Centre for Research in Applied Economics (CRAE)

Working Paper Series
200807
April

"Mature Age Employment Participation: An Analysis of the Roles of Work Incentives, Endowment and Behaviour"

By Rachel Ong and Gavin Wood

Centre for Research in Applied Economics,
School of Economics and Finance
Curtin Business School
Curtin University of Technology
GPO Box U1987, Perth WA 6845 AUSTRALIA
Email: michelle.twigger@cbs.curtin.edu.au
Web: http://www.cbs.curtin.edu.au/crae
ISSN 1834-9536

Curtin
University of Technology

MATURE AGE EMPLOYMENT PARTICIPATION: AN ANALYSIS OF THE ROLES OF WORK INCENTIVES, ENDOWMENT AND BEHAVIOUR[*]

by

Rachel Ong

School of Economics and Finance, Curtin Business School, Curtin University of Technology

Gavin Wood

School of Global Studies, Social Science and Planning, RMIT University

Abstract:
This paper analyses the impacts of work incentives, socio-demographic characteristics and behavioural factors on mature age employment participation decision. A decomposition analysis is performed to determine whether the lower participation of mature age persons is due to an endowment effect or a behavioural effect. The endowment effect represents the role of work incentives and socio-demographic characteristics as determinants of employment participation; the behavioural effect represents the role of preferences of mature age workers or age discrimination that impedes access to suitable job and career prospects. The work incentive findings indicate that mature age males and females have higher replacement rates than prime age males and females. However, the employment participation of mature age males and females appear to be less sensitive to changes in replacement rates than their younger counterparts. The results from the decomposition analysis confirm that mature age persons are less endowed with characteristics that favour employment participation than prime age persons. However, their lower employment participation outcomes are still primarily due to behavioural, rather than endowment, effects.

JEL Codes: J01; J22

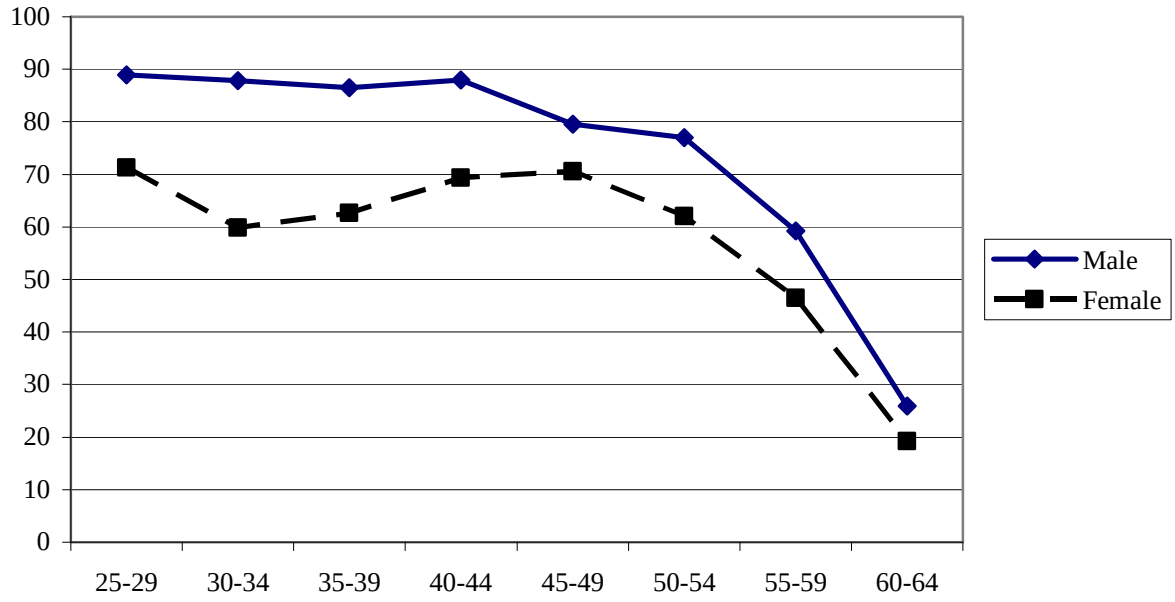
Keywords: Employment participation; Mature age; Prime age; Work incentives; Replacement rates; Endowment; Behaviour

[*] The estimates of replacement rates used in this paper are derived from the AHURI-3M tax-benefit simulator, which was constructed under the Australian Housing and Urban Research Institute's (AHURI) national research venture *Housing Assistance and Economic Participation*. The authors are grateful to Alice Stoakes from RMIT University, who updated the simulator under the AHURI project *The Implications of Loss of a Partner for Older Renters*.

