AUSTRALIAN LABOUR SUPPLY ELASTICITIES: COMPARISON AND CRITICAL REVIEW

Sandra Dandie and Joseph Mercante

Treasury Working Paper

2007 — 04

October 2007

We are grateful to David Gruen, our colleagues in the Participation Modelling Project (PMP) Team, the PMP Steering Group, Robert Breunig and other Treasury colleagues for helpful comments and suggestions. We also thank members of the PMP Academic Reference Panel for comments on an early draft of the paper. The views expressed are those of the authors, and not necessarily those of the Australian Treasury.

ABSTRACT

Labour supply elasticities measure the responsiveness of individuals' labour supply to changes in variables such as the net wage rate (after consideration of tax and transfers) or net non-labour income. Elasticities have been estimated in Australia and internationally using a range of modelling approaches. However, as indicated in previous surveys, caution should be exercised when comparing these estimates, with due consideration of differences in data, methodological approaches and model specifications. When comparing estimates between countries, the institutional framework and state of the labour market in each country also need to be considered.

This paper draws on reviews of elasticity estimates in the literature and considers factors affecting their estimation and interpretation. The paper then summarises the published labour supply elasticity estimates from Australia and discusses what can be learnt from them. Comparisons are also made with estimates from labour supply studies from the United Kingdom, Canada and New Zealand.

Elasticity estimates in the reviewed labour supply studies aid our understanding of the labour supply responses of various Australian population groups. Elasticity estimates are particularly useful when disaggregated, as they allow an understanding of the relative responses of different population groups characterised by education levels, part-time or full-time employment status, level of income, or other household characteristics. However, few studies have estimated disaggregated elasticities and this is an area that could benefit from further research. Our understanding of labour supply behaviour could also

benefit from an analysis of how elasticities may change over time, and from further improvements in modelling methodologies and specifications. This would help to identify population groups that are responsive to changes in net wages and incomes, and thereby strengthen the basis for policy development.

JEL Classification Numbers: C50, D10, H20, J22

Keywords: Labour supply behaviour, wage elasticity

CONTENTS

GLOSSARY

Net wage and net non-labour income	The net wage rate is the wage rate net of the tax and transfer systems. The net non-labour income is the amount of non-labour income net of the tax and transfer systems.
Substitution effect	The change in labour supply caused by a change in the relative price of leisure. An increase in the net wage increases the relative price of leisure and would tend to increase an individual's labour supply. The substitution effect is sometimes also called the compensated effect.
Income effect	The change in labour supply caused by a change in the overall level of income. An increase in an individual's overall level of income would tend to make the individual demand more leisure and so decrease labour supply.
Total (or uncompensated) wage effect	The net change in an individual's labour supply resulting from the change in the net wage. It is the sum of the substitution and income effects.
Uncompensated wage elasticity	Related to the net effect on labour supply and measures the percentage change in an individual's labour supply resulting from a 1 per cent change in their net wage rate.[1]
Compensated wage elasticity	Related to the substitution effect on labour supply and measures the percentage change in an individual's labour supply resulting from a 1 per cent change in their net wage rate whilst keeping the utility of the individual constant. The compensated wage elasticity is sometimes called the substitution elasticity.
Income elasticity	Related to the income effect on labour supply and measures the percentage change in an individual's labour supply resulting from a 1 per cent change in their overall level of income.
Cross-wage elasticity	Important in family labour supply models and measures the percentage change in an individual's labour supply resulting from a 1 per cent change in the partner's net wage rate.
Participation	Refers to participation in employment (unless otherwise qualified).[2]
Labour force participation rate	The labour force participation rate is the percentage of the civilian population either employed (working full-time or part-time hours) or unemployed but looking for work.[3]
Participation effect (extensive margin)	The change in the average number of hours of work of a population group due to the changes in the participation rate that results from a change in, say, the net wage rate.

1 Throughout this paper the use of the term 'wage elasticity' (without qualification) will be synonymous with the more formal term of 'uncompensated wage elasticity'.

2 This is in contrast to the conventional use of the term 'participation' in labour force statistics where it refers to participation in the labour force and encompasses both unemployment and employment. In the labour supply literature, the term 'participation effect' usually refers to individuals moving from non-work to work or vice versa. To avoid confusion in this review, whenever the word participation is used without qualification, it means participation in employment.

3 In Australia, people are in part-time employment when they work less than 35 hours per week.

GLOSSARY (CONTINUED)

Hours of work effect (intensive margin)	The change in the average hours of work on the part of a population already employed that results from a change in, say, the net wage rate.
Total hours of work effect	The change in the average hours of work of a population group resulting from a change in, say, the net wage rate. It is the sum of the participation effect and the hours of work effect.
Participation elasticity	The percentage change in participation resulting from a 1 per cent change in, say, the net wage rate.
Conditional wage elasticity	The percentage change in average hours of work of workers resulting from a 1 per cent change in the net wage rate.
Unconditional wage elasticity	The percentage change in average hours of work resulting from a 1 per cent change in the net wage rate. It is the sum of the conditional and participation elasticities.

AUSTRALIAN LABOUR SUPPLY ELASTICITIES: COMPARISON AND CRITICAL REVIEW

Sandra Dandie and Joseph Mercante

1. INTRODUCTION

A labour supply elasticity estimate can provide an indication of the responsiveness of individuals' labour supply to changes in variables such as the net wage rate (after consideration of tax and transfers), net non-labour income, or the net earnings of spouses. Elasticity measures can provide qualitative and quantitative guidance on the responsiveness of the labour force to policy and other stimuli in so far as these impact the above-mentioned variables.

Although many surveys of labour supply elasticity estimates exist in the international literature (Heckman, Killingsworth and MaCurdy, (1981); Killingsworth, (1983); Hausman, (1983); Pencavel, (1986); Killingsworth and Heckman, (1986); Blundell, (1992); Heckman, (1993); Blundell and MaCurdy, (1999); Fortin and Lacroix, (2002); and Evers, Mooij and Vuuren, (2005)), Australian estimates are not included in these surveys.

However, there are some surveys of Australian labour supply studies. Norris (1996) surveys Australian, United Kingdom (UK) and United States (US) studies, suggesting a summary wage elasticity range without going into any detail. Kenyon and Wooden (1996) survey the labour supply literature from the 1960s to the mid-1990s; however they do not present detailed discussion of elasticity estimates. Birch (2005), in her survey article, reviews Australian studies

on women's labour supply including those that estimate wage and income elasticities.

This review aims to fill a gap in the literature by providing a critical review of published labour supply elasticities for different population groups from studies that have used Australian data. The Australian estimates are also compared to elasticity estimates for countries with comparable institutional settings.

There is considerable variation in the types of models and data sources used to estimate the parameters behind the elasticities, making comparisons between estimates from different studies challenging. Also, the way elasticities are estimated and/or calculated can sometimes vary between studies. Moreover, comparisons between countries are further compounded by institutional and labour market differences. This review discusses the comparability of estimates between studies and the extent to which such comparisons are possible and useful in understanding underlying labour supply behaviour. Across the studies, patterns in the labour supply responsiveness of different population groups are discussed, and the potential for future work in this area is considered.

The focus in this review is on the labour supply responsiveness (and the corresponding elasticities) that result from changes in individuals' net wage rates. The net wage rate is the wage rate net of the tax and transfer systems. The focus is also on elasticities calculated from econometric models of labour supply using data sources at the individual level. The review does not consider studies that estimate labour supply elasticities using quasi-experimental approaches or that estimate elasticities using data at an aggregate, rather than an individual, level.

We show that although elasticities are a useful guide to the labour supply behaviour of various Australian population groups, caution needs to be exercised in interpreting and comparing elasticities across studies and population groups. We find that elasticities are particularly useful when they are disaggregated, as they allow an understanding of the relative responses of population groups distinguished by characteristics such as education level, part-time or full-time employment status, level of income or other household characteristics.

The structure of the paper is as follows. Section 2 provides a brief discussion on elasticities and how they provide a measure of labour supply responsiveness. Also discussed are the types of modelling used to estimate elasticities, an overview of the findings from previous surveys of the labour supply literature, and the comparability of estimates across studies. A review of estimated elasticities from Australian studies is presented in Section 3, which also includes a brief discussion on how these estimates compare with estimates from the UK, Canada and New Zealand. Section 4 concludes and identifies potential areas for further research. Appendix A provides details on the Australian and selected international elasticity estimates referred to in this review.

2. BACKGROUND

2.1 Labour supply elasticities

According to the theory of labour supply, the response of an individual's labour supply to a change in the net wage rate is ambiguous — it depends on the relative size of the income and substitution effects. An increase in the net wage of a worker, say through a decrease in the tax rate, will increase the cost of leisure, making work more attractive compared to leisure, and therefore on its own will tend to increase labour supply in terms of the number of hours worked.[4] This is the substitution effect. However, in this example there will also be an increase in the individual's overall income, making them richer and more able to 'purchase' leisure and therefore likely to want to work less. This is the income effect and will tend to decrease labour supply. The relative magnitude of the income and substitution effects determines whether there will be a positive or negative labour supply response, or no change. The net effect of the substitution and income effects is referred to as the 'total' or 'uncompensated' wage effect on labour supply.

4 The supply of labour is a two-part decision: the participation decision of whether to work or not; and the decision about the number of hours to work for those who decide to participate in work. Non-participation implies hours of work of zero.

It is common to express each of the above-mentioned effects ('total' or 'uncompensated' wage effect, substitution effect and income effect) in elasticity form. Elasticities measure labour supply responsiveness to some stimulus (for example, the wage rate). An elasticity does not measure the absolute value of a response to the stimulus; rather it is a relative measure, in that it measures the percentage change in labour supply resulting from a 1 per cent change in the stimulus. As such, elasticities do not depend on the units used to measure labour supply or the wage rate.

The uncompensated wage elasticity of labour supply (or simply the wage elasticity) is related to the 'total' or 'uncompensated' wage effect. It measures an individual's labour supply response (either in terms of participation in employment or in hours of work) to a 1 per cent change in the wage rate. Usually the net wage rate is used to calculate the elasticity. For an individual who is on a section of their labour supply curve that is upward-sloping, the wage elasticity is positive, and an increase in the wage rate leads to an increase in labour supplied.[5] For an individual who is on a section of their labour supply curve that is backward-bending, the wage elasticity is negative, and an increase in the wage rate leads to a decrease in labour supplied. Furthermore, where the absolute value of the wage elasticity is less than one, labour supply is said to be inelastic; where the absolute value of the elasticity is equal to one, labour supply is said to be unitary elastic; and where the absolute value of the elasticity is greater than one, labour supply is said to be elastic.

5 An individual's labour supply curve plots the individual's utility-maximising hours of work on the horizontal axis against the individual's wage rate on the vertical axis.

Just as the 'total' or 'uncompensated' wage effect can be decomposed into income and substitution effects, the uncompensated wage elasticity can also be decomposed into an income elasticity (which is related to the income effect), and a compensated wage elasticity (which is related to the substitution effect).

The income elasticity of labour supply measures the extent to which an individual's labour supply responds, in terms of an increase or decrease in participation in employment or in hours of work, to a 1 per cent change in overall income. A negative income elasticity indicates that leisure is a normal good, implying that an individual increases leisure time in response to higher overall income.

The compensated wage elasticity measures the extent to which an individual's labour supply responds, in terms of an increase or decrease in participation in employment or in hours of work, to a 1 per cent change in the wage whilst keeping the utility of the individual constant. The sign of the compensated elasticity is positive. This elasticity is not always reported in the labour supply literature but, where it is, its sign provides a useful check on the plausibility of the reported wage elasticity results of the study. A negative compensated wage elasticity estimate does not accord with the underlying labour supply theory, and could suggest there is a misspecification problem with a study reporting such an estimate.

The cross-wage elasticity is another common elasticity measure in the literature and is relevant when referring to the labour supply of married couples. The cross-wage elasticity is the percentage change in a person's labour supply in response to a 1 per cent change in the net wage rate of their partner. Cross-wage elasticities are not discussed in this review.

In the literature, labour supply elasticities are distinguished by whether labour supply refers to entries and exits from employment (called the extensive margin), the changing hours of work of existing workers (called the intensive margin), or a combination of the two where the aggregate effect on labour supply is the combined effect of the change in employment status of individuals and the change in working hours of existing workers. The first is usually referred to as the wage elasticity with respect to participation, the second as the conditional wage elasticity (or the wage elasticity with respect to hours of work of workers), and the third as the total or unconditional wage elasticity. The unconditional wage elasticity is the sum of the wage elasticity with respect to participation and the conditional wage elasticity.[6]

2.2 Modelling labour supply

Elasticities can be calculated from parameters estimated when modelling labour supply. Elasticities can also be calculated by simulating increases in wages or unearned incomes within models, or calculated from non-parametric natural experiments. As argued below, caution should be exercised in making comparisons, especially over time, without knowledge of the specific modelling approach, specification, type of data, policy environment and population group used in the estimation.

6 An assumption here is that, when workforce participation increases, the additional workers work the same average hours as existing workers.

Labour supply modelling has evolved substantially over the past 30 years, addressing data and technical issues and better reflecting the complicated nature of the labour supply decision. Researchers have attempted to develop modelling approaches that address data availability, inter-temporal issues such as changing preferences over time, and institutional frameworks, and have exploited the improvements in computer processing capabilities. Modelling has progressed from simple linear models using Ordinary Least Squares (OLS) regression to more complicated non-linear models that incorporate complex tax and transfer systems or those that factor in bargaining within the household.

Over time, changes in the standard labour supply modelling approach have been prompted by the need to address estimate bias through omitted variables, measurement error and sample selectivity, and to reflect kinks in the budget constraint. One example of these developments is the two-stage approach which treats the decision to participate in the labour force, the hours worked and the wage rate as inter-related, and makes adjustments for potential sample selection bias through the inclusion of a sample selection correction term, as for example proposed by Heckman (1979). In addition, the use of instrumental variables has become commonplace to address endogeneity issues. An example of this is methods that take into account the view that the predicted wage rate and the hours of work choice are both influenced by the same unobservable factors. Also, the development of discrete, in contrast to continuous, hours modelling has reflected the need to take account of contractual barriers to adjusting hours of work by individuals and to allow the incorporation of complex tax and transfer systems. Finally, recent modelling has attempted to reflect more accurately the labour supply behaviour of couples.

There are three distinct stages in the development of labour supply modelling that have naturally defined the progression in the standard modelling approach. These are commonly referred to as first-, second- and third-generation studies.[7]

2.2.1 First- and second-generation models

Killingsworth (1983) describes the main differences between first- and second-generation models.

