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Labour Supply in Australia: A comparison of the behaviour between partnered and single males and females

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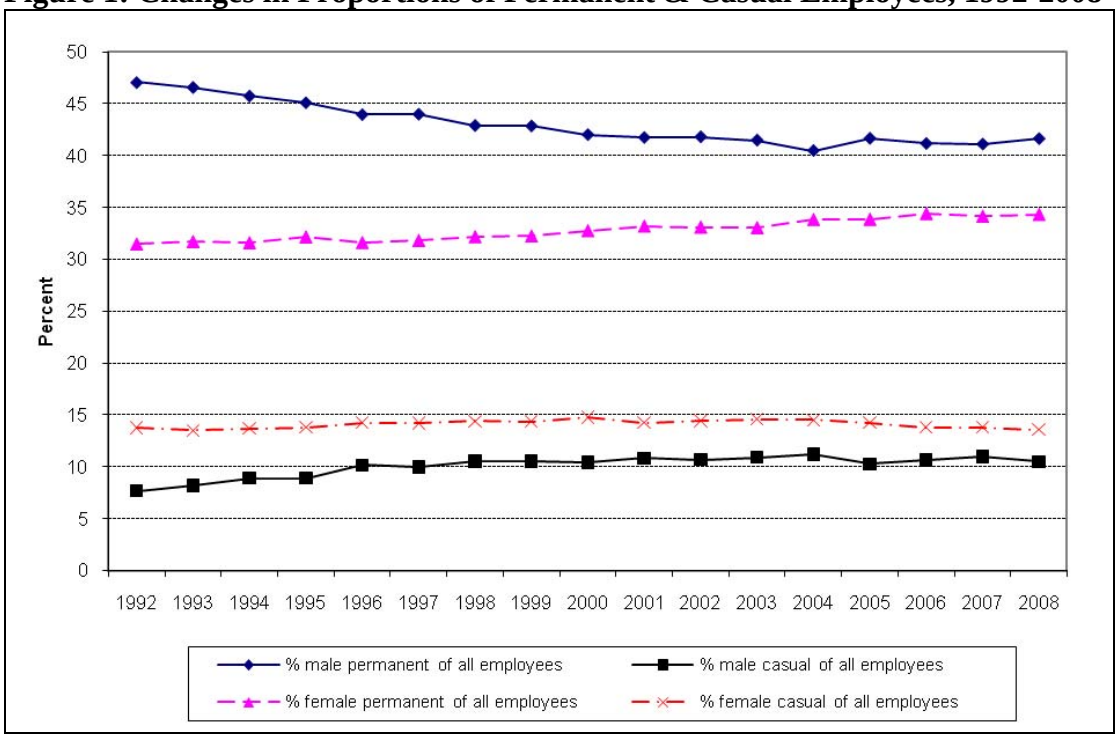
Introduction

During the last 30 years, the Australian labour market has experienced long-run structural changes on both its supply and demand sides, particularly with respect to the participation of females. On the supply-side, the most notable changes have occurred because of the changing composition of the Australian labour force. One of the more significant economic and social changes of recent times has been the increased labour market participation of females, particularly those married and with children, rising from 43per cent in 1979 to 59per cent in 2009; concurrently, male participation fell from 79per cent to 72per cent (ABS, 2009). In addition, growth in employment has been concentrated in the professional, managerial and semi-professional occupations that typically require higher levels of education attainment (i.e. Vocational qualifications, Graduate or Post-graduate qualifications). This has resulted in a greater proportion of females now completing university qualifications, relative to males—for example, 59per cent and 41per cent respectively for the age group 25-29 years in 2006 (ABS, 2006). The Australian labour force has—and will continue to—experienced the challenges of an ageing population and below replacement level fertility rates, resulting in a replacement shortfall of young labour force entrants for elderly labour force exits. These changes have emphasised certain labour shortages and skill gaps in the economy, as well as the importance of female participation.

On the demand side of the labour market, there has been a significant movement by employers towards workforce flexibility. Occurring in conjunction with the growth of female participation, a shift has taken place in the form of employment away from permanent and full-time employment towards casual and part-time employment. Full-time casual employment has expanded. Recent amendments by the Rudd Government to Australia's industrial relations laws may alter the strength of the trends in the growth of contemporary employment types, but are unlikely to reverse them.

Thus, the past 15 years has witnessed a marked change in the Australian labour market (see Figure 1 below): a steady decline in male permanent employment, as a proportion of total employees (from 47per cent in 1992 to 42per cent in 2008—a fall of over 780,000 workers), but an increase of female permanent employees. Over the same period, the proportion of casual employment increased from 21per cent to 24per cent, most of the increase being accounted for by the growth in casual employment among males. In addition, fixed term contract employment increased from 2.8per cent of all employees in 1998 to 3.5per cent in 2006 (ABS, 2000; 2007a).

Figure 1: Changes in Proportions of Permanent & Casual Employees, 1992-2008



Source: ABS Australian Labour Market Statistics, Cat. No. 6105.0 (various issues).

Rigorous economic analysis of the dynamics of labour force participation and supply in Australia has been limited due to the lack of panel data (as well as suitable cross-sectional data). The research into the key determinants of labour supply (i.e. their influence and magnitude) between males and females has been restricted predominantly to descriptive examination. As a consequence, a comprehensive empirical understanding and measurement of labour supply has been lacking in both the academic and the policy literature in Australia.

This paper presents the results of econometric modelling of labour force participation and the supply of hours worked (contingent on being employed) for both single and partnered males and females. We use the Longitudinal Household, Income and Labour Dynamics in Australia (HILDA) Survey [1] and a two-step panel data estimation procedure that controls for the effects of unobserved heterogeneity and the potential influence of endogeneity or sample selection bias.

The labour supplies of coupled and single males and females are modelled separately because of their different behaviours. In Australia, child-rearing activity remains predominantly undertaken by females rather than males, an activity that continues throughout much of the working age life of females. Moreover, beyond the age when it can be assumed children have left the family home, female labour supply remains less than males (e.g. after the first child, at age 48, hours of work per annum

[1] The HILDA Project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the author and should not be attributed to either FaHCSIA or the Melbourne Institute.

of women are about 35 per cent of men's [2]). Female labour supply, as a household decision, favours male labour force participation due to comparative advantage (e.g. women who exit the labour market to bear children will, on average, have less labour market experience than a similar aged male and, therefore, attract a lower per hour wage rate). The disparity in the participation and hours worked between coupled and single males and females, and the need for them to be considered separately, also has grounding in the economic theoretical literature. Recent advances in the theoretical literature have demonstrated that failure to incorporate the attributes of a partner (i.e. potential income earner) within a household may result in biased results. Hence, the estimated models consider the partners' characteristics such as wage rate, education and age (where appropriate) as well as the usual individual determinants (e.g. own wage, education, age, and number of children and their age).

In addition, the estimated models include controls for other key demographic variables, such as geographic locality (i.e. State or Territory and urban or rural), employment characteristics (industry, sector, union status), non-labour income, length of time lived in Australia for immigrants, marital status, the unemployment rate and the influence of maternity/paternity leave entitlements provided by employers.

The methods used in this research allow for a more robust examination of labour market supply. Specifically, the results of the application of an advanced econometric modelling procedure allows the labour supply behaviour of females and males to be compared and the influence of partners' characteristics on that behaviour to be examined (particularly for females). Such comparisons have not been available previously. This has allowed only a limited view of individual labour market decisions. It is not expected that the recent turbulence of global financial markets, and the subsequent economic downturn in 2008-09, will detract from the findings of this research. This judgment reflects the mildness of the impact in Australia and the forecast imminent return to trend growth rates.

Data and sample specification

The Household, Income and Labour Dynamics in Australia (HILDA) Survey is a longitudinal data set that traces the labour market, income and family dynamics of the Australian population. This research is based on analysis of the first six waves of data from 2001 to 2006. The reference population of the HILDA survey is all Australian residents that lived in private households as their primary place of residence. The HILDA survey sample was selected by using a stratified approach applied to States and Territories and to metropolitan and non-metropolitan regions. HILDA data were, and continue to be, collected through a combination of personal interviews and self-completion questionnaires. In the first wave, 2001, the HILDA survey collected information on 13,969 Australian residents from 7,684 households. The household response rate of the first wave was 66per cent and the wave-on-wave rates of attrition for the subsequent five waves were 13.2per cent, 9.6per cent, 8.4per cent, 5.6per cent and 5.2per cent, respectively. These attrition rates were found to

[2] Apps (2007)—Original data: ABS Survey of Income and Housing 2003-04.

compare favourably with the British Panel Household Study (Watson and Wooden 2006).