1. Introduction

One of key challenges facing the ageing Australian population is the noticeably low employment participation of the mature age working age population, defined in this paper as persons aged 45-64 years. Figure 1 shows the employment participation rate of men and women aged 25-64 years by age band in 2004. Clearly, employment participation drops sharply from age 45 onwards.

Figure 1: Employment participation rate, by gender and age band, 2004



Source: Authors' calculations from the confidentialised unit record files of the HILDA Survey wave 4 Release 5.1

Population projections indicate that there is an urgent policy need to create incentives that retain employed mature age workers longer in the workforce and encourage non-employed mature age persons to transition into work. The proportion of Australia's population that is of working age is projected to drop from 67% in 2004 to between 57% and 59% in 2051. Moreover, the share of the working age population that is made up of mature age persons is projected to rise from 36% to between 39% and 44% (Australian Bureau of Statistics, 2006)[2]. A fiscal system that depends on a workforce that is perpetually shrinking in size to support an ever-growing population of retirees with longer life expectancies will be under increasing budgetary pressure. As the superannuation guarantee only came into effect in 1992, the majority of mature age people would not have built up substantial superannuation savings to finance their retirement. The fiscal system will come under additional pressure if mature age persons retire with inadequate retirement incomes.

This paper addresses an urgent policy concern by analysing the impacts of work incentives on mature age employment participation decision. A decomposition analysis is performed to determine whether the lower participation of mature age persons is due to an endowment effect or a behavioural effect. The endowment effect represents the role of work incentives and socio-demographic characteristics as determinants of employment participation; the behavioural effect represents the effect of preferences of mature age workers or age

[2] Authors' calculations from tables 5.3, 5.4 and 5.5 in Australian Bureau of Statistics (2006).

discrimination that impedes access to suitable job and career prospects. In addition the present analysis offers three important innovations over previous Australian mature age participation studies.

First, this study introduces the replacement rate as an exogenous determinant of mature age employment participation. The replacement rate is the proportion of income when working that is replaced by income when not working. Hence, it is a measure of the financial incentive to work. The higher the replacement rate, the lower the incentive to work. While many existing mature age participation studies recognise the importance of the replacement rate as a measure of work incentives, replacement rates are most commonly included in macro data studies that do not capture the heterogeneity that exists across individuals (see, for example, Merrilees, 1983; O'Brien, 2001). Endogeneity issues have typically hindered the use of replacement rates in micro data studies (Ong, 2004). This paper exploits the panel nature of the Household, Income and Labour Dynamics in Australia (HILDA) Survey along with instrumental variable approaches to address endogeneity issues.

Second, most of the existing research on mature age labour supply has focused on the participation of mature age men, or women with children. In comparison, studies rarely examine the employment participation of mature age women after their child-bearing years have ended and the factors affecting their decisions to re-enter the workforce. Yet, 60% of mature age persons who were not employed in 2004 were made up of mature age women[3]. Policy measures aimed at improving the employment participation of mature age persons will clearly need to address the factors affecting mature age women's participation decision. This paper addresses the current lack of empirical research on mature age women's participation decision by modelling and analysing the participation decision of mature age men and women separately.

Third, empirical research on the employment participation of mature age males in Australia is largely dated, the bulk of the research having been conducted in the 1980s (see for example, Merrilees, 1982; Merrilees, 1983; Miller, 1983; Woodland, 1987). Recent work by O'Brien (2003) and Ong (2004) have updated the labour supply literature on mature age Australian men, but these studies have been based on cross-section micro data. This paper adds a longitudinal dimension to the existing cross-section literature by employing the use of panel micro data, that is, the HILDA Survey.

Section 2 of this paper reviews the current Australian literature on the employment participation of mature age persons. Section 3 outlines the methodological approach. Descriptive statistics are presented in Section 4. Key findings from the model estimation and decomposition analysis are reported in section 5. Section 6 concludes.

2. Literature Review

This section reviews mature age labour supply studies that have been conducted in Australia[4]. Existing studies typically postulate that mature age persons retire early in response to financial incentives obtained through wealth accumulation over their working lives or the financial attractiveness of income support payments such as the Disability Support Pension.

[3] Authors' calculations from the confidentialised unit record files of the HILDA Survey wave 4 Release 5.1.
[4] Existing studies differ on the specific age groups analysed. Hence, the term 'mature age' in this section does not strictly refer to persons aged 45-64 years.