First-generation models are often simple models with a linear budget constraint. Issues to do with endogeneity, omitted variables and sample selection bias are generally not addressed.

In second-generation models, rather than an ad hoc approach to estimation, the participation and the hours of work decisions are treated separately, thereby attempting to correct for sample selection bias as part of the estimation. Secondly, in contrast to the first-generation approach to estimating parameters of ad hoc labour supply functions, second-generation studies have tended to use labour supply functions derived from more formal use of explicit utility maximisation in the modelling. Finally, second-generation studies include more complex modelling. For example, in some second-generation studies, tax and transfer systems have been incorporated into continuous-hours labour supply modelling. Other examples include accounting for labour market entry costs and dynamic (or multi-period) labour supply behaviour.

---

7 Referring to models in terms of first- and second-generation was suggested by Killingsworth (1983). This categorisation has been extended, for example in Kalb (2003), to define discrete-hours models as third-generation.

First- and second-generation models are generally estimated using a continuous-hours approach where the dependent variable is hours worked. Elasticities from a continuous-hours labour supply model are calculated by estimating a labour supply function which is dependent on the wage rate and other characteristics. Elasticities are usually calculated at average values of the explanatory variable of interest.

2.2.2 Third-generation models

Third-generation models, also known as discrete-hours models, model the labour supply decision as discrete choices between non-work and one or more distinct working hour categories. A number of early third-generation models were estimated using only a small number of discrete-hours categories (zero, part-time and full-time hours) as the dependent variable. However, many of these models did not incorporate complex tax and transfer systems.

Van Soest's (1995) seminal work in labour supply modelling significantly increased the number of discrete-hours categories and also took account of the complex tax and transfer systems.

Discrete-hours modelling more accurately reflects the labour supply decision where there are contractual barriers to adjusting hours worked, and is consistent with the empirical distribution of hours worked. Because discrete-hours models are based on individuals choosing from a limited number of discrete labour supply points, tax and transfer systems can be allowed for without having to define the whole budget constraint facing individuals. In contrast, it is more

complicated to incorporate such tax and transfer systems into second-generation continuous-hours models.[8]

The elasticities in discrete-hours labour supply models are not simple functions of the estimated parameters. Elasticities are instead calculated by comparing labour supply before and after a change in the explanatory variable of interest. Although elasticities calculated from a discrete-hours model are not perfectly comparable with those calculated from a continuous model, it is still useful to compare the sign and magnitude of the elasticities from the two approaches. Estimates should be similar if both of the modelling methodologies and specifications do a reasonable job of predicting the data.

2.3 Comparability of elasticities

There are several factors to consider when interpreting and comparing elasticity estimates. These concern differences in elasticity definitions, the way in which they are calculated, the specification or methodological assumptions of the underlying labour supply modelling, and the data used (see Box 1).

8 The relative advantages of discrete-hours models are briefly discussed, for example, in van Soest (1995), Creedy and Kalb (2005) and Bloemen (2005).

BOX 1: COMPARABILITY OF ELASTICITIES

Differences to do with the definitions of elasticities used

- Whether the uncompensated wage elasticity is decomposed into compensated and income elasticities.
- Whether the elasticities are decomposed into the participation effect (extensive margin), the hours of work effect for existing workers (intensive margin), or the total effect of both.
- Whether the income elasticity is defined as the 'total income' elasticity.
- Whether elasticities are expressed as changes in before-tax (gross) wages and incomes or net wages and incomes.
- The components of unearned income (non-welfare income, welfare income, partner's earned and unearned income) that are included in the income elasticity definition.

Differences to do with the way the elasticities are calculated

- Whether elasticities are estimated from the estimated parameters of econometric models or are simulated.
- If econometrically estimated, whether the mean or another point in the distribution is used in the calculation.
- If simulated, the basis of the elasticity calculation.
- Whether the sample or population averages are used in the elasticity estimation.

Differences to do with methodological or specificational assumptions made in the modelling

- Broad methodological approach (first-, second- or third-generation).
- The functional form assumed for labour supply responsiveness. That is, whether the wage elasticity is assumed to be constant, variable but with unchanging sign, or fully variable.
- Whether the elasticity refers to labour supply decisions for a single period of time or over different time periods.
- Misspecifications of the underlying model.

BOX 1: COMPARABILITY OF ELASTICITIES (CONTINUED)

Differences in relation to the data

- The level of disaggregation of the population group for which elasticities are estimated.
- The sample selection criteria (and exclusion criteria) of the population group for which elasticities are estimated.
- The definitions of key data items that may alter the definition of elasticities. For example, the use of annual or weekly hours of work to measure labour supply; preferred or observed hours of work; or the definitions of wages and unearned income that are used.
- The time to which the data refer.
- Any country-specific issues (for example, institutional influences on the labour market or the state of the labour market) when undertaking comparative work.

2.3.1 Differences to do with definitions of elasticities

Some studies distinguish labour supply elasticities by whether they include only the change in the hours of work for workers or for both workers and non-workers. The latter combines the effect of the change in employment (extensive margin) and the change in the hours of work of workers (intensive margin). Some studies report only one of these, making it difficult to compare elasticity estimates between studies. Often it is unclear which definition is used, compounding the problem.

Ideally, elasticities should be expressed in terms of changes in net wages and incomes. After all, individuals should be expected to react to net wages and incomes; that is, net of the tax and transfer system. Elasticities defined this way are expected to be, all things being equal, independent of differences in the tax/transfer system as long as preferences have not changed. However, some

studies express elasticities in terms of gross (before tax and transfer) wages and incomes.

The wage elasticity calculated using gross (before tax and transfer) wages would generally be expected to be smaller than if calculated using net (after tax and transfer) wages.

For example, we can take the hypothetical case of a progressive tax system and an individual facing a marginal tax rate of 30 per cent, but an average tax rate of 20 per cent. If the individual earns a gross wage of $20 per hour (and hence a net wage of $16 per hour), a 1 per cent increase in the gross wage will increase it to $20.20 but will increase the net wage to $16.14 per hour, giving a lower 0.875 per cent change in the net wage. Therefore, if hours of work increase by 1 per cent, say, as a result of the wage change, then the wage elasticity using the gross wage (1.0) would be smaller than the elasticity using the net wage (1.143).

2.3.2 Differences in the way elasticities are calculated

Most econometric estimates of labour supply calculate elasticities at the mean of the population group represented in the sample. However, some do not. For example, comparing elasticities across countries (as in the cross-country married women study by Knudsen and Peters, (1994)) may involve comparing elasticities at a common level of wages, incomes and hours of work across the countries rather than the mean wage or income levels of each country individually. In that case, the chosen point may not be close to the 'typical' point for some countries, and understanding the context of the calculation is important when comparing elasticities.

An advantage of studies using econometric estimation is that elasticities are usually obtained as a straightforward calculation from the coefficient estimates in the regression equations that comprise the labour supply model. This is generally the case for first- and second-generation studies. Some modelling techniques, however, and particularly third-generation techniques, estimate elasticities by simulation, as is done for example in the Australian studies by Murray (1997), Kalb (2000), Buddelmeyer, Creedy and Kalb (2007) and Breunig, Cobb-Clark and Gong (2005). Typically, wages (or incomes) are increased by 1 per cent (or another amount) and the corresponding simulated labour supply responses are obtained, and from this information elasticities are calculated.

There are two issues here. Firstly the usual practice is to calculate the elasticity based on a change in the gross wage (or income) rather than the net wage (or income). Secondly, there are several ways in which a 'representative' elasticity could be obtained — for example from the average aggregate response of the population group (as in Breunig, Cobb-Clark and Gong, (2005)) or as the average of the elasticities of all the individuals in the population group (as in Buddelmeyer, Creedy and Kalb, (2007)). These concepts are slightly different and lead to different interpretations of the elasticity for the 'typical' or 'average' individual, adding an extra factor to consider when comparing elasticity estimates.

2.3.3 Differences to do with the methodology or specification of the assumed labour supply model

Elasticity estimates can vary with differences in the basic assumptions made in the modelling. For example, the use of first-, second- or third-generation approaches is likely to lead to differences in estimates. Also, elasticity estimates

may vary as a result of model misspecification. An example of this is where the model used does not take sample selection issues into account.

However, some underlying assumptions have a more fundamental impact on the interpretation given to elasticities, particularly wage elasticities. For example, some models assume the wage elasticity to be the same for the whole population being studied. This assumption is overly restrictive (Blundell and MaCurdy, (1999)). Other models are more flexible and allow elasticities to vary over the population but with the same sign. Other models are even more flexible in allowing elasticities to vary and change sign, as is the case in a backward-bending labour supply curve. What is assumed about the responsiveness of individuals informs the choices of functional forms in the modelling and impacts on any interpretation given to, or comparisons made between, elasticity estimates. If a functional form is used that allows for variation in wage elasticities across individuals of a population group, then the elasticity will be sensitive to the point at which it is evaluated (which is typically the hours of work and wage at the mean of the data).

While most models of labour supply are single-period models (called static models), lifecycle (or dynamic) models consider decisions over multiple periods of time. Killingsworth (1983) and Blundell and MaCurdy (1999) note the difficulty in making direct comparisons between elasticity estimates from these two approaches.

2.3.4 Differences due to the data

Elasticity estimates are sensitive to the point at which they are estimated, usually the mean of the sample of the population group in question. The mean of a

sample will, however, differ for different sub-groups of a population, for example, for women in different age groups. It may also differ for different samples from the same population. Some studies estimate elasticities for a population group, but with slightly different definitions used for the sample compared to other studies (for example one may exclude people over a certain age, while another includes them), thus changing the 'mean' and thereby the point at which the elasticity is calculated.

Even with the same population group, the mean is likely to change for different years of data. The consequent impact on the elasticity estimates would need to be assessed. Estimates which use gross wages and incomes would be expected to change if the tax/benefit system changed between the years of the samples. On the other hand, using net wages and incomes should give more stable results as long as underlying preferences for work, as well as wage and income distributions and the population structure, have not changed over time. Still, preferences may change over time, and examining how and why elasticities change over time has been the subject of some recent work using US data (Blau and Kahn, 2005; Heim, 2005).

Finally, comparing elasticities across countries, even for the same population group, involves the use of data that will reflect any underlying differences in the structure of the labour market (for example, the differences in participation rates or the distribution of wages and working hours), the institutional structures (for example, the tax and welfare system, the method of wage setting and bargaining or the level of unionisation) or the state of the labour market (for example, the economic cycle) of the countries in question. These differences are reflected in elasticity estimates and inter-country comparisons need to take account of these.

Table A7 in Appendix A summarises some of the major features of the modelling used and how the wage elasticities are calculated for the Australian studies covered by this paper. There are many points of difference which make the elasticity estimates not perfectly comparable. Elasticities are not always calculated at the mean, though the studies attempt to obtain some sort of 'average' or 'typical' elasticity. Most elasticities are calculated from the estimated coefficients of econometric equations. However, the third-generation studies use simulation to calculate the elasticities. As far as can be ascertained, most studies in the table use before-tax wages in the calculation. Furthermore, most studies base their estimates just on the sample of workers and so report conditional wage elasticity estimates.

2.4 Elasticity estimates in the literature

A number of Australian and international surveys have reviewed elasticity estimates from labour supply studies for various population groups. Table 1 provides a summary.

Table 1: Wage and income elasticity results from selected labour supply surveys

		Men		Women	
Labour supply survey	**Sample of estimates covered**	**Wage elasticity**	**Income elasticity**	**Wage elasticity**	**Income elasticity**
Heckman, Killingsworth and MaCurdy (1981)[1]	US (1st generation)	-0.45 to 0.55	0.00 to 0.16	-0.10 to 1.60	-0.1 to -0.75
	US (2nd generation)	ns	ns	-0.05 to 4.31	-0.51 to 0.03
Killingsworth (1983)[2,4]	US & UK (1st generation)	-1.00 to 0.34	-2.21 to 0.06	-4.46 to 4.60	-0.47 to 2.10
	US & Canada (2nd generation)	-0.20 to 0.14[3]	-1.03 to -0.08	-0.89 to 15.24	-0.5 to 0.48
Blundell and MaCurdy (1999)[5]	US, UK & Continental Europe	-0.25 to 0.25	-1.03 to 0.04	-0.01 to 2.03	-0.4 to -.52
Fortin and Lacroix (2002)[6]	US, UK, Canada & Continental Europe	-0.13 to 0.82	-1.03 to 0.00	-0.37 to 2.03	-0.50 to 0.52
Evers, de Mooij and van Vuuren (2005)[7]	Various countries (meta-sample)	-0.24 to 0.13	ns	-0.19 to 2.79	ns
	Predicted elasticities (US)	0.01 to 0.24	ns	0.31 to 0.40	ns
	Predicted elasticities (UK)	0.02 to 0.24	ns	0.36 to 0.47	ns
	Predicted elasticities (The Netherlands)	0.07 to 0.16	ns	0.48 to 0.52	ns
	Predicted elasticities (Sweden)	0.12 to 0.42	ns	0.53 to 0.59	ns
Norris (1996)	Australia	ns	ns	0.4 to 0.5	ns
Birch (2005)[8]	Australia (participation — 1st generation)	ns	ns	0.22 to 1.82	-0.66 to -0.22
	Australia (participation — 2nd generation)	ns	ns	0.07 to 1.61	ns
	Australia (hours of work — 2nd generation)	ns	ns	-0.19 to 1.30	-2.31 to -0.04
	Australia (hours of work — 2nd generation — married women only)	ns	ns	-0.19 to 1.30	ns

Figures have been rounded to two decimal places.

ns means not specified.

1. This is the uncompensated wage elasticity.
2. Income elasticities are mostly with respect to property income.
3. Some estimates are ranges. The estimates are mainly US.
4. In Table 4.3 in Killingsworth (1983) the range of wage elasticity estimates for men in second-generation studies is reported as -0.38 to 0.06; however, in the text Killingsworth mentions the range shown here, -0.20 to 0.14.
5. Estimates are given only for studies that take into account non-linear budget constraints. Figures are for the US, UK and Continental Europe.
6. All studies are for those that model non-linear budget constraints. Countries include the US, Canada, UK and Continental Europe.
7. The range referred to as 'meta-sample' is the average of the ‘all men and all women’ point estimates from the studies considered. The point estimates are from selected studies from the US, UK, France, Sweden, Germany, Italy, the Netherlands and Finland. The paper also uses the estimated coefficients of the meta-regression to predict wage elasticities for the four countries shown in the table.
8. Wage elasticities with respect to participation and hours of work are reported separately.