This paper defines single (i.e. non-partnered) persons as those who either lived alone or without dependent children; who lived with other family members, but were not dependent children themselves; or who were unrelated to all other household members (e.g. in a share house). Coupled (i.e. partnered) persons are defined as either married or in a *de facto* relationships with partners of the opposite sex, with or without dependent children. In keeping with the empirical economics literature, a number of other restrictions are further imposed on the sample: (i) individuals are aged 18-64 years, and partners (where applicable) are 18 years or older; (ii) self-employed individuals are excluded, because of differences in the distribution of their wage relative to salary earners; and (iii) full-time students, under the age of 24, are classified as dependent and excluded. Overall, the restrictions imposed on the sample resulted in 28,244 usable observations (waves 1 to 6 of the HILDA survey), of which 15,184 were of females and 13,060 of males. Table 1 outlines the number of observations of labour force participants (i.e. employed and unemployed) and those supplying paid hours of labour.

Table 1: HILDA Survey Observations (waves 1 to 6)

	Household Status	Labour Force Participants	Supplying Hours of Paid Labour
Male			
	Couple	8,654	6,852
	Single	4,406	2,877
Female			
	Couple	9,364	5,117
	Single	5,820	3,480

Notes: (1) Sample HILDA pooled data Wave 1 to 6 (unweighted). (2) Sample is unbalanced (individuals need not be present for all waves)—there are an average of approximately 2.5 observations for each individual (with a range of 1 to 6 waves of observations). (3) The observations in this table sum to less than the total sample available due to missing data.

The Unitary versus Collective approaches to modelling labour supply

The decision to model separately the labour supply behaviour of single and partnered, males and females, is guided by the recent theoretical debate in the literature regarding the influence of partnerships within a household on labour force participation decisions and the allocation of hours of paid work.

Traditionally, in the economic analysis of labour supply behaviour, it has been commonplace to consider the maximisation of an individual's utility function, or preferences, to be characterised by their household as a single entity. Referred to by the literature as the *unitary* approach, this implies that household members pool their incomes so that labour supply and consumption decisions are determined only by the total exogenous income (which may also include welfare payments and investment income), rather than the distribution of income across household members, and that decisions concerning the provision of labour supply maximise the joint utility of all household members. For a couple in a household, in particular, the unitary approach determines the labour supply behaviour of each individual

household member as if they constitute a single unit—individual preferences are not considered and intra-household distribution of welfare is not identified. Hence, the application of the unitary approach has recently come under much scrutiny, both theoretical and empirical, and, in general, the theoretical restrictions that the unitary approach imposes are not necessarily supported by the empirical literature for households with two or more partnered income earners.

The contemporary alternative to the unitary approach is the *collective* approach, which, rather than treating the household as a single unit, considers the household members' individual, but interrelated, labour supply behaviours. The collective approach explicitly determines household labour supply and consumption decisions by means of the individual household members' preferences or utility functions, and, where appropriate, allows the inclusion of the partner's welfare to be considered through a sharing rule determined by an intra-household bargaining process [3] (Chiappori, 1988; 1992).

An extensive review of the economics literature, however, indicates that the application of the collective approach, particularly to panel data models, is still in its infancy. At present, there are few empirical applications of the collective approach (Donni 2003; Bloemen 2004; Blundell et al. 2007; Couprie 2007; van Klaveren 2008)—many current studies exclude couple households with public goods (e.g. dependent children) and labour market non-participants. Consequently, the econometric estimation techniques used in this paper do not explicitly capture the influence of partners on the labour supply decisions of individuals, as proposed by the collective approach. Following the theoretical differences between the *unitary* and *collective* approaches, however, capturing the implicit influence of a partner on the labour supply decisions within a household is attempted by separately modelling coupled and single males and females and by the inclusion (where appropriate)of household partner characteristics.

Econometric issues & model specification

As is well documented, the consequence of using cross-sectional (or pooled panel data) is that individuals' unobserved time-constant characteristics (or unobserved heterogeneity) are not considered; unobserved heterogeneity, if present, results in inefficient econometric model estimates (with high standard errors leading to lack of statistical significance of estimated parameters). Moreover, treating panel or longitudinal data in a cross-sectional framework ignores the information contained in the progress or change of measured variables, and ignores the across-time correlations. Until recently, the scarcity of comprehensive Australian longitudinal survey data has been a contributing factor in restricting research to cross-sectional data analysis. The HILDA survey has provided much needed longitudinal data for Australia. The ability to follow the same persons across time allows the time-invariant characteristics of individuals to be captured by econometric panel data methods, such as the *random effects* method, utilised by the labour supply model in this research.

[3] Where the assumptions underpinning the bargaining process between the individuals in a household are explained by application of economic Game Theory, which shows how the economically efficient (Nash) equilibrium can be obtained (Ligion 2002, Chiappori & Donni 2005).

Sample selection bias

Sample selection bias occurs naturally in labour supply modelling, as hours worked (or wage rates) and the probability of being employed (or of being a labour force participant) are inter-related. Potential bias arises from the exclusion of non-working persons from the sample when estimating the hours of work equation. As the hours worked for non-working individuals are zero, the distribution of hours is truncated and possibly no longer random. Thus, the sub-sample of those who do supply hours overstates the desire to supply hours of work for the underlying population—that is, being employed may be systematically correlated with unobservables that affect the hours worked. Consequently, econometrically estimated coefficients may be biased and inconsistent, leading to false conclusions and poor policy prescription.

Since Heckman (1979), it has been commonplace in econometric analysis to correct for sample selection bias when estimating labour supply models through a two-step procedure. Step one specifies that a 'reduced-form' (secondary) equation be fitted for the complete random sample, from which a selection bias 'correction term' can be constructed. Step two then incorporates the correction term into the 'structural' (primary) equation of interest, being fitted over the non-random sub-sample, to control for selection bias. The two-step estimation procedure used by this paper is a variant on the Heckman procedure, developed by Vella and Verbeek (1999) and particularly suited to parametric panel models with censored endogenous variables and the potential for sample selection bias.

In the labour supply context of this paper, the Vella and Verbeek (1999) model, again, requires that a reduced-form equation [2]—the probability of being employed—be specified as a selection rule to assist in determining the estimation of a structural equation [1]—hours worked. Equation [3] determines when the probability of being employed is positive. Equation [4] (based on selection equation [3]) determines when labour hours supply is greater than zero. Equations [3] and [4] are referred to as the censoring and selection rules.

Structural (primary) hours supplied equation:

$$Hours_{it}^{*} = f_1\left(\boldsymbol{X}_{it}, Employed_{it}; \beta_1\right) + \mu_i + \eta_{it} \qquad [1]$$

Reduced form (secondary) employment equation:

$$Employed_{it}^{*} = f_2\left(\boldsymbol{X}_{it}, Employed_{i,t-1}; \beta_2\right) + \alpha_i + \nu_{it} \qquad [2]$$

Censoring and selection rules:

$$Employed_{it} = f_3\left(Employed_{it}^{*}; \beta_3\right) \qquad [3]$$

$$Hours_{it} = Hours_{it}^{*} \quad \text{if} \quad f_4\left(Employed_{i1}, \ldots, Employed_{iT}\right) = 1$$

$$Hours_{it} = 0 \quad \text{if} \quad f_4\left(Employed_{i1}, \ldots, Employed_{iT}\right) = 0 \qquad [4]$$

where i are individuals (survey participants, $i = 1,\ldots,N$), t is time (or survey waves, $t = 1,\ldots,T$), and f represents functions characterised by the unknown parameters (vector) $\boldsymbol{\beta}$. The $\boldsymbol{X}$ are the vector of observed individual characteristics or explanatory variables (e.g. education level, children in the household, marital status, partner's attributes, etc.) and covariates or control variables which while influential are not the subject of interest in this paper. The terms μ_i and a_i represent the panel-model (random) time-invariant unobserved individual effects (heterogeneity), and η_{it} and ν_{it} represent the random individual-specific time-variant effects—assumed to be independent across individuals. The vector $\boldsymbol{X}$ need not contain identical explanatory variables across functions, although the structural equation must exclude at least one explanatory variable included in the reduced-form equation. Starred variables are latent (unobserved) endogenous variables (i.e. preferred hours supplied, *Hours**, and the probability of a labour force participant being employed, *Employed**)—with observed counterparts (actual hours supplied, *Hours*; and whether or not employed, *Employed*).

The procedure controls for the unobserved heterogeneity (responsible for sample selection bias) through the inclusion of two correction terms as explanatory variables in Equation [1], integrated out from the residuals estimated in Equation [2] (see Vella and Verbeek 1999). The inclusion of the two correction terms ($\bar{u}_i$ and u_{it}) as parameters in Equation [1] controls for endogeneity or selection bias due to (i) the time-invariant unobserved individual effects and (ii) the individual time-specific effects, respectively.