Much of the empirical research into determinants of mature age men's participation decision in Australia have been conducted using time-series models based on macro data. Examples include Miller (1983), Merrilees (1982) and Merrilees (1983). Miller (1983) found private wealth effects to be the major cause of declining participation among males aged 60-64 years old between 1973 and 1982, while Merrilees (1982; 1983) emphasised the role of social security pensions. Woodland (1987) was an exception among studies conducted in the 1980s that addressed the determinants of employment outcomes among mature age men using micro data. The study favoured the role of pension eligibility in determining mature age male employment participation. Recent work based on micro data by Ong (2004) emphasised the impact of work incentives on the participation probability of mature age males. On the other hand another recent study based on micro data by O'Brien (2003) did not emphasise a role for work incentives; instead it found a potentially large role for unanticipated events and unobservable tastes and preferences in determining mature age male employment participation trends.

As mentioned previously, there are relatively few Australian studies on the participation decision of older women. Kelley and Evans (2002) found that Australian mature age women's employment participation behaviour was not influenced by work incentives, as proxied by potential earnings. Miller and Volker's (1983) ordinary least squares analysis of married women found that predicted wage had a significant positive impact on the participation decision of women aged 45-54 years. This finding was corroborated by Birch (2005). Furthermore, Birch (2005) found that investment and other non-labour income had a negative impact of mature age women's participation decision[5]. Ong (2004) found that high replacement rates had a negative impact on the participation probability of mature age females. The only known Australian study that has exploited longitudinal data to analyse the participation behaviour of mature age women is Austen (2006). This paper utilised the Negotiating the Life Course Survey to analyse the employment transitions of mature age women aged 40-58. The paper found that health, carer roles and partners' employment patterns tended to affect the employment transitions of older women. However, the paper did not examine the role of work incentives as financial determinants of employment participation.

Despite the traditional hypothesis put forth by the mature age participation literature that mature age persons retire early in response to work incentives, only Ong (2004) has explicitly measured the impacts of the replacement rate as exogenous financial determinants of mature age persons' participation decision. In Ong (2004), the numerator (income when not working) and denominator (income when working) of the replacement rate were entered separately into a cross-section model of employment participation. The wage estimate that entered the denominator was derived by multiplying each individual's hourly wage rate by the median working hours of the whole population in order to maintain exogeneity in the replacement rate estimate[6]. A more sophisticated study, Dockery et al (2007) entered the replacement rate directly into a panel model of probability of employment transition and addressed endogeneity concerns by modelling the impact of the current replacement rate facing unwaged individuals upon their employment outcomes one year later. However, Dockery et al's (2007) analysis was based on a sample of unwaged persons from the general working age population with no

[5] For a detailed review of non-financial factors affecting the participation behaviour of mature age women, refer to Austen and Birch (2005).

[6] For unwaged individuals, the hourly wage rate was estimated using a wage regression; for wage individuals, the hourly wager ate was their reported hourly rate (Ong, 2004).

explicit focus on mature age persons. Neither Ong (2004) nor Dockery et al (2007) employed the use of instrumental variables to address endogeneity.

In summary, much more research needs to be done one the impacts of work incentives on mature age participation. Previous mature age participation studies that utilise replacement rate variables in analysis have either ignored their endogenous nature (see, for example, O'Brien, 2003) or relied on cross-section methods that do not adequately address endogeneity concerns (Ong, 2004). Panel studies such as Dockery et al (2007), though an improvement from cross-section studies, have been rare and typically do not contain an explicit focus on mature age persons.

This paper extends Dockery et al's (2007) work in two ways. First, the model makes use of interaction variables to compare the impacts of the replacement rate on the labour supply decision of mature age persons relative to younger Australians. Second, Dockery et al (2007) only computes the replacement rate for unwaged persons as the analysis is conducted on a sample of unwaged persons. This paper computes replacement rates for both unwaged and waged persons such that the analysis is not restricted to unwaged persons, but all mature age Australians.

3. Methodology

This section describes the estimation of a model that measures the impact of work incentives on mature age employment participation. First, the underlying employment participation model is specified. Second, we explain the procedure for computing the replacement rate. Third, we outline steps taken to test for and address the potential endogeneity of the replacement rate variable. Finally, we describe the approach taken to estimate the underlying model that specifically takes into account the panel nature of the data.