The immediate observation is the wide ranges of elasticity estimates. In Killingsworth's (1983) survey, for example, the wage elasticity estimates from first-generation studies for men are reported to range from -1.00 to 0.34 with the vast majority negative. For women, the first-generation estimates range from -4.46 to 4.60, with the majority positive and predominantly in the range -1.18 to 1.90. The ranges are quite wide, even within a particular study. Although such variation may suggest limited usefulness of the estimates for policy purposes, Killingsworth (1983) points out that some researchers have narrowed the range by being more selective about the estimates to include. For example, some estimates may be excluded because of problems with sample selection or the definition of the variables used. However, Killingsworth also points to a danger of making these 'selective evaluations', because estimates could be discarded merely because they differ from the estimates of earlier work. Notwithstanding this, there is general agreement about the deficiency of first-generation estimates as a result of misspecification, as outlined in the previous section.

Estimates from second-generation studies also have wide ranges. Estimates from the second-generation studies covered by Killingsworth (1983), for women, generally vary more widely than those from first-generation studies. The second-generation estimates for women are also generally higher. Although there are fewer second-generation estimates for men, the range of second-generation estimates is narrower than first-generation estimates. Killingsworth (1983) finds estimates from second-generation studies for men mostly in the range -0.2 to 0.14, which narrow (to -0.03 to 0.14 for the US) after disregarding estimates that give negative compensated wage elasticities which are at odds with economic theory. For women, the range of estimates is wide — from -0.89 to 15.24 — but with most elasticity estimates from 0.6 to about 3.0.

Killingsworth (1983) notes that, outliers and anomalies aside, some patterns emerge. In particular, men are less sensitive in their labour supply response to wages and unearned income than women. For women, the responsiveness is generally higher than was suggested by first-generation studies. Nonetheless, there is still wide variation with the differing results traced to a number of sources. Firstly, there are differences in estimation techniques, with first-generation estimation procedures generally giving lower elasticities and, within the second-generation studies, some techniques giving higher estimates than others. Another source of variation is differences in the definitions or sample selection criteria of the populations.

The conclusion that elasticities for men tend to be lower than for women is also reported in other surveys, for example, Blundell and MaCurdy (1999), though that study only included estimates from models that took account of non-linear tax systems. It is also the case in Fortin and Lacroix (2002) for estimates for the US, UK and Continental Europe, though Canada was an exception with a predominance of negative estimated wage elasticities for women.

For Australia, Norris (1996) reports wage elasticities for women in the range 0.40 to 0.50. In line with the international surveys, the more recent study by Birch (2005) reports a wide range, from -0.19 to 1.30, in Australian wage elasticity estimates for women, stating that the estimates are generally sensitive to model specification and estimation techniques. Birch examines the source of the differences by grouping estimates according to the data used, the sub-populations of women and the types of methodologies used, but concludes that there is scope to do more.

Some of the surveys, including Killingsworth (1983) and Birch (2005), argue that, despite the differences between first- and second-generation estimation results, the general conclusion that women have higher elasticities than men is a robust one.

Unlike estimates from first- and second-generation studies, to date there has been no comprehensive review of estimates from third-generation studies.

A common theme emerging from the reviews is the importance of ensuring that comparisons are undertaken with caution and using a common framework, considering elasticity estimates on the basis of similar methodology, data and time period.

Another important observation in the literature concerns the responsiveness in participation (extensive margin) compared to responsiveness in hours of work (intensive margin). Birch (2005) finds that wages had a greater impact on women's decisions to enter or exit the labour market than on decisions concerning the number of hours worked for those already working, a finding also discussed in Eissa and Hoynes (2005). Mroz (1987) discusses the difference in married women's labour supply responses at the intensive and extensive

margins, finding that wage elasticities for married men and married women who are already working are not very different.[9]

The study by Evers, de Mooij and van Vuuren (2005) uses a comparative approach to analysing the sources of the variability in uncompensated wage elasticity estimates. It carries out a meta-analysis of 239 elasticity estimates from 32 international studies (but not including any Australian estimates). Regression techniques are used to control for the impact of sex, country, participation rates, specification used, the way elasticities are calculated, information about the significance of estimates and other factors on the variability of elasticity estimates. The authors use the estimated coefficients of the meta-regression to predict wage elasticities. Their results, consistent with the findings in the labour supply literature, show the difference in the range of wage elasticities between men (around 0 to 0.4, but mostly 0 to 0.2) and women (around 0.3 to 0.6).

Evers, de Mooij and van Vuuren (2005) conclude that elasticity estimates for men and women are different. They find that other sources of variation in the elasticity estimates are country-specific differences and differences in the participation rates of the populations being examined. Although it is well known that responsiveness at the extensive margin is higher than at the intensive margin, some researchers (such as Mroz, (1987), as mentioned above) conclude that, once the participation effect is taken into account, the labour

9 Mroz (1987) estimated wage (and income) effects on labour supply, but did not calculate wage elasticities. His aim was to examine the variation in these effects arising from differences in model specifications. He found that the wage effects varied for different model specifications, and when these were controlled for, he found that the wage effects of *working* married men and women were similar. In particular, he showed that the effects on *working* women's labour supply were smaller than those predicted in the labour supply literature. To do this, Mroz selected specifications that estimated labour supply effects for workers, which did not include the influence of the wage effect on participation.

supply behaviours of working men and women (that is, at the intensive margin) are similar.[10] Evers, de Mooij and van Vuuren (2005) find that the participation effect (as proxied by the participation rate) plays a large part in explaining the variation of elasticities between men and women. However they find that the differences in elasticities between men and women are not completely explained by the difference in their respective participation rates. The authors conclude that women have a higher wage elasticity than men both at the extensive and intensive margins.

Furthermore, Evers, de Mooij and van Vuuren (2005) find that, among the estimates they covered, there is no significant impact arising from the specification used in the modelling or from marital status. Also, they find that differences between countries are fairly small.

3. AUSTRALIAN ELASTICITY ESTIMATES

This section begins with an overview of the Australian studies that have produced estimates of labour supply elasticities. Then the estimates for particular population groups are discussed in more detail, followed by comparison of the estimates across the population groups. Finally, the estimates are compared with a selection of estimates from the United Kingdom, Canada and New Zealand.

---

10 In a popular econometric model of labour supply (using the Tobit model), it can be shown that the total (or unconditional) elasticity is dependent on the participation rate. At low participation rates, the participation elasticity is higher than the conditional elasticity, and is a larger fraction of the unconditional elasticity. For this reason it is important to control for the elasticity definition that is used for the estimation, and for the participation rate of the sample used. See Russek (1996) for further details on the dependence of the unconditional, conditional and participation elasticities on the participation rate for the Tobit model.

Detailed material on the elasticity estimates is presented in Appendix A. Tables A1 and A2 provide a summary of wage and income elasticity estimates for each broad modelling approach used in Australian studies. Table A3 provides a summary of Australian wage elasticities with respect to participation. Table A7 summarises modelling, data sources, sample selection and other features of the Australian studies, and provides an aid when comparing elasticity estimates across studies.[11]

Estimates of labour supply elasticities are categorised according to the modelling approach (first-, second- or third-generation) and five population groups: married men, married women, single men, single women and lone parents.[12]

3.1 Overview of the Australian studies

The majority of Australian estimates of labour supply elasticities were generated since the 1980s and most used second and, more recently, third-generation modelling approaches. The absence of earlier Australian labour supply studies is mainly because of the limited unit record data available at the time.

Most of the Australian elasticities are estimated on data that exclude persons aged around Australian Age Pension age or older.[13] All the studies make a distinction between men and women, and all but one also use marital status to identify particular population groups. Most studies have tended to focus on one population group, married women most commonly.

11 All elasticity estimates reported in this review have been rounded to the second decimal place.

12 For recent Australian estimates, married includes individuals who are married de facto or de jure. However the definition of married is not always clear in the international studies.

13 This is 65 years for men, and being increased from 60 to 65 years for women.

Many of the studies estimate disaggregated elasticities; that is, elasticities that are estimated for sub-groups within one of the broad population groups. For example, elasticities can be disaggregated by employment status, age, lifecycle stage, the presence of dependent children, income level or other individual and family characteristics.

We know of no Australian studies which consider the change in elasticities over time, as done by Blau and Kahn (2005) and Heim (2005). In these studies, a number of years of cross-sectional US data are analysed with results from both studies showing a decline in wage elasticities for married women over time.

3.2 Elasticity estimates for population groups

In this section, we examine the variation of wage elasticity estimates for the five broad population groups: married women, married men, lone parents and single men and women.

The following criteria are used to select the estimates considered in Figures 1, 2 and 3:

- estimates from second- and third-generation studies are included;
  - However, estimates in these studies that are based on first-generation techniques, are generally excluded.[14]

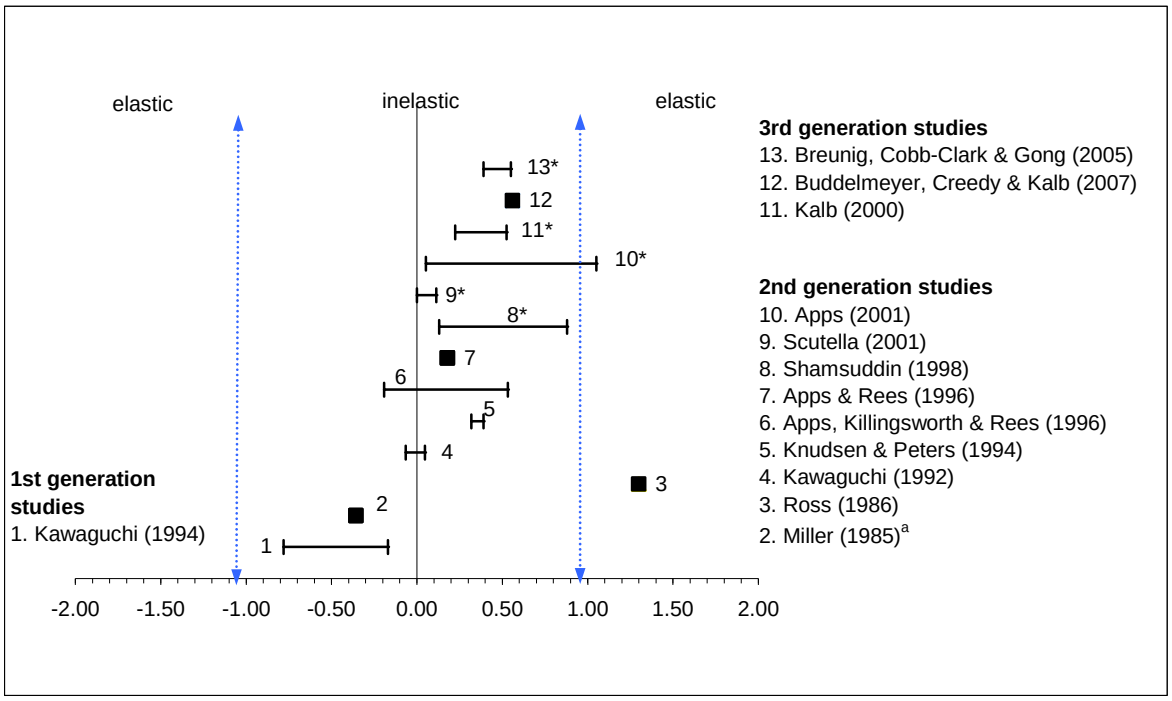
14 Excluded are estimates where sample selection has not been taken into account. The exceptions to this are the estimates from the demand system approaches in Apps, Killingsworth and Rees (1996) and Apps and Rees (1996). Although the sample selection issue is not taken into account fully, the models are still second-generation, that is, not an ad-hoc approach to modelling labour supply. Moreover, the usefulness of the studies is to provide some sensitivity of elasticity results to the modelling methodologies used, and so we include them in the figures.

- where available, individual disaggregated elasticities are included;
- only estimates for the five population groups are included — for example, one study (Kidd and Ferko, (2001)) is excluded as it did not distinguish on the basis of marital status; and
- where the author(s) unambiguously state a preferred model(s) only those estimates are included.

3.2.1 Married women

The wage elasticity estimates for married women are summarised in Figure 1.

Figure 1: Uncompensated wage elasticities — married women (Australia)



a The compensated wage elasticity is negative, contrary to theory.
* Disaggregated studies.

Only one first-generation study, Kawaguchi (1994), estimates labour supply elasticities for married women. Although this study uses non-linear methods, it does not account for selectivity bias. As a result, the estimated negative wage

elasticities for married women (and men) tend to be underestimates and should be viewed with caution.

Australian second-generation labour supply studies report wage elasticity estimates in the range of -0.36 to 1.30 for married women (Miller, (1985); Ross, (1986); Kawaguchi, (1992); Knudsen and Peters, (1994); Apps, Killingsworth and Rees, (1996); Apps and Rees, (1996); Shamsuddin, (1998); Apps, (2001); and Scutella, (2001)).

Miller's (1985) estimate is at the lower end of the range. However, Miller notes potential problems with the estimation method, particularly as the compensated wage elasticities are negative. Therefore, by and large, the results point to positive wage elasticities for married women. The exceptions are Miller's estimate, the few negative elasticity estimates by Apps, Killingsworth and Rees (1996), and the estimates in Kawaguchi (1992) that were noted by the author to be statistically insignificant.

Among the other second-generation studies, there is wide variation among the studies that produce single point estimates (Ross, (1986); Knudsen and Peters, (1994)[15]; and Apps and Rees, (1996)), as well as variation within the disaggregated studies (Shamsuddin, (1998); Scutella, (2001); and Apps, (2001)).

Considering the disaggregated studies first, Shamsuddin (1998) finds non-English speaking background (NESB) immigrants to be not very responsive to wage changes.

15 Knudsen and Peters (1994) estimated the elasticity with respect to weekly and annual hours of work. The more comparable estimate is for weekly hours of work with an elasticity of 0.39.

The variation in Apps' (2001) study is wider. The author uses a more complex model of labour supply which incorporates the different uses of time and, in particular, the use of time for domestic production, and estimates wage elasticities for married women in five pre-retirement lifecycle stages. The variation in estimates is explained by the presence of children and the hours of work. Married women's wage elasticity for full-time workers rises dramatically with the arrival of children (from 0.05 to 0.25) and remains around the 0.25 to 0.33 range in the presence of children until they leave home, when the elasticity drops again (to 0.13). Apps argues that the rise and drop in elasticities is because, in the presence of children, market and domestic work are close substitutes for married women who are secondary earners. In addition, the wage elasticities for part-time workers are higher than those for full-time workers, with the highest elasticity, around 1.1, for part-time working women with primary school-age children.