The model of Equations [1] to [4] demonstrates that the determination of Employed (the probability of employment) is a function, f_3, of the unknown parameter vector $\boldsymbol{\beta}_3$, and the function f_4 indicates that *Hours* (actual worked) is only observed for positive values of *Employed*. Thus, the structural *Hours* equation should not be estimated without first considering what determined its sub-sample, the reduced-form *Employed* equation, or parameter estimates may potentially be biased and inconsistent, leading to incorrect attribution of the causes of hours supplied.

For estimation, further assumptions are made: as usual, errors are normally distributed and explanatory variables are exogenous; autocorrelation in the reduced-form *Employed* equation errors is inadmissible, but heteroskedasticity and/or autocorrelation in the structural *Hours* equation errors can be accommodated.

Furthermore, the procedure considers dynamics and the influence of state dependence through the inclusion of a one-period lag dependent variable ($Employment_{i,t-1}$) in the reduced-form *Employment* equation (see Eq. [2]). The inclusion of dynamics in the reduced-form equation controls for the influence of individuals' behaviour in the previous period on the estimates in the current period. As noted by Vella and Verbeek (1999), the inclusion of the lagged dependent variable for the initial period ($Employed_{i,t=0}$) may be endogenous. Vella and Verbeek suggest as a solution an Instrumental Variable process to approximate the distribution of the initial condition,. The example provided by the Vella and Verbeek, however, indicated that while endogeneity (due to correlation with the individual-effect (a_i) error component of the reduced-form equation) existed, the coefficients in the reduced-form equation were not sensitive to treatment of the initial conditions. In

this research, the lagged dependent variable for the initial period ($Employed_{i,t=0}$) is constructed by using historical information provided by respondents at their first interview, treating initial labour force participation as exogenous.

Empirical model specification

The empirical equations based on the Vella and Verbeek (1999) model outlined above, can now be specified. First, the *Employed* equation (Equation [5]) is estimated as a limited dependent variable (*random-effects probit*) panel data model:

$$Employed_{it}^{*} = \beta_1 x_{1,it} + ... + \beta_k x_{k,it} + \beta_E Employment_{i,t-1} + \alpha_i + \nu_{it} \qquad [5]$$

Second, the *Hours* equation (Equation [6]) is estimated as a continuous dependent variable (*pooled OLS*) panel data model, corrected for selection bias (i.e. only employed labour force participants that supply hours worked) by inclusion of panel data correction terms ($\bar{u}_i$ and u_{it}):

$$Hours_{it} = \beta_1 x_{1,it} + ... + \beta_k x_{k,it} + f_P\left(Employment_{it}; \beta_P\right) + \bar{u}_i + u_{it} \qquad [6]$$

where *Hours* represents the log of hours worked in paid employment per week, x represent observed independent or explanatory variables (e.g. work experience, education, health and marital status), f_P denotes a fourth-order polynomial with unknown coefficients (β_P) for identification, and β_E denotes the coefficient for state dependence. Note that the *Employed* equation is required in contrast to examining the strict definition of participation (i.e. including employed and unemployed), because the selection bias is due to selection into employment, not selection into participation—hours supplied are not independent of selection into employment (but an unemployed labour force participant does not select their hours of work).

Summary statistics and descriptions for the two dependent variables and all independent explanatory variables included in the econometric models are presented in Table 2 below. The combination of explanatory variables included in the reduced-form *Employed* equation differs from to that included in the structural *Hours* equation (i) to estimate properly the model (discussed previously) and (ii) because many work-related variables have no responses for non-participants and their inclusion would cause spurious results.

Table 2: Description and summary statistics of variables used in the econometric models

Variable Name	Description	Couple Females				Single Females				Couple Males				Single Males			
		Employment		Hours Supplied		Employment		Hours Supplied		Employment		Hours Supplied		Employment		Hours Supplied	
		Mean	*Std. Dev.*	Mean	*Std. Dev.*	Mean	*Std. Dev.*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*
empt	Dummy, 1 if employed	0.55	*0.50*	-	-	0.60	*0.49*	-	-	0.79	*0.41*	-	-	0.65	*0.48*	-	-
lnhours	Log of hours worked per week	-	-	3.34	*0.56*	-	-	3.45	*0.55*	-	-	3.76	*0.33*	-	-	3.65	*0.43*
exp	Total empt. experience in years	16.88	*10.27*	-	-	15.45	*11.84*	-	-	24.37	*11.37*	-	-	16.64	*13.01*	-	-
exp^2	Total empt. experience in yr. squared	390.25	*412.86*	-	-	378.90	*456.14*	-	-	723.23	*582.69*	-	-	446.21	*541.94*	-	-
jbsearch	Total job search duration in years	0.42	*1.49*	-	-	0.76	*2.14*	-	-	0.65	*1.71*	-	-	1.42	*3.08*	-	-
$jbsearch^2$	Total job search duration in yr. squared	2.39	*25.45*	-	-	5.14	*32.14*	-	-	3.35	*17.22*	-	-	11.47	*55.30*	-	-
non-lbinc	Non-labour income (real AUD)	123.98	*237.86*	68.28	*220.73*	196.53	*242.94*	109.16	*211.50*	136.31	*441.00*	92.37	*420.05*	139.92	*431.61*	76.70	*356.57*
wage	Hourly wage rate (real AUD)	-	-	23.47	*10.54*	-	-	21.42	*9.22*	-	-	27.45	*13.33*	-	-	21.90	*11.15*
pwage	(Partner) hourly wage rate (real AUD)	20.34	*16.67*	24.34	*14.67*	-	-	-	-	13.50	*14.14*	15.70	*14.14*	-	-	-	-
rural	Dummy, 1 if rural area	0.16	*0.37*	0.14	*0.35*	0.09	*0.29*	0.07	*0.26*	0.16	*0.36*	0.14	*0.35*	0.12	*0.33*	0.11	*0.31*
gh	General health index [0:100]	70.98	*21.22*	75.08	*18.04*	66.74	*22.78*	72.23	*19.21*	68.73	*21.27*	72.90	*17.62*	66.95	*22.65*	72.44	*18.72*
mh	Mental health index [0:100]	74.27	*16.73*	76.09	*14.85*	69.11	*19.38*	72.71	*16.86*	75.70	*16.44*	77.80	*14.39*	71.08	*18.61*	73.76	*16.56*
unemprt	Unemployment rate	3.30	*1.81*	-	-	7.82	*3.00*	-	-	3.15	*1.66*	-	-	9.52	*3.45*	-	-
married	Dummy, 1 if married	0.83	*0.37*	0.81	*0.39*	-	-	-	-	0.82	*0.38*	0.83	*0.38*	-	-	-	-
Age dummies																	
age 18-24	18-24 years	0.05	*0.21*	0.05	*0.22*	0.18	*0.39*	0.21	*0.41*	0.03	*0.18*	0.03	*0.18*	0.26	*0.44*	0.29	*0.45*
age 25-34	25-34 years	0.24	*0.43*	0.26	*0.44*	0.21	*0.41*	0.22	*0.41*	0.21	*0.41*	0.24	*0.43*	0.22	*0.41*	0.26	*0.44*
age 35-44	35-44 years	0.30	*0.46*	0.35	*0.48*	0.21	*0.41*	0.22	*0.42*	0.31	*0.46*	0.35	*0.48*	0.21	*0.41*	0.23	*0.42*
age 45-54	45-54 years	0.22	*0.41*	0.26	*0.44*	0.22	*0.42*	0.24	*0.43*	0.24	*0.43*	0.26	*0.44*	0.18	*0.38*	0.16	*0.37*
age 55-64	55-64 years	0.20	*0.40*	0.08	*0.27*	0.18	*0.38*	0.11	*0.31*	0.21	*0.41*	0.12	*0.32*	0.14	*0.35*	0.06	*0.23*
page 18-24	(Partner) 18-24 years	0.03	*0.17*	0.03	*0.17*	-	-	-	-	0.05	*0.22*	0.05	*0.23*	-	-	-	-
page 25-34	(Partner) 25-34 years	0.20	*0.40*	0.22	*0.42*	-	-	-	-	0.25	*0.43*	0.29	*0.45*	-	-	-	-
page 35-44	(Partner) 35-44 years	0.29	*0.45*	0.32	*0.47*	-	-	-	-	0.32	*0.47*	0.36	*0.48*	-	-	-	-
page 45-54	(Partner) 45-54 years	0.23	*0.42*	0.29	*0.45*	-	-	-	-	0.22	*0.42*	0.22	*0.41*	-	-	-	-
page 55+	(Partner) 55-64 years	0.26	*0.44*	0.14	*0.34*	-	-	-	-	0.15	*0.36*	0.08	*0.27*	-	-	-	-
Education attainment dummies																	
ed 1	Bachelor/Grad. Dip./Postgrad.	0.26	*0.44*	0.37	*0.48*	0.24	*0.43*	0.34	*0.47*	0.27	*0.44*	0.31	*0.46*	0.16	*0.37*	0.21	*0.41*
ed 2	Diploma/Advanced Dip.	0.09	*0.29*	0.10	*0.30*	0.09	*0.29*	0.11	*0.32*	0.10	*0.30*	0.10	*0.31*	0.09	*0.28*	0.09	*0.29*
ed 3	Certificate III/IV	0.11	*0.32*	0.12	*0.32*	0.13	*0.34*	0.14	*0.35*	0.29	*0.45*	0.29	*0.45*	0.25	*0.43*	0.26	*0.44*
ed 4	Cert. I/II or Year 12	0.17	*0.38*	0.17	*0.38*	0.19	*0.39*	0.19	*0.40*	0.11	*0.31*	0.11	*0.32*	0.22	*0.41*	0.23	*0.42*
ed 5	Year 11 or below	0.36	*0.48*	0.24	*0.43*	0.34	*0.47*	0.21	*0.41*	0.23	*0.42*	0.18	*0.39*	0.28	*0.45*	0.21	*0.41*
ped 1	(Partner) Bachelor/Grad. Dip./Postgrad.	-	-	0.32	*0.47*	-	-	-	-	-	-	0.31	*0.46*	-	-	-	-
ped 2	(Partner) Diploma/Advanced Dip.	-	-	0.11	*0.31*	-	-	-	-	-	-	0.10	*0.30*	-	-	-	-
ped 3	(Partner) Certificate III/IV	-	-	0.27	*0.45*	-	-	-	-	-	-	0.11	*0.31*	-	-	-	-
ped 4	(Partner) Cert. I/II or Year 12	-	-	0.11	*0.31*	-	-	-	-	-	-	0.18	*0.39*	-	-	-	-
ped 5	(Partner) Year 11 or below	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Resident dependent children dummies																	
ch A	one aged 0-4 yr.	0.08	*0.27*	0.08	*0.27*	0.04	*0.20*	0.02	*0.14*	0.10	*0.30*	0.11	*0.31*	0.00	*0.06*	0.00	*0.06*
ch B	one aged 5-14 yr.	0.04	*0.19*	0.05	*0.22*	0.07	*0.25*	0.06	*0.25*	0.04	*0.20*	0.04	*0.20*	0.02	*0.13*	0.02	*0.12*
ch C	one aged 15-24 yr.	0.06	*0.23*	0.06	*0.24*	0.06	*0.25*	0.07	*0.26*	0.06	*0.23*	0.05	*0.22*	0.03	*0.16*	0.03	*0.17*
ch D	at least two aged 0-4 yr. & additional aged >0 yr.	0.08	*0.27*	0.05	*0.22*	0.02	*0.13*	0.00	*0.07*	0.08	*0.27*	0.09	*0.29*	0.00	*0.05*	0.00	*0.05*