3.1 The Employment participation Model

The employment participation model is

$$P(E_{i(t+1)}) = \alpha + \beta_1 RR_{it} + \beta_2 X_{it} + \delta_0 MA_{it} + \delta_1 MA.RR_{it} + \delta_2 MA.X_{it} + \mu_{it} \qquad (1)$$

where i indexes individuals, t indexes time or wave of observation, $P(E)$ represents the probability of employment participation, RR is the replacement rate, X is a vector of socio-demographic characteristics (see table 1) and u is the error term. The estimation sample comprises all non-dependent working age persons aged 25-64, and mature age persons are identified by the variable MA, a dummy indicator that equals 1 if a person is mature age (aged 45-64) and 0 if a person is prime age (aged 25-44).

The impact of each explanatory variable on participation probability is obtained by analysing the magnitude and direction of the coefficients β_k and δ_k that are significant. The coefficients on the non-interaction terms β_k represent the impact of the explanatory variables on the employment probability of prime age persons. The δ_k coefficients on variables interacted with the mature age indicator MA measure the differential impact of being a mature age person. For example, if the coefficient δ_1 is significant, it indicates that mature age persons respond differently to changes in their replacement rates than do prime age persons. Conversely, if the coefficient δ_1 is insignificant, it indicates that mature age persons do not respond differently to changes in replacement rates than do prime age persons. The sum of β_k

and δ_k capture the total impact of being a mature age person. For example, the sum of β_1 and δ_1 captures the responsiveness of mature age persons to changes in their replacement rates. The model therefore facilitates comparisons between mature age persons and prime age persons through the interaction variables. If the coefficients δ_k are generally insignificant, then mature age persons do not behave differently from prime age persons. If this is the case, then variations in the employment participation of mature age persons compared to prime age persons can be mostly explained by variations in their endowment. On the other hand, if the coefficients δ_k are generally significant, then the observed variations in employment participation between mature age and prime age persons are due to differential behaviour between the two groups. This behavioural effect can be broadly described as a composite effect of differential preferences and age discrimination.

Table 1: Socio-demographic variables in regressions

Explanatory variable	Variable type	Mnemonic	Variable categories
Time trend (wave of interview)	Binary	*W1*	Interviewed in 2001 (omitted)
		W2	Interviewed in 2002
		W3	Interviewed in 2003
Marital status	Binary	*MARR*	Married (omitted)
		SINGLE	Single never married
		DEF	De facto
		SEPAR	Separated
		DIVOR	Divorced
		WIDOW	Widowed
Disability status	Binary	*DISAB*	Disabled
Aboriginality	Binary	*ABOR*	Aboriginal
Number of children	Continuous	*K0T4*	Number of children aged 0-4
		K5T9	Number of children aged 5-9
		K10T14	Number of children aged 10-14
Highest educational qualification	Binary	*QPGRAD*	Postgraduate
		QGRAD	Graduate diploma or graduate certificate
		QBACH	Bachelor degree
		QDIP	Advanced diploma or diploma
		QCERT34	Certificate III or IV
		QCERT12	Certificate I or II
		QCERTN	Certificate not defined
		QYR12	Year 12
		QYR11	Year 11 and below
Time spent out of work	Continuous	*TUNEMR*	Years in unemployment as a percentage of time since left full-time education
		TNILFR	Years not in the labour force as a percentage of time since left full-time education
English proficiency	Binary	*ENGONLY*	Speaks only English at home (omitted)
		ENGWELL	Speaks language other than English at home but speaks English well or very well
		ENGPOOR	Speaks language other than English at home and speaks English poorly or not at all
Region		*SYD*	Sydney (omitted)
		NSWB	Balance of New South Wales
		MEL	Melbourne
		VICB	Balance of Victoria
		BRI	Brisbane
		QLDB	Balance of Queensland
		ADE	Adelaide
		SAB	Balance of South Australia
		PER	Perth
		WAB	Balance of Western Australia
		TAS	Tasmania
		NT	Northern territory
		ACT	Australian capital territory

3.2 Computing the Replacement Rate[7]

The replacement rate is defined as the ratio of disposable income while unwaged to disposable income while in paid work. The higher the replacement rate is, the weaker is the financial incentive to be in paid employment. The replacement rate formula used in this analysis is

[7] The computation of replacement rates requires the estimation of two auxiliary regressions, a Heckman wage model and a market rent regression. Both auxiliary regressions are overall significant. Results are not presented in this paper, but are available from the authors upon request.

$$RR_i = Y_i^u / Y_i^w \qquad (2)$$

where *i* indexes individuals and *RR* is the replacement rate. Y_i^u is the income unit disposable income of individual *i* while s/he is unwaged and Y_i^w the income unit disposable income of individual *i* while s/he is waged or in paid work. Both Y_i^u and Y_i^w are calculated on an income unit basis so that the replacement rate estimates account for the full income unit ramifications of a transition from one labour force status position to another for individual *i*. This approach is appropriate because the level of income support payments and tax liabilities of each individual *i* is not simply dependent on personal income, but the income of the income unit to which s/he belongs.