In contrast, Scutella (2001) reports less variation for different sub-groups of married women, grouped on the basis of educational qualifications and the number and ages of children. On the whole, the estimates are fairly close to zero.

Comparing the responses of different groups of married women, Scutella finds that the labour supply of married women responds significantly less to a wage change as the number of dependent children increases. Scutella also finds that the greater response (which is much smaller than the estimates in some other studies) comes from married women with older dependent children rather than those with pre school-aged children.

The source of variation amongst studies producing single point estimates is probably a result of a number of factors. Firstly, the earliest of these estimates is based on 1980 data (Ross, 1986), when we would expect wage elasticities to be slightly higher given the lower labour force participation rates of women in general.[16] Secondly, Knudsen and Peters (1994) is an international comparative study and, for this reason, the point of estimation is not at the mean as in the other two studies. Finally, the study by Apps and Rees (1996) uses a more complex labour supply model with household production and assumes a more individualistic approach to labour supply decisions in the household. The authors find that allowing for household production in the labour supply model produces lower elasticity estimates than those estimated from more common neoclassical models of labour supply which ignore household production.

In the non-disaggregated study by Apps, Killingsworth and Rees (1996), the variation in the estimates is a result of the use of different modelling methodologies. The authors test several different models and specifications, finding that the estimated responsiveness is highly sensitive to model type, specification and the availability of suitable data. This result suggests that disentangling the variations in estimates resulting from within-group differences as shown by the disaggregated studies, from those arising from differences in modelling and specification is likely to be difficult.[17]

---

16 In June 1980, the labour force participation rate for women was 45 per cent, 20 years later (June 2000) it had increased to 55 per cent, and by June 2007 it was 58 per cent (ABS, 2007a).

17 One way to disentangle the influence of modelling specification from the variability in elasticities is through a meta-regression analysis, an example of which is discussed in section 2. However, the meta-regression analysis by Evers, de Mooij and van Vuuren (2005) concluded that specification and modelling differences are not significant in explaining the variation in wage elasticity estimates across different studies.

Elasticities reported from third-generation studies that model married women (Kalb, (2000); Buddelmeyer, Creedy and Kalb, (2007); Breunig, Cobb-Clark and Gong, (2005)) are in the range of 0.23 to 0.55, which is narrower than that from the second-generation results.

Two third-generation studies provide disaggregated estimates. Kalb (2000) allows for the presence of children and presents results for low-, average- and high-wage families. Generally, married women in families with partners on low wages have higher elasticities than those with higher wages. This is, in part, because of the fewer hours worked (especially in the presence of young children) by those in low-wage families, and in part because of a stronger income effect for those in high-wage families.[18] Also, married women with young children generally have higher wage elasticities than those without children.

Breunig, Cobb-Clark and Gong (2005) disaggregate their estimates according to education level, finding higher elasticities for women with lower levels of educational attainment. They also find that the elasticities of both men and women with respect to their partners' wage are negative and small, with married women more responsive than men to a change in their partner's wage.

18 A Committee for Economic Development of Australia report (Lateral Economics, 2006) presents some evidence of wage elasticities disaggregated by household income quintiles, using the discrete-choice MITTS model. Although individual elasticities are not presented, the report indicates that the married women's wage elasticity is highest for the two lowest income quintiles, then drops for the higher quintiles. However, the wage elasticity is higher than the elasticity for married men for all income quintiles. For married men, single men and single women, wage elasticities also decline with household income quintile, and for singles, become slightly negative for the highest income households.

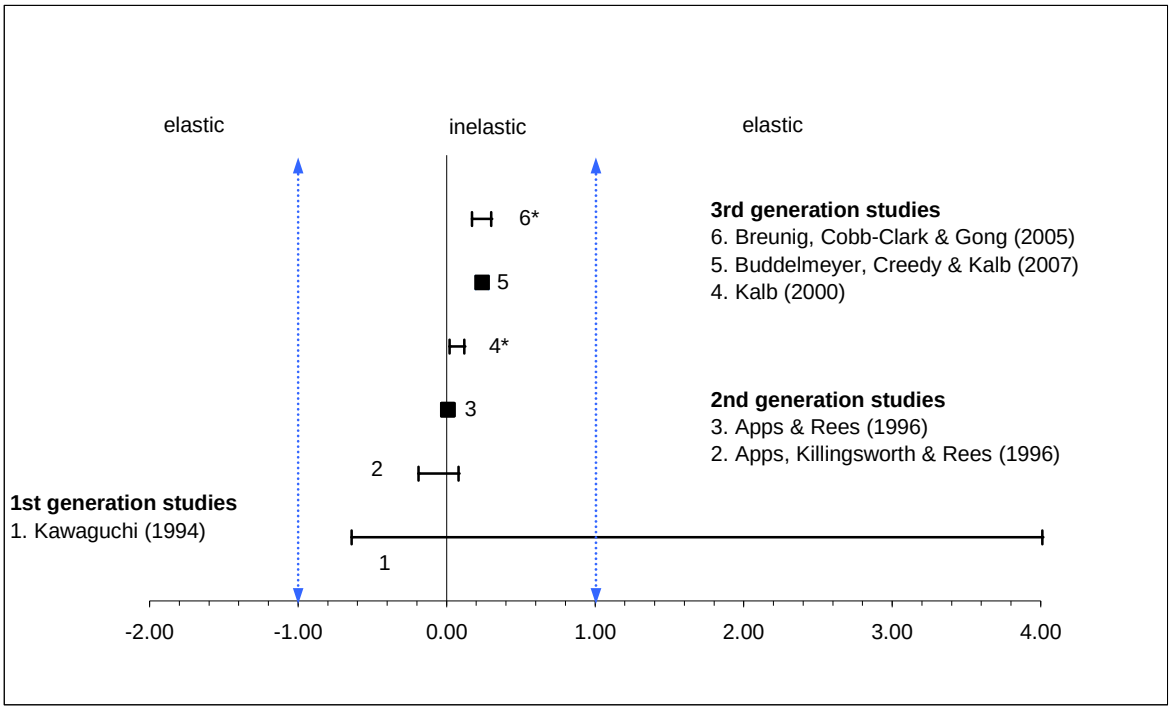
The wage elasticity estimates from Buddelmeyer, Creedy and Kalb (2007) and Breunig, Cobb-Clark and Gong (2005) using the authors' preferred model, are quite similar (0.56 and 0.50), despite using different data and specifications. However these elasticities are unconditional wage elasticities and therefore include the participation effect. The estimates of the wage elasticities with respect to participation are slightly different.[19] If the wage elasticities are adjusted to take into account the participation effect of a wage change, then we would expect the conditional wage elasticity estimates in Buddelmeyer, Creedy and Kalb (2007) and Breunig, Cobb-Clark and Gong (2005) to be lower.

3.2.2 Married men

The reviewed studies generally show a very inelastic labour response by married men to changes in the wage rate. Their response is thus much less than that of married women. The elasticity estimates for married men are shown in Figure 2.

19 Note that the estimates of the participation elasticities in the two studies are not directly comparable. The participation elasticity figures in Buddelmeyer, Creedy and Kalb (2007), reproduced in Table A3, are the percentage point change in the participation rate resulting from a 1 per cent change in the wage rate. This is not the elasticity with respect to participation, defined as the percentage change in the probability of employment (or equivalently the percentage change in the participation rate) with respect to a 1 per cent change in the wage rate.

Figure 2: Uncompensated wage elasticities — married men (Australia)



* Disaggregated studies.

Fewer studies focus on married men, but this is not surprising. The majority of men work full time in Australia and the propensity for them to change working hours is low.[20] Furthermore, married men are still predominantly the main breadwinners mainly because of married women's child bearing and caring responsibilities.

The only two studies to give negative elasticity estimates are the first-generation study by Kawaguchi (1994) and Apps, Killingsworth and Rees (1996). Other estimates are close to zero and no higher than 0.3. The ranges of estimates from the two disaggregated studies (Kalb, (2000); and Breunig, Cobb-Clark and Gong, (2005)) are much narrower than for married women.

20 In June 2007, around 90 per cent of married men who worked were working full time, compared to 53 per cent of working married women (ABS, 2007c).

As with married women, Breunig, Cobb-Clark and Gong (2005) find higher elasticities for those married men with lower levels of educational attainment. The estimates reported in Kalb (2000) suggest similar responsiveness of married men with and without young children. However, men in average-wage families have slightly lower elasticities when young children are present. Also, those in lower wage families are generally more responsive to wages than those in higher wage families.

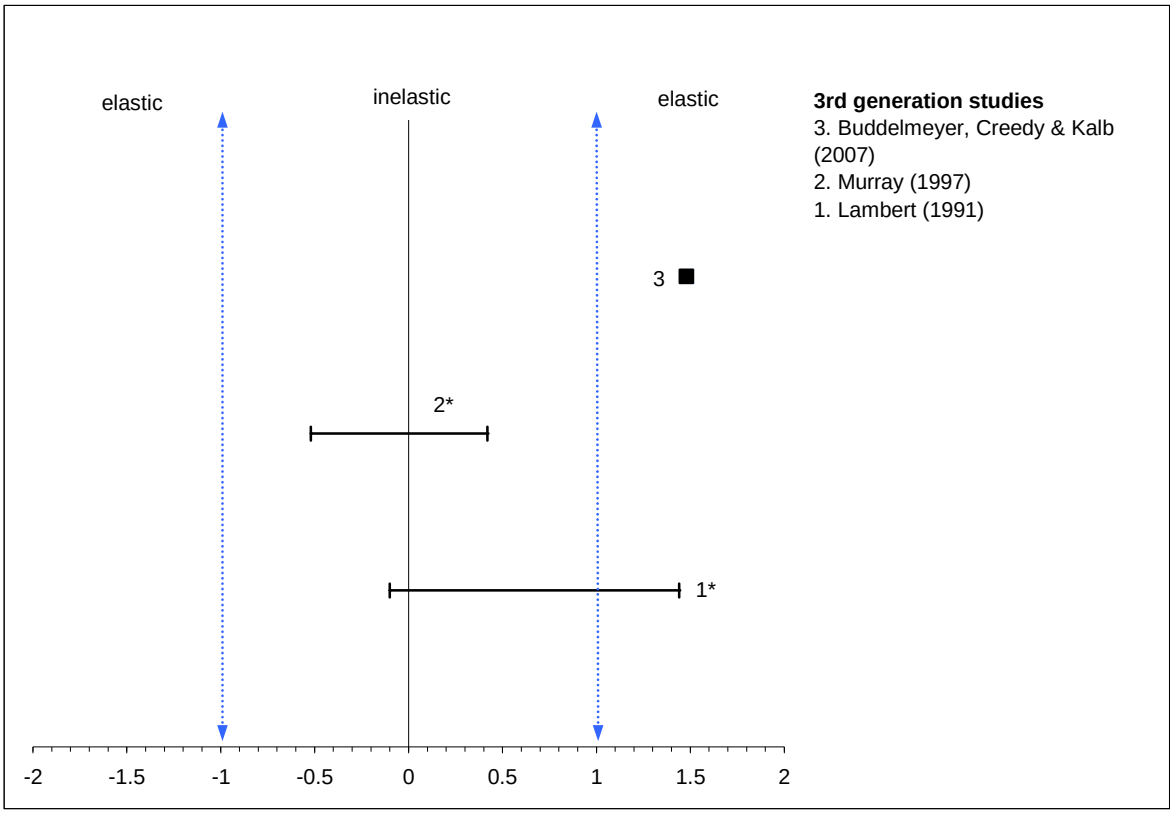
The results from Apps, Killingsworth and Rees (1996) show that, for married men, the variation in the estimates as a result of differences in model specification is around half that found for married women.

3.2.3 Lone parents

The few Australian studies that consider lone parents (Lambert, (1991); Murray, (1997); Buddelmeyer, Creedy and Kalb, (2007)) all use third-generation modelling approaches.[21] Their elasticity estimates are shown in Figure 3.

21 Other labour supply studies of lone parents, for example, by Doiron (2004) and Duncan and Harris (2002), do not estimate elasticities. The results of both these studies suggest that lone parents' labour supply is fairly responsive to policy changes that impact on work incentives, such as decreasing welfare benefit withdrawal rates.

Figure 3: Uncompensated wage elasticities — lone parents (Australia)



* Disaggregated studies.

The earlier studies of lone parents' labour supply produce quite different, but overlapping, estimates. Murray (1997), disaggregating for part-time and full-time workers, finds lower estimates compared to other studies and finds that elasticities are highest for female lone parents who are not working, followed by those working part time. Those working full time generally have negative wage elasticities. Some of the estimates for part-time lone parents are zero.

Lambert (1991) disaggregates the elasticities by welfare dependency. Female lone parents with some degree of welfare dependency have lower and negative wage elasticities. However, this result does not accord with Murray's (1997) finding that the elasticities of non-workers, who are more likely to have some level of welfare dependency, are highest.

The more recent study by Buddelmeyer, Creedy and Kalb (2007), using a model with a greater number of discrete hours points than the previous two studies, finds lone parents to be much more responsive than other Australian studies, with elasticity estimates that are at the higher end of those found internationally.

Two of the three lone parent studies (Murray, 1997; and Buddelmeyer, Creedy and Kalb, 2007) appear to estimate unconditional wage elasticities. After taking the participation effect into account, the resulting conditional wage elasticities from these studies would be expected to be smaller.

Overall, the evidence on lone parents is mixed, and would benefit from further study, particularly at the disaggregated level. Wage elasticities are likely to be positive, and possibly higher than those of married women. However, the evidence is ambiguous in relation to the relative size and direction of the wage elasticity of non-workers compared to workers.

3.2.4 Single men and women

The two remaining population groups are single men and women. The one Australian study that considers the labour supply of these groups (Buddelmeyer, Creedy and Kalb, (2007)), finds positive but fairly inelastic responses. The paucity of studies on single men and women is a likely reflection of greater policy focus over recent decades on families and lone parents.

3.3 Overview of Australian elasticity estimates

Table 2 summarises the range of wage elasticity estimates from selected Australian studies.