Variable Name	Description	Couple Females				Single Females				Couple Males				Single Males			
		Employment		Hours Supplied		Employment		Hours Supplied		Employment		Hours Supplied		Employment		Hours Supplied	
		Mean	*Std. Dev.*	Mean	*Std. Dev.*	Mean	*Std. Dev.*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*
ch E	one aged 0-4 yr. & additional aged >4 yr.	0.08	*0.28*	0.07	*0.26*	0.04	*0.20*	0.02	*0.14*	0.08	*0.27*	0.09	*0.29*	0.00	*0.03*	0.00	*0.04*
ch F	at least two aged 5-14 yr. & additional aged >14 yr.	0.15	*0.36*	0.18	*0.38*	0.07	*0.26*	0.06	*0.24*	0.15	*0.36*	0.17	*0.38*	0.02	*0.13*	0.01	*0.11*
ch G	one aged 5-14 yr. & additional >14 yr.	0.05	*0.22*	0.07	*0.25*	0.04	*0.18*	0.03	*0.18*	0.05	*0.22*	0.06	*0.23*	0.01	*0.08*	0.01	*0.09*
ch H	two or more aged >14 yr.	0.05	*0.21*	0.06	*0.25*	0.02	*0.15*	0.03	*0.16*	0.04	*0.21*	0.05	*0.22*	0.00	*0.06*	0.00	*0.06*
ch I	none	0.41	*0.49*	0.37	*0.48*	0.64	*0.48*	0.69	*0.46*	0.40	*0.49*	0.34	*0.47*	0.92	*0.27*	0.92	*0.27*
Non-resident dependent children dummies																	
non-resch	one or more	0.34	*0.47*	0.23	*0.42*	0.33	*0.47*	0.24	*0.43*	0.35	*0.48*	0.26	*0.44*	0.31	*0.46*	0.27	*0.45*
pnon-resch	(Partner) one or more	0.39	*0.52*	0.29	*0.46*	-	-	-	-	0.31	*0.46*	0.22	*0.42*	-	-	-	-
Immigration dummies																	
immi A	Australian resident 0-4 years	0.02	*0.13*	0.01	*0.12*	0.01	*0.10*	0.01	*0.10*	0.01	*0.11*	0.01	*0.11*	0.02	*0.12*	0.02	*0.14*
immi B	Australian resident 5-9 years	0.02	*0.15*	0.02	*0.15*	0.01	*0.12*	0.01	*0.11*	0.02	*0.14*	0.02	*0.14*	0.02	*0.14*	0.02	*0.15*
immi C	Australian resident 10-19 years	0.06	*0.23*	0.06	*0.23*	0.04	*0.19*	0.04	*0.19*	0.05	*0.23*	0.05	*0.23*	0.04	*0.20*	0.05	*0.22*
immi D	Australian resident ≥20 years	0.13	*0.34*	0.11	*0.32*	0.11	*0.32*	0.10	*0.30*	0.15	*0.35*	0.12	*0.33*	0.09	*0.29*	0.07	*0.26*
immi E	Australian born	0.77	*0.42*	0.79	*0.41*	0.82	*0.38*	0.84	*0.36*	0.77	*0.42*	0.79	*0.41*	0.83	*0.38*	0.83	*0.37*
Employment characteristic dummies																	
mtleave	paid maternity leave available	-	-	0.48	*0.50*	-	-	0.50	*0.50*	-	-	-	-	-	-	-	-
pmtleave	(Partner) paid maternity leave available	-	-	-	-	-	-	-	-	-	-	0.32	*0.47*	-	-	-	-
unmtleave	unpaid maternity leave available	-	-	0.74	*0.44*	-	-	0.71	*0.45*	-	-	-	-	-	-	-	-
punmtleave	(Partner) unpaid maternity leave available	-	-	-	-	-	-	-	-	-	-	0.50	*0.50*	-	-	-	-
ptleave	paternity leave available (paid/unpaid)	-	-	-	-	-	-	-	-	-	-	0.71	*0.45*	-	-	0.57	*0.50*
pptleave	(Partner) paternity leave available (paid/unpaid)	-	-	0.65	*0.48*	-	-	-	-	-	-	-	-	-	-	-	-
union	Trade union member	-	-	0.33	*0.47*	-	-	0.32	*0.47*	-	-	0.36	*0.48*	-	-	0.29	*0.45*
sector	Private sector	-	-	0.61	*0.49*	-	-	0.64	*0.48*	-	-	0.70	*0.46*	-	-	0.80	*0.40*
Industry dummies																	
ind A	Agriculture, Forestry and Fishing	-	-	0.01	*0.10*	-	-	0.01	*0.09*	-	-	0.02	*0.15*	-	-	0.03	*0.18*
ind B	Mining	-	-	0.00	*0.04*	-	-	0.00	*0.07*	-	-	0.03	*0.18*	-	-	0.02	*0.14*
ind C	Manufacturing	-	-	0.05	*0.22*	-	-	0.06	*0.24*	-	-	0.16	*0.37*	-	-	0.17	*0.37*
ind D	Electricity, Gas and Water Supply	-	-	0.00	*0.05*	-	-	0.00	*0.06*	-	-	0.02	*0.14*	-	-	0.01	*0.11*
ind E	Construction	-	-	0.01	*0.12*	-	-	0.01	*0.10*	-	-	0.08	*0.27*	-	-	0.09	*0.29*
ind F	Wholesale Trade	-	-	0.03	*0.16*	-	-	0.02	*0.15*	-	-	0.05	*0.21*	-	-	0.05	*0.22*
ind G	Retail Trade	-	-	0.10	*0.29*	-	-	0.12	*0.32*	-	-	0.07	*0.25*	-	-	0.13	*0.33*
ind H	Accommodation, Cafes and Restaurants	-	-	0.04	*0.19*	-	-	0.06	*0.24*	-	-	0.02	*0.14*	-	-	0.06	*0.23*
ind I	Transport and Storage	-	-	0.02	*0.15*	-	-	0.02	*0.12*	-	-	0.06	*0.24*	-	-	0.05	*0.23*
ind J	Communication Services	-	-	0.02	*0.14*	-	-	0.02	*0.14*	-	-	0.03	*0.18*	-	-	0.03	*0.17*
ind K	Finance and Insurance	-	-	0.05	*0.22*	-	-	0.05	*0.21*	-	-	0.05	*0.21*	-	-	0.03	*0.18*
ind L	Property and Business Services	-	-	0.11	*0.31*	-	-	0.10	*0.29*	-	-	0.11	*0.31*	-	-	0.10	*0.30*
ind M	Government Administration and Defence	-	-	0.06	*0.24*	-	-	0.07	*0.25*	-	-	0.09	*0.29*	-	-	0.06	*0.25*
ind N	Education	-	-	0.21	*0.41*	-	-	0.16	*0.37*	-	-	0.09	*0.29*	-	-	0.05	*0.22*
ind O	Health and Community Services	-	-	0.23	*0.42*	-	-	0.24	*0.42*	-	-	0.05	*0.22*	-	-	0.04	*0.20*
ind P	Cultural and Recreational Services	-	-	0.03	*0.16*	-	-	0.03	*0.16*	-	-	0.03	*0.17*	-	-	0.03	*0.18*
ind Q	Personal and Other Services	-	-	0.03	*0.17*	-	-	0.04	*0.20*	-	-	0.04	*0.20*	-	-	0.03	*0.16*

