12.953 | 15.026 |
| Male × age 55+ | 0.157 | 0.657 | 0.244 | 0.668 | -0.121 | 0.678 | 8.264 | 16.384 |
| Male × degree | 0.451 | 0.482 | 0.865* | 0.486 | 0.424 | 0.265 | 5.501 | 5.106 |
| Male × qualification | -0.295 | 0.192 | -0.232 | 0.179 | 0.135 | 0.167 | -4.651 | 3.906 |
| Born in ESC | -0.060 | 0.094 | 0.023 | 0.088 | 0.134 | 0.083 | 1.260 | 1.774 |
| Born in NESC | -0.596** | 0.096 | -0.652** | 0.093 | -0.315** | 0.096 | -14.787** | 2.409 |
| Major urban | -0.003 | 0.072 | 0.018 | 0.067 | 0.071 | 0.066 | 1.425 | 1.443 |
| Home: purchased | 0.298** | 0.100 | 0.278** | 0.092 | 0.482** | 0.085 | 8.228** | 1.785 |
| Private rental | -0.072 | 0.097 | -0.263** | 0.091 | 0.034 | 0.091 | -3.468* | 2.043 |
| Government rental | -0.445** | 0.102 | -0.502** | 0.099 | -0.372** | 0.106 | -12.104** | 2.379 |
| Live with relatives | -0.051 | 0.148 | 0.081 | 0.143 | 0.115 | 0.136 | 2.309 | 3.204 |
| Have other children | 0.088 | 0.070 | 0.136** | 0.066 | 0.006 | 0.065 | 1.995 | 1.433 |
| Post policy | -0.161 | 0.105 | -0.026 | 0.095 | -0.123 | 0.091 | -1.769 | 1.989 |
| Treatment | -0.488** | 0.104 | -0.230** | 0.095 | -0.285** | 0.093 | -6.912** | 2.022 |
| Treatment × post policy | 0.258* | 0.138 | 0.092 | 0.128 | 0.096 | 0.125 | 3.121 | 2.720 |
| Constant | 1.391** | 0.283 | 0.905** | 0.255 | -0.163 | 0.231 | 24.812** | 5.004 |
| (Pseudo) R-squared | 0.133 | | 0.126 | | 0.114 | | | |
| Chi-squared (26) | 235.5 | | 264.4 | | 272.8 | | 431.07 | |
| Sigma(σ) | | | | | | | 27.060 | 0.610 |
| Number of observations | 1,865 | | 1,865 | | 1,865 | | 1,865 | |

Note: ** and * indicate significance at the 5% and 10% level respectively.