Table 2: Summary of uncompensated wage elasticities for Australia by population group

Population group	Studies	Estimates	Range	Mean	Median	Standard Deviation
Married men	5	14	-0.19 to 0.26	0.00	0.00	0.13
Married women	11	27	-0.19 to 1.3	0.30	0.18	0.35
Single men	1	1	0.28	0.28	0.28	-
Single women	1	1	0.34	0.34	0.34	-
Lone parents	3	6	-0.15 to 1.48	0.52	0.20	0.75

In addition to the criteria used for the selection of studies shown in Figures 1, 2 and 3, the following additional criteria are used to select the studies for table 2:

- only estimates from second and third-generation studies are included;
- estimates are excluded where it is known that the compensated elasticities are negative; and
- if the study provided elasticity estimates for the whole population group, then these estimates are included and the disaggregated elasticities ignored. On the other hand, if elasticities for the whole population group are not provided, then the averages of the disaggregated elasticities are included in the table.[22]

Mean and median columns in Table 2 are provided as a tool to aid comparison between the population groups, and should not be interpreted as summary estimates of the wage elasticities of the population groups in question.

22 This is not a 'perfect' criterion, however it ensures that the estimates from the disaggregated studies are included, and taking the mean ensures that the study does not have a 'dominating' influence on the elasticity range compared to the non-disaggregated studies. This only affected a total of 7 estimates from 4 studies.

The table highlights a number of issues. Firstly, the variation in elasticity estimates across population groups points to the usefulness of grouping the estimates by population group. However this level of disaggregation is low. Policy makers may often be interested in the responsiveness of particular sub-groups within a population group. Only seven Australian studies provide a greater level of disaggregation. These studies disaggregate elasticities by employment status (Murray, (1997); Apps, (2001)), an individual's lifecycle stage (Apps, (2001)), wage levels (Kalb, (2000)) and other individual characteristics including education level and the presence of dependent children (Shamsuddin, (1998); Scutella, (2001); Breunig, Cobb-Clark and Gong, (2005)).

Secondly, given the variation in the estimates, there are not enough studies to give a clear indication of a typical elasticity figure for any population group. This is particularly the case for lone parents and single men and women where very few estimates are available.

Thirdly, the range of the estimates within a population group is wide. There are a number of reasons for this. It could be due to different methodologies employed in the modelling; the specification and estimation techniques; or the method used in calculating the elasticities. Furthermore, the period of time of the data and the definition and measurement of the variables used, can be a source of variation as well.

Given the variation in the estimates, and their sensitivity to modelling, data and methods of calculation, it is difficult to draw definitive conclusions about the responsiveness of various population groups to policy stimuli. On the other hand, a single study can provide a useful basis for comparing the relative responsiveness of different population groups. Using estimates from a single

study allows comparisons to be made using the same methodology and data source. However, only a handful of Australian studies (Kawaguchi, (1994); Apps, Killingsworth and Rees, (1996); Apps and Rees, (1996); Kalb, (2000); Kidd and Ferko, (2001); Breunig, Cobb-Clark and Gong, (2005)) estimate elasticities for two or more of the broad population groups; in particular, for married men and married women. Only one study (Buddelmeyer, Creedy and Kalb, (2007)) compares all the five population groups identified above. Table 3 shows the elasticity estimates for the studies that estimate elasticities for both married men and married women.

Table 3: Summary of uncompensated wage elasticities for Australia by population group for studies that estimate elasticities for both married men and women

Population group	Studies	Estimates	Range	Mean	Median	Standard Deviation
Married Men	5	14	-0.19 to 0.26	0.00	0.00	0.13
Married Women			-0.19 to 0.56	0.21	0.15	0.25

Despite the variability in estimates shown in Tables 2 and 3, there are patterns. Lone parents have the widest range of wage elasticity estimates, and the top of the range is higher than for any of the other population groups. The only study that estimates elasticities for all the population groups (Buddelmeyer, Creedy and Kalb, (2007)) reports lone parents as the most responsive, with the wage elasticity greater than that of married women by almost a factor of three.

As expected, there is less spread for married men and they are less responsive than the other groups, indicative of their greater propensity to work full time with less scope to adjust their working hours. The majority of estimates are in the range -0.1 to 0.2. From the studies considered, the 'average' elasticity of married men is around zero and of married women around 0.3 (Table 2). If we

consider only the studies that estimate elasticities for both married men and married women (Table 3), we similarly find that married men are less responsive than married women.

The negative estimates for married men come from a single study (Apps, Killingsworth and Rees, (1996)) which investigates the sensitivity of estimates to assumptions made about how labour supply decisions are made in the household. The estimates from the remaining four studies are all positive, collectively ranging from 0 to 0.3, with a mean of around 0.14.

As well as having a higher average elasticity than married men, married women have a greater spread of estimates, with just over half the estimates in the range 0 to 0.6, and 20 per cent negative. The negative estimates are from two studies, the first from Apps, Killingsworth and Rees (1996) and the second from Kawaguchi (1992). Considering only the estimates from the remaining studies, the wage elasticity ranges from 0.1 to 1.3 with mean around 0.6.

Most of the elasticity estimates included in the sample to produce Tables 2 and 3 are conditional wage elasticities. If the estimates of two of the studies that report unconditional wage elasticities are to be replaced with conditional wage elasticities, the estimates would be expected to be reduced. In the study by Breunig, Cobb-Clark and Gong (2005) the wage elasticities for working married men and women would be around 0.08 and 0.15 after removing the participation effect. There is insufficient information in the Buddelmeyer, Creedy and Kalb (2007) study to calculate the conditional wage elasticity estimate, though, based on employment-to-population ratio data, the conditional wage elasticities for working married men and women are likely to be around 0.06 and 0.24. Doing this will slightly reduce the mean elasticity reported in Table 1 to -0.02 for

married men and 0.27 for married women. We would also expect a small reduction in the range and standard deviation for married men. The reduction in the mean of the lone parent estimates would be expected to be somewhat larger given that two out of the three lone parent studies estimate unconditional elasticities (from 0.52 to 0.39 after the adjustment).

Furthermore, the evidence supports the view that the participation elasticities can be quite high and that responsiveness at the extensive margin is just as high as, or higher than, the responsiveness at the intensive margin. The estimates by Breunig, Cobb-Clark and Gong (2005) suggest that the participation elasticities are around 70 per cent of the unconditional wage elasticities for both married women and married men. Making adjustments as described above to the estimates by Buddelmeyer, Creedy and Kalb (2007) suggests that the participation elasticities in those estimates are around 75 per cent of the unconditional wage elasticities for married men and 55 per cent of the unconditional wage elasticities for women.

If all individual disaggregated estimates are included in the sample, then the range of the estimates would be wider, reflecting the wider variation in responsiveness when the population groups are broken down by characteristics such as the number of hours worked and the ages and number of children. As married women have higher part-time participation rates than married men, they have more opportunity to change their hours of work, and because of their lower overall workforce participation rates, the decision whether or not to work is often more relevant for them.

Both these factors seem to be reflected in their higher elasticity estimates.[23]

There is only one elasticity estimate for single men and single women, which shows these groups to be fairly responsive to wage changes; more responsive than married men and slightly less responsive than married women. However, if an adjustment is made to the estimates to account for the participation effect, the elasticities drop to around 0.00 for single men and 0.09 for single women.

Table 4 provides an overall summary of the Australian evidence.

23 In 2006 for example, the full-time and part-time employment-to-population ratios of married men under 65 years of age were around 80 per cent and 8 per cent. For married women under 65 years of age, the full-time and part-time employment-to-population ratios were 36 per cent and 31 per cent (ABS 2007b). Also using data from June 2000, the average working hours of all working married men was 42 hours and for all working married women was 28 hours (ABS 2000).

Table 4 Summary of the responsiveness of population groups to wages based on Australian evidence

		Married men	Married women	Lone parents	Singles
Evidence on variation between population groups					
Responsiveness		Least responsive.	Fairly responsive, and a wider variation in responsiveness.	Possibly the highest responsiveness and widest range.	Likely to be more responsive than married men and less responsive than married women. Single women are likely to be a little more responsive than single men.
Uncompensated wage elasticity		Mostly in the range between 0 (or slightly negative) to around 0.3 with average around 0.	Mostly in the range 0 to 0.8 with an average around 0.3.	Around 0.5 on average, but probably higher than this (could be as high as 1.5).	Insufficient data, however an average around 0.3 is possible.
Evidence on variation within population groups					
Source of variability within the population group	**Lifecycle stage/children**	Slightly more responsiveness from those without children than those with young children, however the difference is fairly small.	Higher wage elasticity for those with dependent children compared to those without children or where children have left home. Those with older children (school-aged) generally have higher elasticities than those with younger (pre school-aged) children.		
	Wage level	Some evidence of slightly reduced responsiveness for those in families with both partners with higher wages compared to those with lower wages.	Generally those in families with both partners with lower wage levels have higher elasticities than those with higher wage levels.		
	Hours of work/employment status		Those on lower hours (part-time work) have higher elasticities than those working higher hours (full-time work).	Generally higher elasticities for those not working or working part-time hours.	
	Education	Generally higher responsiveness for those with lower educational attainment.	Generally higher responsiveness for those with lower educational attainment.		
	Foreign status		Australian-born women have higher elasticities than foreign-born women. Of the foreign-born, those from NESB backgrounds have the lowest elasticities.		
	Welfare dependency			Lower elasticities for lone mothers with some degree of welfare dependency.	

Notes: As the number of disaggregated studies is small, some of the reported responses within a particular population group are based on single studies.

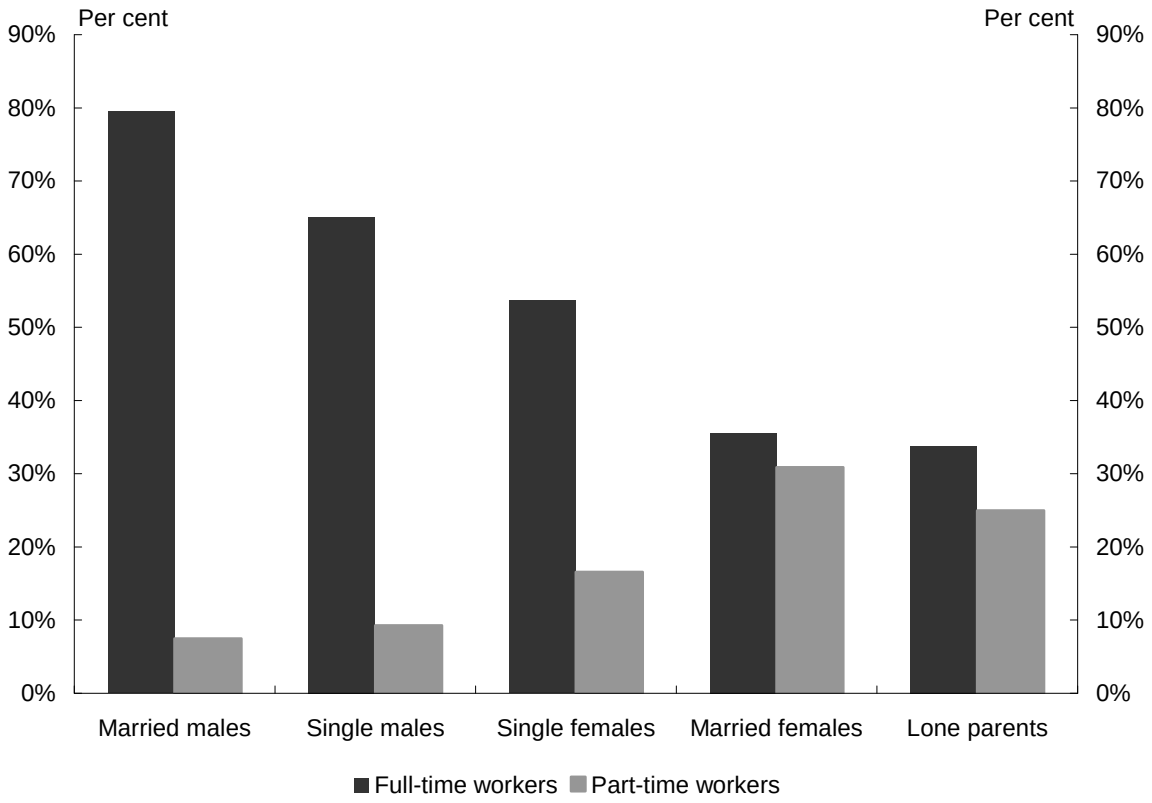
Most of the studies upon which this table is based use data that excludes persons that are aged around Australian Age Pension age (65 years for men and changing from 60 to 65 years for women) or older. See Table A9 for further details of the samples of the studies referred to in the review.

Given that the majority of lone parent estimates, and all of the single men and single women estimates, presented in this review are unconditional wage elasticities, we would expect the conditional wage elasticities for these groups to be smaller than those shown in this table. For example, in the estimates presented in Tables A1 and A2 for the study by Breunig, Cobb-Clark and Gong (2005), the participation effect could account for up to 70 per cent of the unconditional wage elasticity estimate. Making the adjustment from the studies that provide sufficient information to do so, the average elasticity for lone parents drops to around 0.4, for single men it drops to 0.0 and for single women it drops to 0.1.

Finally, Figure 4 shows the full-time and part-time employment-to-population ratios for the population groups identified in the elasticity estimates presented in Table 4. The population groups with the higher wage elasticities are generally those with the lower full-time employment rates and the higher part-time employment rates.

Figure 4: Australian full-time and part-time employment-to-population ratios (2006)

Percent of civilian population aged under 65 years



Source: ABS (2007b), Data Cube FM2 — Labour Force Status by Sex, Age, Relationship.

3.4 Selected international comparisons

Table 5 compares Australian elasticity estimates with those from the United Kingdom, Canada and New Zealand, chosen because of their comparable institutional settings to Australia. [24] Only second- and third-generation studies are reported and estimates that did not correct for sample selection are excluded. The estimates in Table 5 are based on studies outlined in Tables A4, A5 and A6 of Appendix A, which are a representative rather than an exhaustive list of the labour supply elasticities estimated for these countries.

Table 5 Summary of uncompensated wage elasticities for the United Kingdom, Canada and New Zealand by population group

Population sub-group	UK		Canada[1]		NZ	
	Studies	Range	Studies	Range	Studies	Range
Married men	1	-0.29	1	-0.18 to 0.22	1	0.24
Married women	4	-0.30 to 0.71	6	-0.37 to 0.46	2	-0.12 to 0.40
Single men	-	-	1	0.07	1	0.63
Single women	-	-	1	0.07	1	0.82
Lone parents	3	0.11 to 1.44	1	0.07	1	0.34

Notes:
1 Table excludes the all men & all women estimates of Osberg and Phipps (1993) and the all women estimate of Lacroix and Fréchette (1994).