Variable Name	Description	Couple Females				Single Females				Couple Males				Single Males			
		Employment		Hours Supplied		Employment		Hours Supplied		Employment		Hours Supplied		Employment		Hours Supplied	
		Mean	*Std. Dev.*	Mean	*Std. Dev.*	Mean	*Std. Dev.*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*	Mean	*Std. Dev*
State & Territory dummies																	
NSW	New South Wales	0.29	*0.46*	0.30	*0.46*	0.30	*0.46*	0.29	*0.45*	0.29	*0.46*	0.30	*0.46*	0.28	*0.45*	0.29	*0.45*
VIC	Victoria	0.24	*0.43*	0.25	*0.43*	0.24	*0.43*	0.25	*0.44*	0.24	*0.43*	0.25	*0.43*	0.24	*0.43*	0.26	*0.44*
QLD	Queensland	0.21	*0.41*	0.20	*0.40*	0.22	*0.41*	0.21	*0.41*	0.21	*0.41*	0.21	*0.41*	0.21	*0.41*	0.19	*0.39*
SA	South Australia	0.09	*0.29*	0.09	*0.28*	0.10	*0.30*	0.09	*0.28*	0.09	*0.28*	0.09	*0.28*	0.11	*0.31*	0.10	*0.30*
WA	Western Australia	0.10	*0.30*	0.08	*0.28*	0.09	*0.28*	0.09	*0.29*	0.10	*0.29*	0.10	*0.29*	0.11	*0.31*	0.11	*0.31*
TAS	Tasmania	0.03	*0.18*	0.03	*0.17*	0.04	*0.18*	0.04	*0.20*	0.03	*0.18*	0.03	*0.16*	0.03	*0.18*	0.02	*0.15*
NT	Northern Territory	0.01	*0.08*	0.01	*0.11*	0.01	*0.09*	0.01	*0.10*	0.01	*0.08*	0.01	*0.09*	0.00	*0.07*	0.01	*0.08*
ACT	Australian Capital Territory	0.03	*0.16*	0.03	*0.18*	0.02	*0.13*	0.02	*0.15*	0.03	*0.17*	0.03	*0.18*	0.02	*0.13*	0.02	*0.15*

Notes: (1) Dummy variables are coded so that presence is set to one and absence to zero. (2) Index [0:100] is an index measured as a continuous variable with range 0 to 100. (3) The hourly wage rate is inflated to the value in the year 2006 by the RBA annual inflation rate over the period (2001-2006). (4) Non-labour income is inflated to the value in the year 2006 by the RBA annual inflation rate over the period (2001-2006). (5) Rural location of a household is defined by the ABS Australian Standard Geographical Classification (2001), Cat. No. 1216.0. (6) Trade Union membership as defined by the ABS. (7) The unemployment rate is derived from Data Cube LM8–Labour Force Status by Sex, State, Age, Marital Status (ABS Labour Force, Australia, Detailed – Electronic Delivery, Mar 2008, Cat. No. 6291.0.55.001). (8) Industry classifications are defined by the ABS Australian and New Zealand Standard Industrial Classification (ANZSIC) 1-digit code, first edition (1994), Cat. No. 1293.0.

Empirical Results

Following the two-step estimation procedure outlined by the system of Equations [1−4], the estimated coefficients of the parameters for the reduced-form *Employed* equation [5] (i.e. the probability of participation in the labour force) and the structural *Hours* equation [6] (i.e. the number of hours worked per week, contingent on being employed) are presented in Table 3 below for four sub-sample cohorts (i.e. coupled females, single females, coupled males and single males). Overall, in terms of the modelling, the goodness-of-fit measures (i.e. the *Pseudo* R^2 and R^2 indicators) were healthy, in relation to the panel data techniques used, and were consistent across the four sub-sample cohorts. The presence of state dependence was indicated in all four *Employed* equations by the significance of the estimated coefficient for the lagged dependent variable. Moreover, the two correction variables ($\bar{u}_i$ and u_{it}) included in the estimation of the *Hours* equations were both statistically significant in all but one of the specifications (i.e. the single female cohort), indicating the presence of the time-invariant and time-varying unobserved individuals effects that cause selection bias (i.e. endogeneity bias).

Table 3: Estimation results of the *random-effects probit* probability of employment (*Employed*) equation and the *ordinary least squares* hours of work (*Hours*) equation.