Appendix E: Budget constraints and METRs for singles and married mothers

Figure E1a: Budget constraint for a single person

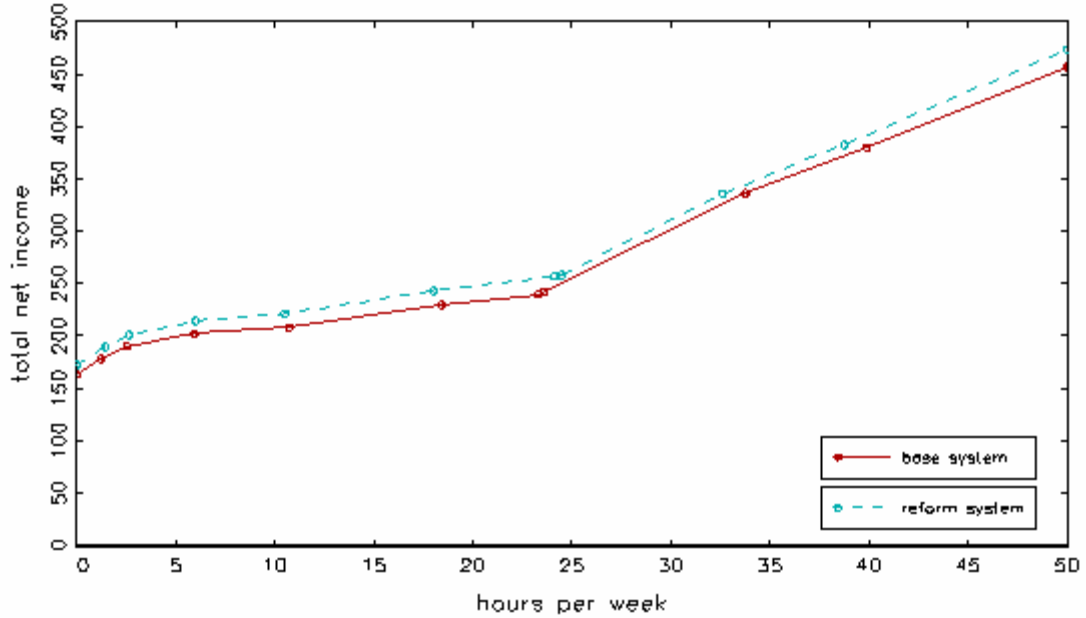


Figure E1b: METRs for a single person

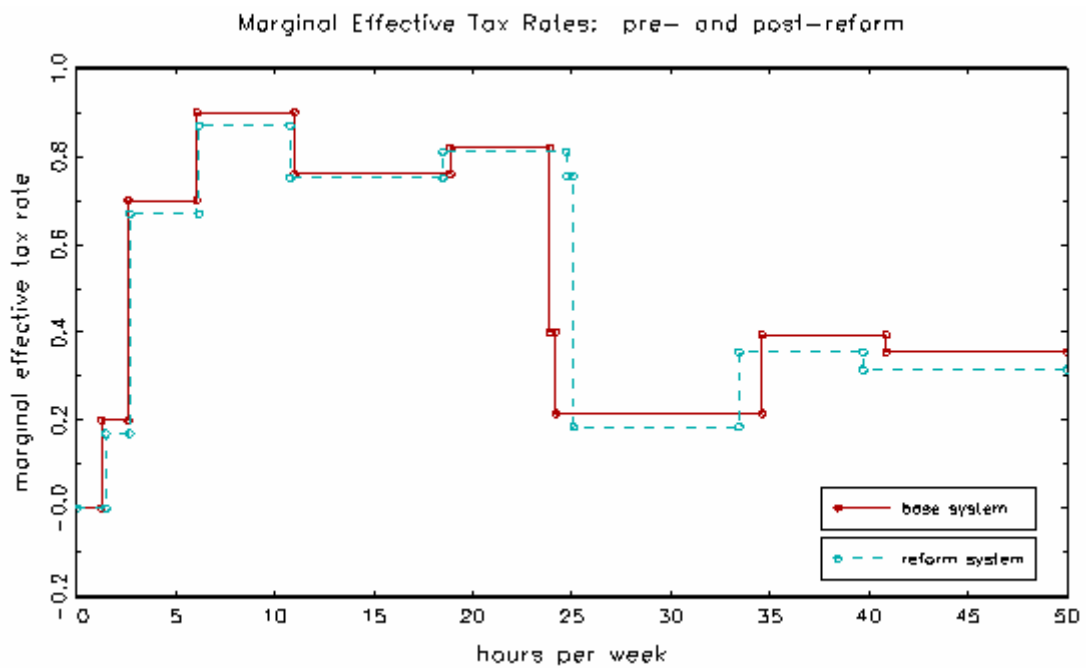


Figure E2a: Family budget constraint for varying mother's labour supply – 1 child under 13, mother's wage \$20 (father is working 40 hours at a wage of \$20)

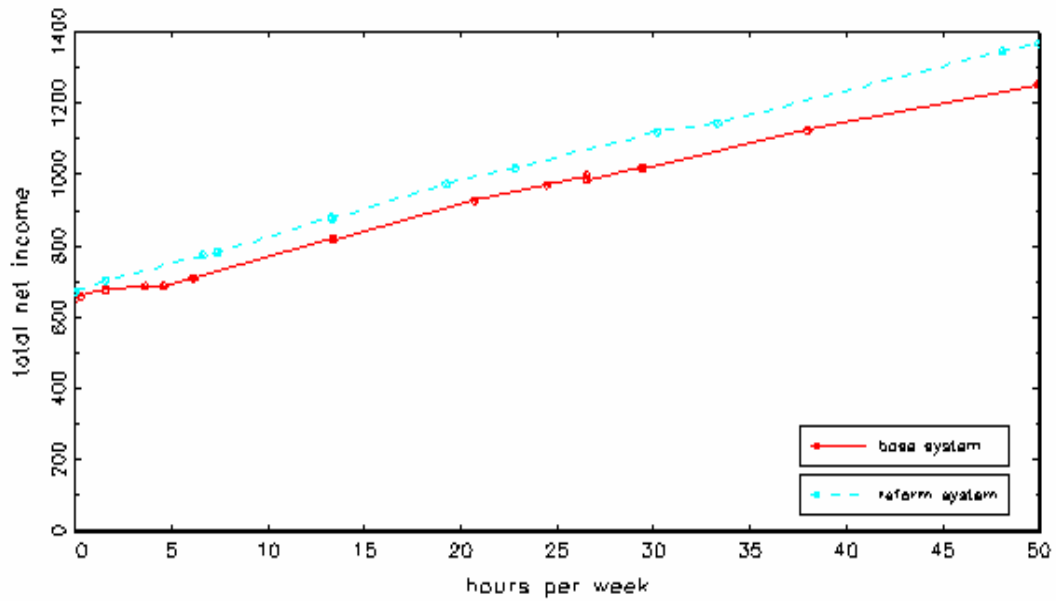


Figure E2b: Mother's METR – 1 child under 13, mother's wage \$20 (father is working 40 hours at a wage of \$20)