There are more studies that calculated wage elasticity estimates for married women than any other group. The range of wage elasticity estimates for married women is wide, but narrower than that found for married women in Australia. However, part of the reason for this may be the smaller number of estimates covered compared to the Australian estimates shown in Table 2.

24 Institutional settings include industrial relations and welfare systems. For instance, the operation of the Australian labour market has been influenced by a set of historical institutional constructs such as the federal system of government, bargaining and wage setting, the extent of unionism and the welfare safety net.

Consistent with Australian studies, married women are generally more responsive to wage changes than married men. For lone parents, estimates vary. For the UK, as for Australia, the estimates for lone parents tend to be at the higher end of the elasticity estimates as a whole. This is not the case for estimates for Canada and New Zealand (although there is only one estimate for each of these countries). Like Australia, there are very few estimates for singles. From the few estimates, single men and women have similar responsiveness to wages, though the response is higher for New Zealand singles than for Canadian singles.

Generally, the pattern of responsiveness for married women is similar to that revealed by the Australian evidence. Apart from the generally smaller overall elasticity, there is similar variation in the disaggregated studies compared to Australia. The effect of children is also broadly in line with the Australian evidence. Having more dependent children decreases the wage elasticity, and the elasticity is higher for those with older rather than younger children.

The impact of age contrasts with the evidence for Australia. However, age is probably only an indirect source of variation in the elasticities. The relevant variable is more likely to be the stage of the lifecycle, of which age is one component, and the presence and ages of children are others.

The evidence for lone parents from the one study that disaggregates by the ages of children indicates that the wage elasticity of lone parents is higher for those with younger children rather than older children. This is different from the evidence for married women noted above. The study also found lone parents to be fairly wage-elastic at low hours of work.

In relation to married men and singles, there are no disaggregated studies that look at the variation of wage elasticities within these population groups.

Two sources of variation in the international studies arise from some features of the modelling used. The first modelling feature relates to taking account of labour market constraints. These constraints arise for a number of reasons. One reason may be underemployment, where workers would prefer to work more hours but cannot do so, perhaps because of institutional rigidities in the number of hours of work available. Another constraint is involuntary unemployment, where workers prefer to work, but cannot find a job. One UK study finds that married women are generally more responsive to wage changes when their partners are assumed not to be free to choose their hours of work, than when they are assumed to be free to do so. As expected, two Canadian studies find that when both married men and women are assumed not to be able to freely choose their hours of work, the elasticities are lower than if they are assumed to be able to choose their working hours. This suggests that models that ignore these labour market constraints may be over-estimating the wage elasticities.

The second modelling feature relates to making different assumptions about the labour supply behaviour of households. For couples without young children, if the household is assumed to be following a collective pattern of behaviour, then women's and men's wage elasticities are found to be fairly similar. In contrast, if a unitary approach is assumed (as is the case in most labour supply modelling) then the elasticity for women is found to be higher than that for men.[25]

25 The collective model assumes each individual in the household maximises their own individual utility function, whereas the unitary model assumes the household maximises a single utility function. In the collective model, consumption and labour supply choices are assumed to result from some bargaining within the household.

Therefore, the presence and extent of labour market constraints (which could differ over time depending on the business cycle) or the bargaining that takes place within households over how much labour to supply (which could differ over the lifecycle stage of the household) are relevant considerations in assessing how accurately elasticity estimates reflect the responsiveness of individuals to changes to net wages.

4. CONCLUDING COMMENTS

A comparative review of labour supply elasticity estimates can provide useful information about the labour market responsiveness of particular population groups to the impact of policy changes or other changes in the labour market. However, a number of issues need to be considered when interpreting labour supply elasticities. These include the degree of disaggregation of the elasticities, the modelling and specification used, differences in data, and country-specific institutional factors when making comparisons between countries.

This review has highlighted some areas where our understanding of labour supply could be improved.

Firstly, there are very few studies that report wage elasticities for singles, a group with relatively high labour supply responsiveness.

Secondly, many Australian studies have undertaken analysis with only a small degree of disaggregation. Greater disaggregation would allow us to improve our understanding of the labour supply responses of various sub-groups of people within the usual five population groups summarised by gender and marital status, and in particular by income level, stage in the life-cycle, labour market status and various family characteristics .

Although there is a reasonably wide coverage of married women, there is still the need for more disaggregated information on the influence of the age of children on labour market responsiveness.

Thirdly, there are no Australian studies which examine the changes in labour supply elasticities over time, an area that could be fruitful even with existing cross-sectional data. This is particularly important for the population groups where labour force participation rates and average working hours have changed significantly over time.

Fourthly, it would be useful to have a better understanding of the relative roles of different modelling assumptions and specification techniques as opposed to different population characteristics in explaining the observed variation in elasticity estimates. Finally, our understanding would be improved by further improvements to modelling methodologies and specifications. Two examples of this could be specifications that more accurately capture couples' labour supply decisions within the household and those that more explicitly take labour market constraints into account.

5. REFERENCES

Apps, P (2001), 'Why an Earned Income Tax Credit Program is a Mistake for Australia', Discussion Paper No. 431, Centre for Economic Policy Research, Australian National University.

Apps, P F, Killingsworth, M and Rees, R (1996), 'On the Specification of Labour Supply and Household Production Models', ANU Working Papers in Economics and Econometrics, No. 300.

Apps, P F and Rees, R (1996), 'Labour supply, household production and intra-family welfare distribution', *Journal of Public Economics*, 60, pp 199-219.

Apps, P and Rees, R (2001), 'Household Saving and Full Consumption over the Life Cycle', The Institute for the Study of Labor (IZA) Discussion Paper No. 280.

Arellano, M and Meghir, C (1992), 'Female Labour Supply and On-the-Job Search: An Empirical Model Estimated Using Complementary Data Sets', *The Review of Economic Studies*, 59 (3), pp 537-559.

Arrufat, J L and Zabalza, A (1986), 'Female Labor Supply with Taxation, Random Preferences, and Optimization Errors', *Econometrica*, 54 (1), pp 47-64.

Ashworth, J S and Ulph, D T (1981), 'Household Models', in Brown, C V (ed), *Taxation and Labour Supply*, George Allen and Unwin, London, Chapter 9.

Atkinson, A B, Stern, N H and Gomulka, J (1980), 'On the Switch from Direct to Indirect Taxation', *Journal of Public Economics*, 14, pp 195-224.

Australian Bureau of Statistics (ABS), (2000), *Labour Force Status and Other Characteristics of Families, Australia*, June 2000, Cat. 6224.0, available from http://www.abs.gov.au.

Australian Bureau of Statistics (ABS), (2007a), *Labour Force, Australia, Spreadsheets*, July 2007, Cat. 6202.0.55.001, available from http://www.abs.gov.au.

Australian Bureau of Statistics (ABS), (2007b), *Labour Force, Australia, Detailed — Electronic Delivery*, July 2007, Cat. 6291.0.55.001, available from http://www.abs.gov.au.

Australian Bureau of Statistics (ABS), (2007c), *Labour Force, Australia: Labour Force Status and Other Characteristics of Families — Electronic Delivery*, June 2007, Cat. 6224.0.55.001, available from http://www.abs.gov.au.

Bingley, P, Symons, E and Walker, I (1992), 'The Labour Supply of UK Lone Mothers: the Effects of Maintenance', and the Welfare System, Institute for Fiscal Studies (IFS) Working Paper Series No. W92/19.

Birch, E R (2005), 'Studies of the Labour Supply of Australian Women: What Have We Learned?', *The Economic Record*, 81 (252), pp 65-84.

Blau, F D and Kahn, L M (2006), 'Changes in the Labor Supply Behavior of Married Women: 1980-2000', The Institute for the Study of Labor (IZA) Discussion Paper No. 2180.

Bloemen, H G (2005), 'Income Taxation in a Collective Household Labour Supply Model with Discrete Hours', Free University Amsterdam Working Paper, paper presented at the Seminaire D'analyse Economique et D'econometrie, Université de Cergy-Pontoise, November 2005.

Blundell, R (1992), 'Labour Supply and Taxation: A Survey', *Fiscal Studies*, 13 (3), pp 15-40.

Blundell, R W, Chiappori, P A., Magnac, T and Meghir, C (2005), 'Collective Labour Supply: Heterogeneity and Non-Participation', Centre for Economic Policy Research (CEPR) Discussion Paper No. 5287.

Blundell, R, Duncan, A and Meghir, C (1992), 'Taxation in Empirical Labour Supply Models: Lone Mothers in the UK', *The Economic Journal*, 102 (411), pp 265-278.

Blundell, R and MaCurdy, T (1999), 'Labor Supply: A Review of Alternative Approaches', in Ashenfelter, O and Card, D (eds), *Handbook of Labor Economics Volume 3A*, North-Holland.

Blundell, R and Walker, I (1982), 'Modelling the Joint Determination of Household Labour Supplies and Commodity Demands', *The Economic Journal*, 92 (366), pp 351-64.

Blundell, R and Walker, I (1986), 'A Life-Cycle Consistent Empirical Model of Family Labour Supply Using Cross-Section Data', *The Review of Economic Studies*, 53 (4), pp 539-558.

Breunig, R, Cobb-Clark, D A and Gong, X (2005), 'Improving the Modeling of Couples' Labour Supply', The Institute for the Study of Labor (IZA) Discussion Paper No. 1773.

Buddelmeyer, H, Creedy, J and Kalb, G (2007), *Tax Policy Design and Behavioural Microsimulation Modelling*, Edward Elgar Publishing Limited, UK.

Christofides, L N , Stengos, T and Swidinsky, R (1997), 'Welfare Participation and Labour Market Behaviour in Canada', *The Canadian Journal of Economics*, 30 (3), pp 597-621.

Creedy, J. and Kalb, G. (2005), 'Behavioural Microsimulation Modelling for Tax Policy Analysis in Australia: Experience and Prospects', *Australian Journal of Labour Economics*, 8 (1), pp 73-110.

Doiron, D J (2004), 'Welfare Reform and the Labour Supply of Lone Parents in Australia: A Natural Experiment Approach', *The Economic Record*, 80 (249), pp 157-176.

Duncan, A and Harris, M N (2002), 'Simulating the Behavioural Effects of Welfare Reforms Among Sole Parents in Australia', *The Economic Record*, 78 (242), pages 264-276.

Eissa, N and Hoynes, H (2005), 'Behavioral Responses to Taxes: Lessons from the EITC and Labor Supply', National Bureau of Economic Research, Working Paper 11729.

Evers, M, de Mooij, R and van Vuuren, D (2005), 'What Explains the Variation in Estimates of Labour Supply Elasticities?', CPB Netherlands Bureau for Economic Policy Analysis Discussion Paper No. 51.

Eyland, E A, Lapsley, H M and Mason, C A (1982), 'Determinants of Female Employment', *The Economic Record*, 58 (160), pp 11-17.

Fallon, P and Verry, D (1988), *The Economics of Labour Markets*, Philip Allan, UK.

Fortin, B and Lacroix, G (1997), 'A Test of the Unitary and Collective Models of Household Labour Supply', *The Economic Journal*, 107 (443), pp 933-955.

Fortin, B and Lacroix, G (2002), 'Assessing the Impact of Tax and Transfer Policies on Labour Supply: A Survey', Cirano Project Report 2002RP-10, Montreal.

Greenhalgh, C (1980), 'Participation and Hours of Work for Married Women in Great Britain', *Oxford Economic Papers*, 32 (2), pp 296-318.

Hausman, J (1985), 'Taxes and Labour Supply', in Auerbach, A and Feldstein, M (eds), *Handbook of Public Economics, Volume 1*, North-Holland, Chapter 4.

Heckman, J J (1979), 'Sample Selection Bias as a Specification Error', *Econometrica*, 47 (1), pp 153-162.

Heckman, J J (1993), 'What Has Been Learned About Labor Supply in the Past 20 Years?', *The American Economic Review*, 83 (2), pp 116-121.

Heckman, J, Killingsworth, M and MaCurdy T (1981), 'Empirical Evidence on Static Labour Supply Models: A Survey of Recent Developments', in Hornstein, Z, Grice, J and Webb, A (eds), *The Economics of the Labour Market: Proceedings of a Conference on the Labour Market*, 10-12 September 1979, Oxford.

Heim, B T (2005), 'The Incredible Shrinking Elasticities: Married Female Labor Supply, 1979-2003', Working Paper, Duke University.

Jenkins, S P (1992), 'Lone Mothers' Employment and Full-Time Work Probabilities', *The Economic Journal*, 102 (411), pp 310-320.

Jones, G. and Savage, E. (1996), 'An Evaluation of Income Splitting with Variable Female Labour Supply', *The Economic Record*, 72 (218), pp 224-235.

Kalb, G R (2000), 'Labour Supply and Welfare Participation in Australian Two-Adult Households: Accounting for Involuntary Unemployment and the 'Cost' of Part-time Work', Centre of Policy Studies and the Impact Project Preliminary Working Paper No. BP-35.

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

Kalb, G (2003), 'The impact of social policy initiatives on labour supply incentives: A review of the literature', Commonwealth Department of Family and Community Services Policy Research Paper No. 18.

Kalb, G and Scutella, R (2003), 'New Zealand Labour Supply from 1991-2001: An Analysis Based on a Discrete Choice Structural Utility Model', New Zealand Treasury Working Paper, 03/23.

Kawaguchi, A (1992), 'Female Labour Supply: Sensitivity to the Specification of Labour Supply Function', University of Melbourne Department of Economics Research Paper Number 331.

Kawaguchi, A (1994), 'Testing neoclassical and non-neoclassical models of household labour supply', *Applied Econometrics*, 26 (1), pp 9-19.

Kenyon, P and Wooden, M (1996), 'Labour Supply', in Norris, K and Wooden, M (eds), *The Changing Australian Labour Market*, Economic Planning Advisory Commission, Commission Paper No. 11, Australian Government Publishing Service, Canberra, Chapter 2.

Kidd, M P and Ferko, I (2001), 'The Employment Effects of Gender Discrimination in Australia 1994-95', *The Economic Record*, 77(236), pages 71-88.

Killingsworth, M R (1983), *Labor Supply*, Cambridge University Press.

Killingsworth, M R and Heckman, J J (1986), 'Female Labor Supply: A Survey', in Ashenfelter, O and Layard, R (eds), *Handbook of Labor Economics Volume 1*, North-Holland, Chapter 2.

Knudsen, C and Peters, H E (1994), 'An International Comparison of Married Women's Labor Supply', Luxembourg Income Study Working Paper No. 106.

Lacroix, G and Fortin, B (1992), 'Utility-based Estimation of Labour Supply Functions in the Regular and Irregular Sectors', *The Economic Journal*, 102 (415), pp 1407-1422.