Variables	Employment equation								Hours Supplied equation							
	Couple Females		*Single Females*		*Couple Males*		*Single Males*		*Couple Females*		*Single Females*		*Couple Males*		*Single Males*	
employment lag	0.629	***	0.618	***	0.629	***	0.593	***	-		-		-		-	
	(0.012)		*(0.017)*		*(0.023)*		*(1.039)*		-		-		-		-	
exp	0.035	***	0.038	***	0.009	***	0.029	***	-		-		-		-	
	(0.004)		*(0.005)*		*(0.002)*		*(0.133)*		-		-		-		-	
exp^2	0.000	***	-0.001	***	0.000	**	0.000	**	-		-		-		-	
	(0.000)		*(0.000)*		*(0.000)*		*(0.001)*		-		-		-		-	
jbsearch	-0.027	***	-0.039	***	-0.019	***	-0.048	***	-		-		-		-	
	(0.009)		*(0.010)*		*(0.005)*		*(0.218)*		-		-		-		-	
$jbsearch^2$	0.001	**	0.002	**	0.001	***	0.002	***	-		-		-		-	
	(0.001)		*(0.001)*		*(0.000)*		*(0.008)*		-		-		-		-	
age 18-24 (base)	-		-		-		-		-		-		-		-	
	-		-		-		-		-		-		-		-	
age 25-34	-0.008		-0.061		-0.040		-0.129	***	-0.020		0.083	***	0.048	*	0.085	***
	(0.054)		*(0.041)*		*(0.038)*		*(0.484)*		*(0.037)*		*(0.029)*		*(0.027)*		*(0.022)*	
age 35-44	-0.122	*	-0.226	***	-0.101	**	-0.274	***	0.007		0.103	***	0.073	**	0.012	
	(0.063)		*(0.056)*		*(0.050)*		*(0.773)*		*(0.043)*		*(0.032)*		*(0.029)*		*(0.030)*	
age 45-54	-0.256	***	-0.370	***	-0.183	***	-0.639	***	-0.002		0.128	***	0.070	**	0.080	***
	(0.070)		*(0.063)*		*(0.069)*		*(0.163)*		*(0.048)*		*(0.033)*		*(0.032)*		*(0.030)*	
age 55-64	-0.461	***	-0.521	***	-0.411	***	-0.829	***	-0.068		0.218	***	0.055		0.209	***
	(0.061)		*(0.060)*		*(0.093)*		*(1.218)*		*(0.059)*		*(0.045)*		*(0.042)*		*(0.048)*	
page 18-24 (base)	-		-		-		-		-		-		-		-	
	-		-		-		-		-		-		-		-	
page 25-34	-0.073		-		-0.007		-		0.101	**	-		0.028		-	
	(0.058)		-		*(0.023)*		-		*(0.042)*		-		*(0.023)*		-	
page 35-44	-0.119	*	-		0.018		-		0.088	*	-		0.023		-	
	(0.063)		-		*(0.025)*		-		*(0.048)*		-		*(0.026)*		-	
page 45-54	-0.101		-		0.007		-		0.075		-		0.015		-	
	(0.068)		-		*(0.029)*		-		*(0.051)*		-		*(0.029)*		-	
page 55+	-0.271	***	-		-0.025		-		0.169	***	-		0.018		-	
	(0.070)		-		*(0.038)*		-		*(0.058)*		-		*(0.041)*		-	
ed 1	0.203	***	0.206	***	0.077	***	0.192	***	0.115	***	0.055	*	0.011		-0.030	
	(0.022)		*(0.027)*		*(0.010)*		*(1.147)*		*(0.025)*		*(0.033)*		*(0.020)*		*(0.034)*	
ed 2	0.094	***	0.122	***	0.022		0.089	**	0.062	*	-0.030		0.011		0.028	
	(0.029)		*(0.034)*		*(0.013)*		*(0.480)*		*(0.028)*		*(0.033)*		*(0.015)*		*(0.030)*	
ed 3	0.100	***	0.092	***	0.016		0.056	*	-0.006		0.033		0.008		0.010	
	(0.027)		*(0.030)*		*(0.011)*		*(0.274)*		*(0.025)*		*(0.030)*		*(0.012)*		*(0.020)*	
ed 4	0.081	***	0.095	***	0.037	***	0.062	**	0.020		-0.031		-0.033	*	-0.059	**
	(0.023)		*(0.028)*		*(0.012)*		*(0.305)*		*(0.022)*		*(0.030)*		*(0.017)*		*(0.024)*	
ed 5 (base)	-		-		-	-	-		-		-		-		-	
	-		-		-		-		-		-		-		-	
ped 1	-		-		-		-		0.010		-		-0.007		-	
	-		-		-		-		*(0.022)*		-		*(0.012)*		-	
ped 2	-		-		-		-		0.016		-		0.009		-	
	-		-		-		-		*(0.027)*		-		*(0.014)*		-	
ped 3	-		-		-		-		0.018		-		0.011		-	
	-		-		-		-		*(0.020)*		-		*(0.012)*		-	
ped 4	-		-		-		-		0.061	**	-		-0.004		-	
	-		-		-		-		*(0.026)*		-		*(0.011)*		-	
ped 5 (base)	-		-		-		-		-		-		-		-	
	-		-		-		-		-		-		-		-	
ch A	-0.277	***	-0.157	***	0.050	***	0.105		-0.176	***	-0.159	*	-0.027	*	-0.251	
	(0.029)		*(0.053)*		*(0.012)*		*(0.621)*		*(0.037)*		*(0.083)*		*(0.016)*		*(0.208)*	
ch B	-0.011		0.059		0.016		0.033		-0.152	***	-0.156	***	0.007		-0.002	
	(0.046)		*(0.041)*		*(0.020)*		*(0.176)*		*(0.033)*		*(0.041)*		*(0.016)*		*(0.051)*	
ch C	0.088	**	0.170	***	0.003		0.117	*	-0.079	**	-0.015		0.042	**	-0.009	
	(0.037)		*(0.037)*		*(0.018)*		*(0.691)*		*(0.031)*		*(0.037)*		*(0.019)*		*(0.049)*	
ch D	-0.324	***	-0.047		0.038	**	-0.186		-0.289	***	-0.048		-0.017		-0.111	
	(0.031)		*(0.087)*		*(0.015)*		*(0.563)*		*(0.049)*		*(0.164)*		*(0.015)*		*(0.132)*	
ch E	-0.147	***	0.060		0.057	***	0.265		-0.339	***	-0.247	***	-0.070	***	-1.513	***
	(0.035)		*(0.053)*		*(0.013)*		*(0.014)*		*(0.036)*		*(0.076)*		*(0.019)*		*(0.304)*	
ch F	-0.007		0.090	**	0.041	***	-0.123		-0.277	***	-0.210	***	-0.018		0.029	
	(0.032)		*(0.041)*		*(0.014)*		*(0.421)*		*(0.024)*		*(0.048)*		*(0.015)*		*(0.058)*	
ch G	0.116	***	0.117	**	0.035	*	0.215	*	-0.221	***	-0.118	**	0.005		-0.195	***
	(0.041)		*(0.051)*		*(0.017)*		*(1.606)*		*(0.031)*		*(0.049)*		*(0.019)*		*(0.066)*	
ch H	0.101	**	0.120	*	0.012		0.140		-0.080	***	-0.067		0.023		-0.122	
	(0.043)		*(0.060)*		*(0.022)*		*(0.886)*		*(0.030)*		*(0.049)*		*(0.020)*		*(0.113)*	
ch I (base)	-		-		-		-		-		-		-		-	
	-		-		-		-		-		-		-		-	

Variables	Employment equation								Hours Supplied equation							
	Couple Females		*Single Females*		*Couple Males*		*Single Males*		*Couple Females*		*Single Females*		*Couple Males*		*Single Males*	
non-resch	-0.065	**	-0.031		-0.029	**	0.053	*	-0.048	*	-0.020		0.059	***	0.017	
	(0.030)		*(0.031)*		*(0.015)*		*(0.254)*		*(0.026)*		*(0.024)*		*(0.013)*		*(0.019)*	
pnon-resch	0.042	*	-		-0.012		-		0.020		-		-0.012		-	
	(0.023)		-		*(0.015)*		-		*(0.021)*		-		*(0.018)*		-	
non-lbinc	0.000	***	-0.001	***	0.000	***	0.000	***	0.000		0.000	*	0.000		0.000	
	(0.000)		*(0.000)*		*(0.000)*		*(0.001)*		*(0.000)*		*(0.000)*		*(0.000)*		*(0.000)*	
wage	-		-		-		-		-0.011	***	-0.009	***	-0.004	***	-0.004	***
	-		-		-		-		*(0.001)*		*(0.001)*		*(0.001)*		*(0.001)*	
pwage	0.001	**	-		0.003	***	-		-0.003	***	-		-0.002	***	-	
	(0.001)		-		*(0.000)*		-		*(0.001)*		-		*(0.001)*		-	
rural	-0.027		-0.021		-0.035	***	-0.013		0.004		0.010		0.031	**	-0.002	
	(0.023)		*(0.035)*		*(0.013)*		*(0.067)*		*(0.020)*		*(0.035)*		*(0.013)*		*(0.026)*	
gh	0.002	***	0.003	***	0.001	***	0.003	***	-0.001		-0.001	**	-0.001		-0.001	**
	(0.000)		*(0.001)*		*(0.000)*		*(0.013)*		*(0.000)*		*(0.001)*		*(0.000)*		*(0.000)*	
mh	0.001	*	0.002	***	0.001	***	0.003	***	-0.001		-0.001		-0.002	***	-0.001	
	(0.001)		*(0.001)*		*(0.000)*		*(0.011)*		*(0.001)*		*(0.001)*		*(0.000)*		*(0.001)*	
immi A	-0.155	***	-0.273	***	-0.094	**	0.074		0.115	**	0.061		0.024		-0.173	**
	(0.057)		*(0.084)*		*(0.049)*		*(0.406)*		*(0.050)*		*(0.088)*		*(0.041)*		*(0.068)*	
immi B	-0.034		-0.216	**	-0.024		0.063		0.114	***	0.183	***	-0.034		-0.047	
	(0.051)		*(0.088)*		*(0.036)*		*(0.336)*		*(0.042)*		*(0.059)*		*(0.036)*		*(0.050)*	
immi C	-0.102	**	-0.070		-0.062	***	0.035		0.086	***	0.076	*	0.049	***	0.068	***
	(0.036)		*(0.052)*		*(0.026)*		*(0.177)*		*(0.028)*		*(0.045)*		*(0.017)*		*(0.024)*	
immi D	-0.046	*	-0.069	**	-0.007		-0.053		0.036	*	0.008		0.012		0.013	
	(0.026)		*(0.035)*		*(0.012)*		*(0.219)*		*(0.021)*		*(0.028)*		*(0.013)*		*(0.028)*	
immi E (base)	-		-		-		-		-		-		-		-	
	-		-		-		-		-		-		-		-	
mtleave	-		-		-		-		0.149	***	0.102	***	-		-	
	-		-		-		-		*(0.015)*		*(0.018)*		-		-	
pmtleave	-		-		-		-		-		-		-0.025	***	-	
	-		-		-		-		-		-		*(0.009)*		-	
unmtleave	-		-		-		-		0.183	***	0.144	***	-		-	
	-		-		-		-		*(0.019)*		*(0.022)*		-		-	
punmtleave	-		-		-		-		-		-		0.007		-	
	-		-		-		-		-		-		*(0.010)*		-	
ptleave	-		-		-		-		-		-		0.080	***	0.085	***
	-		-		-		-		-		-		*(0.011)*		*(0.017)*	
pptleave	-		-		-		-		-0.037	**	-		-		-	
	-		-		-		-		*(0.016)*		-		-		-	
unemprt	-0.003		0.003		0.002		-0.001		-		-		-		-	
	(0.006)		*(0.004)*		*(0.003)*		*(0.007)*		-		-		-		-	
union	-		-		-		-		0.122	***	0.080	***	0.020	**	0.010	
	-		-		-		-		*(0.014)*		*(0.018)*		*(0.009)*		*(0.016)*	
sector	-		-		-		-		0.052	***	0.029		0.051	***	-0.003	
	-		-		-		-		*(0.019)*		*(0.022)*		*(0.012)*		*(0.026)*	
married	-0.040	*	-		0.029	**	-		-0.016		-		-0.032	***	-	
	(0.023)		-		*(0.013)*		-		*(0.018)*		-		*(0.012)*		-	
$\bar{u}_i$	-		-		-		-		-0.016	***	0.000		-0.002	***	-0.060	***
	-		-		-		-		*(0.004)*		*(0.003)*		*(0.001)*		*(0.012)*	
u_{it}	-		-		-		-		-0.102	***	0.030		-0.037	***	-0.190	***
	-		-		-		-		*(0.037)*		*(0.026)*		*(0.010)*		*(0.044)*	
Observations	9364		5820		8654		4406		5117		3480		6852		2877	
Individuals	3497		2332		3235		1960		-		-		-		-	
Psuedo-R^2	0.332		0.359		0.388		0.308		-		-		-		-	
R^2	-		-		-		-		0.342		0.333		0.176		0.228	