Lacroix, G and Fréchette, P (1994), 'A Microeconomic model of Female Labour Supply in the Presence of Unemployment and Underemployment', *Annales d'Economie et de Statistique*, 36, pp 113-131.

Lambert, S F (1991), *An Analysis of the Labour Supply Behaviour of Female Lone Parents in Australia*, PhD Thesis, Murdoch University.

Lateral Economics (2006), 'Tax Cuts for Growth: The Impact of Marginal Tax Rates on Australia's Labour Supply', Committee for Economic Development of Australia (CEDA) Information Paper 84.

Layard, R (1978), 'Hours supplied by British Married Men, with Endogenous Overtime', Discussion Paper No. 30, Centre for Labour Economics, London School of Economics.

Layard, R, Barton, M, and Zabalza, A (1980), 'Married Women's Participation and Hours', *Economica*, 47 (185), pp 51-72.

McDonald, J F and Moffitt, R A (1980), 'The Uses of Tobit Analysis', *The Review of Economics and Statistics*, 62 (2), pp 318-321.

Miller, P W (1985), 'Female Labour Supply in Australia: Another Example of a Backward-Bending Labour Supply Curve', *Economics Letters*, 19, 287-90.

Miller, P W and Volker, P A (1983), 'A Cross-Section Analysis of the Labour Force Participation of Married Women in Australia', *The Economic Record*, 59 (164), pp 28-42.

Mroz, T A (1987), 'The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions', *Econometrica*, 55 (4), pages 765-799.

Murray, J (1996), 'Modelling the Labour Supply Behaviour of Sole Parents in Australia', in McAleer, M, Miller, P W and Ong, C, *Proceedings of the Econometric Society Australasian Meeting 1996, 4: Microeconometrics*, Perth, University of Western Australia, pp 507-546.

Murray, J (1997), 'The Labour Supply Behaviour of Australian Lone Mothers', UNSW School of Economics Discussion Paper 97/2.

Nakamura, A and Nakamura, M (1981), 'A Comparison of Labor Force Behavior of Married Women in the United States and Canada, with Special Attention to the Impact of Income Taxes', *Econometrica*, 49 (2), pp 451-489.

Norris, K (1996), *The Economics of Australian Labour Markets*, 4th Edition, Longman Australia.

Osberg, L and Phipps, S (1993), 'Labour Supply with Quantity Constraints: Estimates from a Large Sample of Canadian Workers', *Oxford Economic Papers*, 45 (2), pp 269-291.

Pencavel, J (1986), 'Labor Supply of Men: A Survey', in Ashenfelter, O and Layard, R (eds), *Handbook of Labor Economics Volume 1*, North-Holland, Chapter 1.

Robinson, C and Tomes, N (1985), 'More on the Labour Supply of Canadian Women', *The Canadian Journal of Economics*, 18 (1), pp 156-163.

Ross, R T (1980), 'Disaggregate Labour Supply Functions for Married Women: Preliminary Estimates for New Zealand', Working Papers in Economics No. 37, Department of Economics, University of Sydney.

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

Ross, R and Saunders, P (1993), 'The Labour Supply Behaviour of Sole Mothers and Married Mothers in Australia: Evidence from the 1986 Income Distribution Survey', *Australian Economic Papers*, 32 (60), pp 116-133.

Russek, F R (1996), 'Labor Supply and Taxes', CBO Memorandum, Congressional Budget Office, Washington, DC.

Scutella, R (2001), 'Labour Supply Estimates for Married Women in Australia', *Australian Journal of Labour Economics*, 4 (3), pp 152-172.

Shamsuddin, A (1998), 'Labour Supply of Immigrant Women in Australia', *Australian Journal of Labour Economics*, 2 (2), pp 105-133.

Smith, J B and Stelcner, M (1988), 'Labour Supply of Married Women in Canada, 1980', *The Canadian Journal of Economics*, 21(4), pp 857-870.

Stelcner, M and Breslaw, J (1985), 'Income Taxes and the Labor Supply of Married Women in Quebec', *Southern Economic Journal*, 51 (4), pages 1053-1072.

Van Soest, A (1995), 'Structural Models of Family Labor Supply: A Discrete Choice Approach', *The Journal of Human Resources*, 30 (1), pp 63-68.

Wooldridge, J M (2003), *Introductory Econometrics: A Modern Approach*, 2nd Edition, South Western.

APPENDIX A

Table A1: Australian wage elasticities with respect to hours of work[1]

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no dependent children	Married women - children	Married men - young dependent child	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
Miller (1985)[2]			-0.41 to -0.23									
Ross (1986)			1.3									
Lambert (1991)	All lone parents, those with a degree of welfare dependency										1.44, -0.10	
Kawaguchi (1992)[3]			-0.06 to 0.04									
Kawaguchi (1994)[4]		-0.64 to 4.01	-0.78 to -0.17									
Knudsen and Peters (1994)[5]	Labour supply defined as weekly hours of work or annual hours of work		0.32, 0.39									
Apps, Killingsworth and Rees (1996)[6]		-0.19 to 0.08	-0.19 to 0.53									
Apps and Rees (1996)[7]	Model with and without household production	0.01, 0.11			0.18, 0.23							

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A1: Australian wage elasticities with respect to hours of work (continued)

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no dependent children	Married women - children	Married men - young dependent child	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
Jones and Savage (1996)[8]			1.13									
Murray (1997)[9]	Zero hours, P/T hours or F/T hours										0.06 to 0.3, -0.00 to 0.42, -0.52 to 0.39	
Shamsuddin (1998)[10]	All persons, NESB immigrants, ESB immigrants, or Australian-born		0.66 to 0.74, 0.13 to 0.19, 0.28 to 0.36, 0.85 to 0.88									
Kalb (2000)[11]	Low wage	0.12 to 0.32		0.46 to 0.73		0.10 to 0.24	0.48 to 0.50					
	Average wage	0.03 to 0.24		0.28 to 0.39		0.10 to 0.21	0.52 to 0.81					
	High wage	0.03 to 0.09		0.23 to 0.26		0.02 to 0.08	0.40 to 0.70					
Scutella (2001)[12]	Whole sample		0.083	0.104								
	Persons aged <25, 25-34, 35-44, 45 or more		0.03, 0.09, 0.10, 0.09									
	Persons with post-graduate, under-graduate, diploma, vocational or no educational qualifications		0.08, 0.02, 0.08, 0.11, 0.10									

NB: 1st generation ■ 2nd generation ■ 3rd generation ☐

Table A1: Australian wage elasticities with respect to hours of work (continued)

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no dependent children	Married women - children	Married men - young dependent child	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
Scutella (2001) (cont'd)	Persons with 1, 2, 3 or 4 or more children				0.11, 0.07, 0.02, 0.00							
	Persons with children aged 0-2 or 3-4 years						0.06, 0.01					
	Persons with children aged 5-9 or 10-15							0.07, 0.11				
Apps (2001)[13]	Working full-time hours			0.05, 0.13[14]			0.25, 0.33[15]	0.32[16]				
	Working part-time hours			0.56[17]			0.86, 1.05[15]	0.13[16]				
Kidd and Ferko (2001)[18]	Men and women											0.07 to 0.13, 0.10 to 1.00
Breunig, Cobb-Clark and Gong (2005)[20]	Whole sample	0.11 to 0.26	0.24 to 0.5									
	Persons with low or high education	0.13 to 0.3, 0.07 to 0.17	0.25 to 0.55, 0.20 to 0.39									
Buddelmeyer, Creedy and Kalb (2007)[19]		0.24	0.56						0.22	0.38	1.48	

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A1: Australian wage elasticities with respect to hours of work (continued)

Notes:

1. Unless otherwise stated the figures are uncompensated wage elasticities and are calculated at the sample means.
2. These are from a model with the labour supply equation corrected for sample selection. However the estimate with wages corrected for sample selection was -0.36. The model without sample correction in the hours equation gave -0.22. All were significant to at least the 10 per cent level. Note that the compensated wage elasticities were negative.
3. Over all the models estimated. None of the wage elasticities are significant (to at least the 10 per cent level).
4. These are results from all the models estimated. Elasticities for the most general 'unrestricted' model were -0.34 (married women) and -0.16 (married men).
5. This study estimated elasticities for four countries, and elasticities were calculated at a common point for all countries rather than at each country's sample mean. The wage was set at $8.20 (in terms of USD in 1986), annual income of $26,040, annual hours of work of 1560 and weekly hours of work of 32.5.
6. Three theoretical models were postulated and a total of 10 wage elasticity estimates were provided using variations in assumptions. These are the results from all estimated models and specifications.
7. Figures are for model that includes and excludes household production. The elasticity estimates are for married person households with at least one child less than 15 years, husbands and wives working at least 500 hours per year each.
8. This is the compensated wage elasticity.
9. Elasticities are calculated for sub-samples of people working zero, part-time and full-time hours over four different specifications.
10. Uses predicted wage rather than observed wage in the labour supply equation. Results are from two slightly different specifications. NESB immigrants are immigrants born in a non English-speaking country and ESB immigrants are immigrants born in an English-speaking country.
11. These estimates are from the 'basic model' and 'extended model', the basic model giving the higher figure of the quoted range. The figure shown is the median elasticity estimate; however, the paper provides a 95 per cent confidence interval for these estimates. Also the married men figure is for married men without children.
12. Two models were estimated, however elasticities were provided only for the preferred model.
13. The modelling referred to in the paper is based on Apps and Rees (2001). Elasticities were calculated for married women over various life cycle stages.
14. These are women who have not yet had children and those whose children have left home.
15. These are married women with pre school-age and primary-school age children.
16. These are married women with high school-age children or whose children have left school.
17. These are women whose children have left home.
18. The results are from the 1994-95 IDS. Using the preferred model with a linear experience variable as an identification restriction the estimates are 0.07 and 1.00 for men and women.
19. Uses elasticity estimates simulated from the expected labour supply. The elasticity estimates reported in the Buddelmeyer, Creedy and Kalb (2007) paper are revisions of the estimates reported in Creedy and Kalb (2005).
20. Two models were estimated, a base model and an extended preferred model. The estimates from the preferred model are at the higher end of the ranges quoted.

Table A2: Australian income elasticities with respect to hours of work[1]

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Lone parents
Miller (1985)[2]			-0.001					
Ross (1986)[3]			-0.07					
Lambert (1991)	All lone parents, those with a degree of welfare dependency							-1.27, 0.05
Kawaguchi (1992)[4]			-0.045 to -0.060					
Kawaguchi (1994)[5]		-0.00 to -0.01	-0.00					
Knudsen and Peters (1994)			-0.04					
Apps, Killingsworth and Rees (1996)[6]		-1.19 to -0.65	-2.32 to -1.43					
Apps and Rees (1996)[7]	Model with and without household production	-0.03, -0.69			-0.15, -1.45			
Murray (1997)[8]	Zero hours, P/T hours or F/T hours							-1.38 to -0.39, -0.64 to -0.14, -0.71 to -0.2
Shamsuddin (1998)[9]	NESB immigrants, ESB immigrants, Australian-born		-0.10, -0.05, -0.06					

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A2: Australian income elasticities with respect to hours of work (continued)

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Lone parents
Scutella (2001)[10]	Whole sample		-0.104	-0.085				
	Persons aged <25, 25-34, 35-44, 45 or more		-0.04, -0.10, -0.13, -0.09					
	Persons with post-graduate, under-graduate, diploma, vocational or no educational qualifications		-0.12, -0.08, -0.11, -0.12, -0.10					
	Persons with 1, 2, 3 or 4 or more children				-0.11, -0.12, -0.13, -0.12			
	Persons with children aged 0-2 or 3-4 years					-0.08, -0.173		
	Persons with children aged 5-9 or 10-15						-0.14, -0.12	
Breunig, Cobb-Clark and Gong (2005)[11]	Whole sample	-0.01 to 0.00	-0.01					
	Low or high education	-0.01 to 0.00, -0.01 to 0.00	-0.01 to 0.00, -0.01					

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A2: Australian income elasticities with respect to hours of work (continued)

Notes:

1. Unless otherwise stated elasticities are calculated at sample means.
2. With respect to husband's income.
3. Elasticity with respect to spouse's wage is -0.07. Elasticity with respect to other family income is not significant.
4. This is the total income elasticity over all the models estimated.
5. These are results for all the models. For the more general 'unrestricted' model the results were 0.001 (married women) and -0.015 (married men).
6. Three theoretical models were postulated and a total of four income elasticity estimates were made using variations in the assumptions. These are the results from all the estimated models and specifications.
7. Figures are for the models that include and exclude household production. The elasticity estimates are for married person households with at least one child less than 15 years, husbands and wives working at least 500 hours per year each.
8. Elasticities are calculated for sub-samples of people working zero, part-time and full-time hours over four different specifications.
9. With respect to family income. Excludes government benefits.
10. Two models were estimated, however elasticities were provided only for the preferred model.
11. The elasticity shown is with respect to own income. Two models were estimated, a base model and an extended preferred model. The estimates from the preferred and base models are not very dissimilar.

Table A3: Australian wage elasticities with respect to participation[1]

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	Men	Women
Miller and Volker (1983)[2]	OLS model: By age: 15-24 years, 25-34 years, 35-44 years, 45-54 years, 15-64 years		0.22, 0.44, 0.64, 0.87, 0.93;							
	IV model: By age: 15-24 years, 25-34 years, 35-44 years, 45-54 years, 15-64 years		0.86, 1.76, 1.24, 1.63, 1.82							
Kidd and Ferko (2001)[3]	1994-95 data								0.03 to 0.23	0.07 to 1.61
	1989-90 data								0.11 to 0.18	0.09 to 1.20
Breunig, Cobb-Clark and Gong (2005)[5]		0.10 to 0.18	0.19 to 0.35							
Buddelmeyer, Creedy and Kalb (2007)[4]		0.15	0.20			0.16	0.19	0.41		

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Notes:

1. Unless otherwise stated elasticities are calculated at sample means.
2. These are based on Local Government Area averages rather than at the individual level. The figures measure the participation elasticity with respect to wages.
3. The results are from the 1994-95 and 1989-90 IDS. From the model with the linear experience variable as an identification restriction, as preferred by the authors, the estimates for 1994-95 were 0.03 and 0.77 and for 1989-90 were 0.12 and 0.53 for men and women.
4. Uses elasticity estimates that were simulated from expected labour supply. The figures quoted here are the percentage point change in participation with respect to a 1 per cent change in wages.
5. Two models were estimated, a base model and an extended model preferred by the authors. The estimates from the preferred model are at the higher end of the ranges quoted.

Table A4: UK, Canada and New Zealand wage elasticities with respect to hours of work[1]

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
New Zealand											
Ross (1980)			-0.12 to -0.10								
Kalb and Scutella (2003)[2]		0.24	0.40					0.63	0.82	0.34	
United Kingdom											
Layard (1978)		-0.13 to -0.12	0.66								
Atkinson, Stern and Gomulka (1980)		-0.16 to -0.15	-								
Greenhalgh (1980)			0.64 to 0.72								
Layard, Barton and Zabalza (1980)[3]			0.49								
Ashworth and Ulph (1981)[4]		-1.00	-4.46								
Blundell and Walker (1982)[5]	Non-rationed labour supply	-0.29		0.43	0.10, -0.19[6]						
	Rationed labour supply			0.64	0.09, -0.30[6]						
Blundell and Walker (1986)	Compensated elasticity	0.02	0.01								
Arrufat and Zabalza (1986)[7]			0.62								

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A4: UK, Canada and New Zealand wage elasticities with respect to hours of work (continued)

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
Arellano and Meghir (1992)	Young dependants are aged 0-3 and 3-5 years; older dependants are aged 5-10 and 11 years or more			0.37		0.29, 0.50	0.71, 0.62				
Blundell, Duncan and Meghir (1992)[8]	All lone mothers, preschool, primary or secondary aged youngest child									0.16, 0.26, 0.18, 0.11	
Bingley, Symons and Walker (1992)[9]										0.76	
Jenkins (1992) (hours>24)[10]										1.44	
Blundell, Chiappori, Magnac and Meghir (2005)	No children or children left home			0.66							
Canada											
Nakamura and Nakamura (1981)	Age group 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59		-0.37, -0.27, -0.31, -0.09, -0.09, 0.14, -0.05								
Robinson and Tomes (1985)[11]			-0.23 to -0.20								

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A4: UK, Canada and New Zealand wage elasticities with respect to hours of work (continued)

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
Stelcner and Breslaw (1985)[12]			0.40								
Smith and Stelcner (1988)	Age group 20-34, 35-54 and 20-54		0.15, 0.03, 0.10								
Lacroix and Fortin (1992)[13]											0.25
Osberg and Phipps (1993)[14]	Men: unconstrained (linear, quadratic), constrained (linear)										-0.00, 0.03, -0.05
	Women: unconstrained (linear, quadratic), constrained (linear)										-0.01, 0.07, 0.02
Lacroix and Fréchette (1994)[15]	All women										0.47
Knudsen and Peters (1994)[16]			0.05 to 0.06								
Christofides, Stengos and Swidinsky (1997)[17]								0.07	0.07	0.07	
Fortin and Lacroix (1997)[18]	Unitary	0.18	0.46								
	Collective	0.22	0.29								

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A4: UK, Canada and New Zealand wage elasticities with respect to hours of work (continued)

Notes:

1. Unless otherwise stated the figures are uncompensated wage elasticities and are calculated at the sample means.
2. For married men and women this is not the own wage elasticity, instead it is the elasticity to a change in both partners' wage. The own wage elasticity, according to the authors, would be somewhat higher.
3. Tobit model estimate.
4. Results are for model with individual utilities for each household member and a family budget constraint.
5. Estimates are from the Blundell and Walker (1982) paper; however for compensated and total income elasticities see Killingsworth (1983).
6. These figures are for 1 child and 2 children.
7. This is an elasticity of hours of work conditional on participation. The overall elasticity (which includes the effect on hours of work by new participants and the effects on hours of work by those who are already workforce participants) is 2.03.
8. Results are from the tax selection model.
9. The figure was obtained from Blundell (1992).
10. This is the elasticity of the probability of working 24 or more hours with respect to wages.
11. Figures shown are from models that correct for selection bias.
12. Although four different models are presented in the study, only the results for the model utilising the two-step Heckman procedure are presented.
13. Estimates are for the formal/regular labour market. Uses an unconstrained model, that is, there is no upper bound in the hours of work worked by individuals in the regular sector.
14. Constrained model is the one in which constraints on labour supply are taken into account (in terms of weeks of work that are available to workers). In the unconstrained case, results from a linear and quadratic specification are presented. For the constrained case, estimates from the specification with selection correction are presented.
15. Results are from the model that takes into account rationing mechanisms of involuntary unemployment and underemployment and information on sample separation. The 'ex-post' elasticities are shown and the estimate for the unrationed model was 0.71. The estimate for the 'rationed' model which did not take into account rationing information was 0.10.
16. This study estimated elasticities for four countries, and elasticities were calculated at the same point for all countries rather than at each country's sample means.
17. This is from a model of the labour supply of non-welfare participants. Results were also reported for lone fathers with a wage elasticity of 0.146.
18. Sample restricted to working couples with no pre-school age children.

Table A5: UK, Canada and New Zealand income elasticities with respect to hours of work[1]

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
United Kingdom											
Layard (1978)		-0.05 to -0.03	-0.19								
Atkinson, Stern and Gomulka (1980)		-0.07 to 0.06									
Greenhalgh (1980)			-0.08								
Layard, Barton and Zabalza (1980)[2]			-0.04								
Ashworth and Ulph (1981)[3]		-1.47	0.56								
Blundell and Walker (1982)				-0.22	-0.22						
Blundell and Walker (1986)		-0.29	-1.50 [4]								
Arrufat and Zabalza (1986)[5]			-0.06								
Arellano and Meghir (1992)	Young dependants are aged 0-3 and 3-5 years; older dependants are aged 5-10 and 11 years or more			-0.13		-0.4,-0.3	-0.21,-0.32				
Bingley, Symons and Walker (1992)										-0.52	
Jenkins (1992) (hours>24)[6]										-0.24	

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A5: UK, Canada and New Zealand income elasticities with respect to hours of work (continued)

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - no children	Married women - children	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	All
Canada											
Nakamura and Nakamura (1981)	Age Group 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59		-0.22, -0.50, -0.19, -0.27, -0.21, -0.27, -0.08								
Robinson and Tomes (1985)[7]			0.00								
Stelcner and Breslaw (1985)			-0.09								
Smith and Stelcner (1988)	Age group 20-34, 35-54 and 20-54		-0.18, -0.08, -0.12								
Lacroix and Fortin (1992)											-0.05
Knudsen and Peters (1994)[8]			-0.08 to -0.07								
Fortin and Lacroix (1997)[9]	Unitary	0.00	-0.02								
	Collective	0.00	-0.02								
Lacroix and Fréchette (1994)[10]	All women										-0.17

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A5: UK, Canada and New Zealand income elasticities with respect to hours of work (continued)

Notes:

1. Unless otherwise stated elasticities are calculated at sample means.
2. Tobit model estimate. Elasticity with respect to unearned income; excludes husband's earnings.
3. Results are for model with individual utilities for each household member and a family budget constraint as reported in Killingsworth (1983).
4. The estimate is for the rationed model, ex-post estimate. Income elasticity is with respect to increase in welfare payments for the sub-sample who qualified for these payments. The unrationed model gave an estimate of -0.32. The estimate for the 'rationed' model which did not take into account rationing information was -0.02.
5. With respect to unearned family income which excludes the husband's earnings. Also this is an elasticity of labour supply conditional on participation. The overall elasticity is -0.2 with respect to unearned family income.
6. This is the elasticity of the probability of working 24 or more hours with respect to non-labour income in the form of Child-care Benefit and One Parent Benefit. Apart from maintenance, no other forms of non-labour income were considered in the study.
7. With respect to spouse's annual income.
8. This study estimated elasticities for four countries, and the elasticities were calculated at the same point for all countries rather than at each country’s sample means.
9. In the collective case this is the elasticity with respect to the husband's or wife's own non-labour income. In the unitary case this is the elasticity with respect to the household non-labour income.
10. Lower for married women with children.

Table A6: UK, Canada and New Zealand wage elasticities with respect to participation[1]

Study	Level of disaggregation in the estimates provided or other comments	Married men	Married women	Married women - young dependent child	Married women - older dependent child	Single men	Single women	Lone parents	Men	Women
United Kingdom										
Layard, Barton and Zabalza (1980)[2]			0.49							
Arrufat and Zabalza (1986)			1.41							
Jenkins (1992) (hours>0)								1.80		

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Notes:

1. Unless otherwise stated elasticities are calculated at sample means.
2. Logit model estimate.

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Miller (1985)	1972 Social Mobility in Australia Survey, employed women								X	Estimates alternative models	X			X	X	Elasticities are assumed constant. Elasticities calculated for various models including those not accounting for sample selection.
Ross (1986)	1980 Sydney Survey of the Work Patterns of Married Women, married women. Unemployed excluded.								X	Various specifications (of some variable definitions) estimated.	X			X	X	
Lambert (1991)	1981 IDS, female sole parents	X					X		ns	Trichotomous model (0 hours, part-time and full-time hours).	ns		ns	ns	X	

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Knudsen and Peters (1994)	1986 IDS (within the Luxembourg Income Study framework), married women (15-59 years)								X	Labour supply models estimated for weekly and annual hours of work	X			X		Compares elasticities for Australia, US and Germany. Single reference point used for all countries.
Kawaguchi (1992)	1986 IDS, married women aged 20-45 years (with husbands aged 20-50 years)								X	Alternative functional forms for labour supply are estimated	X				X	Elasticities estimated for different functional forms of the labour supply equation
Kawaguchi (1994)	1986 IDS, couples (men 20-45, women 20-40 years, both working)					V				Alternative assumptions about household labour supply are tested	X			X	X	Compares elasticities using alternative assumptions about household labour supply

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data (continued)

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Apps and Rees (1996)	1985-86 IDS and 1987 TUS (Pilot), two-adult families (both partners 20-50 years, with dependent children)		V	X		X	X			Demand system approach. Estimates models accounting / not accounting for household production				X	X	Compares elasticities for husbands and wives for model with and without household production
Apps, Killingsworth and Rees (1996)	1990 IDS and 1992 TUS, two-adult families (both partners employed, 20-50 years, with dependent children)		V	X		X	ns			Demand system approach. Estimates models based on alternative assumptions of household behaviour	ns			X	X	Compares elasticities of wives and husbands for different models
Jones and Savage (1996)	1985-86 IDS, married women						X		X	Demand system approach.		X	X	X	X	Only compensated wage elasticity provided.

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data (continued)

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Murray (1997)	1986 IDS, lone mothers	X					X		X	Trichotomous model (0 hours, p/t hours, f/t hours). Two models estimated: FIML (wage and hours simultaneously estimated) and CML (wage estimated separately with two-step method)	X		X		X	Sensitivities to model specification used. Average elasticity obtained by simulation (no further details provided)
Shamsuddin (1998)	1990 SIHC, married women (21-64 years)								X	Different models of immigrant status estimated.	X			X	X	Disaggregated by place of birth (Australia, not English-speaking, English-speaking country). Sensitivity tested with regard to wage estimation and different ways of measuring immigrant status

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data (continued)

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Kalb (2000)	1994-95 SIHC, two-adult households (with/without dependants, below age-pension age).	X				X	X	X	X	Various discrete points for husbands and wives. Involuntary unemployment and welfare participation 'stigma' modelled. Penalty for part-time work to improve fit. Models with combinations of features are estimated.	ns		X			Calculated for given family types (given age, number of children, education, income level). Further disaggregated by households with/without small children, income levels of both partners. Welfare participation elasticity also calculated.
Apps (2001) and Apps and Rees (2001)	1993 HES, 1994 IDS, 1992 TUS, two-adult households		X		X		X		X	Demand system approach				X	X	Elasticities disaggregated by married women at various life-cycle stages and whether in full-time or part-time work

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data (continued)

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Kidd and Ferko (2001)	1994-95 and 1989-90 IDS, men and women separately (18-64 years)								X	Various specifications tested	X			X	X	Participation and conditional hours of work elasticities. Sensitivity to specification tested.
Scutella (2001)	1995-96 (pooled) SIHC, married women with working husbands						X		X	Estimated models to take account of endogeneity between wage and unearned income to hours of work, and assuming partner's wage and hours of work are exogenous.				X	X	Disaggregated by age group, number of children, age of youngest child, education, and for all married women.
Breunig, Cobb-Clark and Gong (2005)	2002 HILDA, Couples (25-59 years) with/without children	X				X	X		X	Nine discrete points for each person. Fixed costs of working modelled. Joint wage and labour supply model. Simulated ML.	X		X			Disaggregated by level of education. Elasticity calculated at aggregate averaged level.

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Table A7: Comparisons of modelling and wage elasticity estimation methods in studies using Australian data (continued)

		Modelling features									Elasticities					
Study	**Year, data source and population**	**Discrete hours (else continuous hours)**	**Household model (else neoclassical)**	**Collective LS (else unitary)**	**Lifecycle model (else static)**	**Family LS (else single, partner exogenous if modelling couples)**	**Tax/benefit system accounted for (various extents)**	**Labour market constraints (else none modelled)**	**Sample selection accounted for (to various extents)**	**Other features**	**Based on gross wage (else net wage)**	**Compensated wage elasticity (else uncompensated)**	**Simulated (else from coefficients)**	**Conditional (else unconditional)**	**Calculated at the mean of the sample**	**Level of disaggregation and/or sensitivities tested**
Buddelmeyer, Creedy and Kalb (2007)	1994-95, 1995-96, 1996-97 and 1997-98 SIHC (pooled), married men and women, single men, single women, lone parents (15-65 years)	X				X	X		X	Six discrete hours for married men, 11 for others. Modelling of fixed costs of working to improve model fit.	X		X	V		Disaggregation by population sub-group. Two methods used (using expected labour supply for all individuals, and calibrated labour supply for workers only). Elasticities are averaged over the population.

NB: 1st generation ■ 2nd generation ■ 3rd generation □

Notes.

1. This table reflects the authors' best guess of the modelling features of the Australian studies included in the table. Often it is unclear which definition of wage elasticity is used in a study. In this case, we refer to the model specification and make a judgment about which definition the elasticity refers to.
2. X means the item applies (blank means the item does not apply). V means various models, methodologies or definitions apply. ns means not stated or not able to be deduced from the study.
3. The table only includes studies reporting wage elasticities.
4. The results of the modelling described in Apps and Rees (2001) are reported in Apps (2001).
5. Acronyms for data sources used: HES is the Household Expenditure Survey; HILDA is the Household, Income and Labour Dynamics in Australia survey; IDS is the Income Distribution Survey; SIHC is the Survey of Income and Household Costs; TUS is the Time Use Survey.