Notes: (1) *** represents p-value ≤ 1per cent, ** represents p-value ≤ 5per cent (> 1per cent), * represents p value ≤ 10per cent (> 5per cent). (2) Standard errors are included in parenthesis. (3) Control dummy variables for Australian State or Territory, industry sector, and year are excluded from the results of both *Employed* and *Hours* equations for brevity. (4) Similarly, fourth-order polynomial variables of the predicted values of the employment dependent variable are also excluded from the *Hours* equations. (5) The reported coefficients in the *Employed* equations represent the marginal effect.

Although many of the independent explanatory variables included in the analysis are common in previous labour supply models (e.g. level of education, marital status, and wage) there are a number that have, generally, not been included in previous work or are defined by this paper to a greater level of detail. In this analysis, the presence of resident dependent children is represented by a set of dummy variables, rather than a count, to consider the marginal influence between the presence of one child and two or more children across a combination of three age cohorts (i.e. 0-4 years, 5-14 years and 15-24 years). Similarly, in place

of the usual dichotomous 'immigrant' dummy variable, in this analysis immigrants are represented by a set of dummy variables that also consider the marginal influence of the length of time an immigrant has resided in Australia (i.e. 0-4 years, 5-9 years, 10-19 years and 20 or more years). In contrast with many other studies, this analysis also attempts to capture the influence of the availability of maternity or paternity leave arrangements on the supply of hours worked through the inclusion of a set of dummy variables. At present, particularly in Australia, there is little empirical evidence on the influence of maternity/paternity leave arrangements on labour supply, despite the recent introduction of the 'Paid Parental Leave' Scheme.

In general, the estimated coefficients for the remainder of the explanatory variables in the *Employed* and *Hours* equations, across the four sub-sample cohorts, are in keeping with expectations. As a random-effects probit model was for the *Employed* equations, the reported coefficients represent the marginal effect calculated at the sample means of the exogenous variables. That is, for continuous variables (e.g. non-labour income), the coefficients are interpreted as the effect on the probability of labour force participation for a small (marginal) change in the parameter; for discrete dummy variables (e.g. trade union membership), the coefficients are interpreted as the effect on the probability of labour force participation for a change in state (i.e. between zero and one). Similarly, as a log-linear ordinary least squares (OLS) model was used to estimate the *Hours* equations, the reported coefficients represent a constant proportional or relative change (in hours worked) for a given ['given' is absolute change in the parameter—also referred to as semi-elasticities. Thus, for continuous variables, the coefficients are interpreted as the percentage change in hours supplied per week (coefficient multiplied by 100) for an additional, or marginal, unit change in the parameter; for discrete variables, the coefficients are interpreted as a percentage change in the hours worked (coefficient multiplied by 100) for a change between zero and one.

Rather than discuss separately the results of the *Employed* and *Hours* equations for the four sub-sample cohorts, we collate the salient points by topic and discussed them with respect to the participation of single and coupled males and females in the labour force and the hours of work supplied. Importantly, the average labour supply behaviours of singles and couples and males and females over the period 2001-06 were varied, with none of the four sub-sample cohorts behaving like another, confirming the requirement that the four groups be examined separately. In particular, coupled and single women do not constitute an homogenous sample.

Education

In general, increased levels of educational attainment had a positive significance, both statistically and economically, on the probability of employment (i.e. *Employed* equations) rather than hours of work (i.e. *Hours* equations)—particularly for coupled females, single females and single males.

In keeping with usual practice, educational levels are included in models as a set of ordinal dummy variables. The "base case" is education below the final year of high school (*ed 5*) and comparisons are the increase in the probability of employment, or increase in hours of work supplied, for an education level above the base case.

For all four of the sub-sample cohorts, higher levels of education attainment had a positive influence on the probability of employment at an increasing rate, above the base case (*ed 5*). Noticeably, completion of a university qualification had greater influence on employment compared with a vocational/technical or secondary education. For example, the completion of

a 'Bachelor degree or higher' qualification level (i.e. *ed 1*—university education) increased the probability of employment by approximately 20per cent for coupled females, single females and single males; in comparison, at the lower Certificate III/IV qualification level (*ed 3*—standard vocation/technical education), the influence was only about 10per cent, for single and couple females and 6per cent for couple males. For coupled males however, the influence of education attainment on employment and the gap between a university education and vocational/technical education were much less relative to the other sub-sample cohorts. Hence, there is evidence that increased investment in education, particularly higher education, was a large and positive contributor to labour force participation in Australia. In particular, the results highlight the positive influence of education in maintaining the participation of coupled females, roughly equivalent to single females, despite the presence of a male partner (with or without children in the household). The increased and improved provision of education is recognised as a policy instrument to increase labour supply in the long-term.

Children

The influence of children was pervasively significant in the *Employed* and *Hours* equations, but the direction and magnitude of their influence on the probability of being employed and on the number of hours worked were mixed. In general, the presence of resident dependent children influenced females more than males and couples more than singles; the presence of non-resident dependent children influenced outcomes to a lesser extent and was more important for coupled males and females.

For females, the presence of resident dependent children had a negative influence, both statistically and economically, on the probability of employment and on hours worked. The presence of one young child (i.e. *ch A*—aged 0-4 years) decreased the probability of employment by approximately 28per cent, for coupled females, and 16per cent for single females. For coupled females, the presence of additional young children (i.e. *ch D*—aged 0-4 years) further decreased the probability of employment to approximately 32per cent. As the age of resident children increased, however, the influence of their presence on their parents/guardians probability of employment reversed and became positive. For example, the presence of two or more children, where one was aged 5-14 years and another child was aged more than 14 years (i.e. *ch G*), increased the probability of employment by approximately 12per cent, for both single and couple females. Simultaneously, for those employed, the age and number of resident children had a similar negative influence on hours worked, although as the children became older their negative influence diminished.

For males, particularly coupled males, the presence of resident children had a small positive influence on the probability of employment, but this effect remained relatively constant regardless of the number or age of the children. For example, the presence of one young child (i.e. *ch A*), in comparison with the presence of at least two children aged 5-14 years (i.e. *ch F*), increased the probability of employment for coupled males by approximately 5per cent and 4per cent, respectively. The influence of resident children on the hours worked by males was statistically significant in only a small number of cases and the estimated coefficients were inconsistent between singles and couples.

Overall, the age and number of resident children caused females to exit the labour force to deliver and to care for their young, returning to the labour force when their children were old enough to attend primary and secondary school; whereas, for males, children were a consistently positive influence on participation. Furthermore, for individuals engaged in the workforce, the presence of children generally decreased the number of hours worked—an affect that was stronger in the presence of younger and additional children, but diminished towards zero as the age of the children increased. The effect of children was strongest for the coupled female sub-sample, possibly because of the male 'breadwinner' effect (discussed below). Thus, if government perceives a labour shortage, it may consider increasing participation and engagement in the workforce through the funding of child-care or early childhood education as potential ways to influence females' preferences between labour force participation and hours of paid work undertaken in preference to remaining out of the workforce.

Wage and non-labour income

Average hours per week worked in Australia were relatively high: single females (males) 34.9 (45.0) and, coupled females (males) 31.7 (41.3). Consequently, a wage increase may have a limited impact on hours supplied since Australian families, and especially working mothers, are "time poor" (Apps 2007). Further, in many cases, workers have limited discretion about the number of hours worked (even casual employees respond to employers' requests to increase or decrease hours). Moreover, most low-wage workers in Australia live in middle and upper income households (Richardson, 1998) and, hence, may choose their hours with reference to the household requirements be little affected by wage changes (this is an area requiring further research when collective models for joint household decisions become accessible). In summary, increased wage rates did not increase the number of hours supplied:

the wage rate was highly statistically significant for all groups, but in all cases the coefficient was very small and negative.

Non-labour income varies considerably between coupled and single males and females. For example, average (positive) non-labour income for coupled females (males) who work is $68 ($77)[4] per week, but averages $197 ($136) for single females (males) for the sub-sample in the employment model. For coupled males and females the median is $52 per week and $46 per week respectively; for coupled persons who work, the median non-labour income is $11 per week for females and $35 per week for males, but for singles it is $11 per week for males but just $1 per week for females.

Non-labour income was statistically significant at the 1per cent level for all *Employed* equations, but was not significant at the 5per cent level for the *Hours* equations. Although coefficients for weekly data are very small, on an annual basis the negative impact on the probability of being employed ranges from about 9per cent for single females to about 1per cent for coupled males—but as noted above the distribution of non-labour income is both wide and skewed and hence the impact varies considerably. Nonetheless, as with education, non-labour income does influence the probability of employment, but not the number of hours worked (with the exception of single females).

Immigration

For immigrants to Australia, the increased duration of their residence in Australia decreased the negative influence on their probability of being employed towards the base 'Australian born' (i.e. *immi E*)—except for single males. For example, immigrant coupled females with fewer than five years of residency (i.e. *immi A*), were approximately 16per cent less likely to be employed than Australian born coupled females; but the difference fell to less than 5per cent after 20 years of residence (i.e. *immi C*). Conversely, immigrant coupled males were approximately 9per cent less likely to be employed within the first five years, but the difference had fallen to 6per cent within 20 years of residence. Single females were the least likely to be employed; single males did not differ from non-immigrants.

For the *Hours* equations, results are more varied. For example, coupled females who were resident for less than five years supplied approximately 12per cent more hours per week than non-immigrants; whereas single males supplied approximately 17per cent fewer hours per week. Nonetheless, overall, the influence of immigrant status diminished over time—hours supplied by immigrants and Australian born residents tend to converge—but it is a well recognised feature of immigrants' interaction with the labour market that the time for convergence with non-immigrants can be substantial (Lester 2007).

Employment characteristics

The availability of paid or unpaid maternity leave had a positive effect, both statistically and economically, on the hours supplied by females. For example, for coupled (single) females, paid maternity leave (i.e. *mtleave*) increased hours supplied by about 15per cent (10per cent), while unpaid maternity leave (i.e. *unmtleave*) increased supply by approximately 18per cent (14per cent). Similarly, for single and coupled males, the availability of (paid or unpaid)

[4] In 2006 dollars.

paternity leave (i.e. *ptleave*) increased hours supplied by about 8per cent and 9per cent, respectively.

Conversely, partner's paid maternity leave (i.e. *pmtleave*) was significant, but counter-intuitively reduced the hours supplied by coupled males by about 3per cent. Similarly, for coupled females, partner's (paid or unpaid) paternity leave (i.e. *pptleave*) reduced hours supplied by about 4per cent. Again, this indicates an area for investigation in future research.

Control for maternity/paternity leave has rarely been included in labour supply models: these results indicate that the omission is a model misspecification (resulting in biased model estimates). Moreover, maternity leave may also be a proxy for other employment conditions (e.g. desirable working conditions).

The influence of trade union membership (i.e. *union*) had a positive significance, both statistically and economically, on the hours supplied by all the sub-sample cohorts except single males. The influence differed in magnitude: for coupled (single) females, membership increased hours worked by about 12per cent (8per cent); for coupled males, by only about 2per cent. These differences may reflect, amongst other things, the differential industry-occupation distribution between coupled males and females.

The influence of employment in the private sector on hours worked was significant (and slightly positive) only for females. Coupled females in the private sector supply about 5per cent more hours; single females supply about 3per cent more hours, but the sector of employment does not appear to influence male hours supplied.

Further partner influences

Explanatory variables included in the regressions to capture the influence of the partners' characteristics on the labour supply behaviour of coupled males and females, such as partners' age and education attainment, were either immaterial or not statistically significant. It is possible that the lack of statistical significance of some partners' attributes was due to the restrictive assumptions imposed by the unitary approach in a multi-income household (previously discussed). In this adaptation of the unitary model, however, the influence of a partner on labour supply was also observed implicitly through the reciprocity in the complimentary behaviour of coupled males and females, and the differences in the estimated results between the single and couple sub-samples. The implicit nature of the influence of a partner within the same household on the labour supply behaviour of males and females is exemplified through the influence of children on the probability of employment and hours worked (previously discussed). For example, the presence of a male partner within the same household provided a support mechanism that enabled coupled females to lower their participation in, and engagement with, the workforce to deliver and care for children, relative to single females. Concurrently, the positive influence of resident children on the participation of couple males, accompanied by a decrease in their hours worked, compliments the notion of male partners as a support mechanism (or 'breadwinner').

Conclusion

The Australian economy has experienced long-run structural changes in both the supply and demand for labour—noticeably with respect to female participation and male forms of employment. Changes will continue as the population ages, the fertility rate remains below

the replacement rate, and employers continue to seek workforce flexibility—i.e. to demand further growth in the proportion of workers in casual and part-time employment.

This paper presents the results of examining the influence of some key determinants of employment (i.e. the probability of gaining paid employment) and hours worked (i.e. the number of hours worked per week, contingent on being employed) for both single and coupled males and females in Australia. Separate consideration of the labour supply behaviour of individuals with a partner (i.e. potential income earner) within the same household is driven by the theoretical concept of explicitly identifying the utility maximising behaviour of two or more income earners within a household, and the subsequent welfare transfers (i.e. the *collective* approach), as opposed to treating the household as a single unit and the individuals within as equals (i.e. the *unitary* approach). Practical limitations on the econometric estimation of models with collective approach attributes, however, restrict its application in this analysis. In place of the complete collective model, the effect of partners on the labour supply behaviour of individual is limited to their implicit effects through the comparison of singles in a unitary framework and couples in an augmented unitary model. Thus, this work is an advance on previous methods, and it provides econometric model results that are more reliable by addressing serious forms of endogeneity, such as unobserved heterogeneity, selection bias and dynamics/state dependency, using the Vella and Verbeek (1999) two-step panel data procedure. The analysis demonstrates that these matters must be taken into account to avoid a miss-specified model.

To address the changes in the labour market it is necessary to understand more fully the behaviour of the labour supply side: the choices made by individuals, and the factors that influence those choices—whether they are individual, partners' or household characteristics. In this way, it may be possible to devise government policy that alleviates labour and skill shortages that have occurred and will continue to occur in the Australian labour market. Important to the estimation of factors influencing labour market activity is recognition that there are clear differences in behaviours of males and females, and between singles and couples. The econometric model results for the four sub-samples of individuals considered by this analysis of labour market supply confirm that this disaggregation is appropriate.

In particular, this research finds that, as has been shown in previous analysis, the standard explanatory variables appear to influence the probability of being in employment and the number of hours of work supplied. For example, lower levels of education attainment, shorter lengths of residency in Australia (i.e. immigration) and advancing age are strongly associated with -lower probabilities of being employed.

Importantly, variables included in this research not generally found in other analysis, such as partners' attributes, access to paid and unpaid maternity/paternity leave, and more detailed categories of children are shown to be important in explaining labour market behaviour. For example, the presence of children alters the probability of employment or the number of hours worked between couples and singles, males and females, depending on the number of children present and their age categories. For couples, partner's education level does not appear to be influential for employment or hours, but partner's wage is influential for both decisions. Similarly, access to maternity/paternity leave increases the hours worked (in varying magnitudes) by both coupled and single males and females; whereas, the leave entitlements of a partner lowers the hours worked by both males and females.

The econometric models used in this research take a step towards a more nuanced understanding of the Australian labour market supply. Furthermore, the estimated results provide an interesting insight into labour supply behaviour, and suggest several areas where government policy intervention may contribute to increased hours supplied—for example, in the area of maternity/paternity leave, access to labour market skills for immigrants, investment in education attainment and childcare or early childhood education.

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