The method of computing Y_i^u and Y_i^w depends on the initial labour force status of the specified person *i*. For unwaged persons, Y_i^u is known. For example, actual retirement annuities are included in the 'known' incomes of currently unwaged persons. However, Y_i^w is unknown and must, therefore, be imputed for the person under consideration. We do so in this study by estimating separate wage equations for males and females using Heckman models to address sample selection bias issues. For waged persons, Y_i^u is unknown. A waged person who does not receive any government income support may become eligible for income support payments upon quitting paid employment. It is assumed that non-disabled persons are assigned to Newstart Allowance, whereas disabled persons are assigned to Disability Support Pension. Females in the sample who would be eligible for Age Pension should they quit employment are assigned to Age Pension regardless of their disability status. Retirement annuities are imputed for persons aged 55 or over who are assigned to a pension. It is assumed that the average retirement annuities received by persons aged 55 or over who are not in the labour force are representative of the retirement annuities persons aged 55 or over in paid employment would receive upon retiring. When imputing Y_i^u and Y_i^w, the wage and salary of one's partner is assumed to remain constant.

Replacement rate estimates are computed using a tax-benefit simulator of the Australian Housing and Urban Research Institute, AHURI-3M. Importantly, the simulator allows Australian tax provisions and income support parameters to be taken into account in both Y_i^u and Y_i^w [8]. An important methodological feature not commonly found in replacement rate studies is that this paper incorporates the clawback of rental subsidies for persons living in public housing. An unwaged tenant who gains paid employment will have their rent increased to the lesser of market rent or 25 per cent of household assessable income as per public housing rules. This is treated as equivalent to a decrease in their disposable income. The opposite applies for a waged tenant who quite employment.

3.3 Testing for Endogeneity

The replacement rate variable is a potentially endogenous variable. The model combines panel and instrumental variable approaches to minimise the risk of endogeneity. First, the use of panel data ensures that individual-specific traits that are unobservable can be controlled for by observing outcomes for the same person at different points in time. To the extent that

[8] Even when an unwaged person gains employment, s/he is still eligible to receive income support payments at a reduced rate if income is low when in paid work.

unobservable factors that impact upon participation are fixed for any one person, correlations between replacement rate and participation decisions cannot be attributable to unobserved differences in the characteristics of individuals in the sample as might be the case in cross-section data. Second, the employment outcomes in wave t+1 are modelled on variables observed in the preceding wave t as in Dockery et al (2007). This mitigates endogeneity problems associated with simultaneity or reverse causality. The AHURI-3M tax-benefit simulator is operationalised using current income in waves 1 to 3 of the HILDA Survey. Hence, the variable *RR* can be computed for individuals in waves 1-3 for the years 2001 to 2003. The longitudinal nature of the HILDA data is then exploited by matching variables in waves 1-3 to employment outcomes in the following year (waves 2-4).

Any remaining endogeneity due to omitted variable bias is tested for using an instrumental variable strategy. First, a test for the validity of the chosen instruments is conducted. In order for an instrument to be valid, the instrument should be sufficiently correlated with the potentially endogenous replacement rate measure but uncorrelated with the error term in an employment equation. Second, upon confirming that the instruments are valid, an instrument-based test of exogeneity, the Wald's test is conducted. If the exploitation of the panel nature of the data has in fact addressed the endogeneity problems, then the Wald's test of exogeneity would be insignificant, such that it is not possible to reject the null hypothesis of exogeneity. The actual replacement rate would be used as the explanatory variable in equation 1. If, however, the test is significant, the replacement rate variable would be instrumented using a valid instrument. The instrumented, instead of actual, replacement rate would then be inserted into equation 1.

Three specific steps are taken to test for the validity of each instrument. First, the replacement rate is regressed on a set of exogenous socio-demographic variables and the chosen instrument[9]. Second, the decision to undertake employment is regressed on the same set of exogenous socio-demographic variables and chosen instrument[10]. In order for the chosen instrument to be valid, it should satisfy all of the following conditions. First, it should have sufficient explanatory power in the replacement rate regression. Second, it should not have significant explanatory power in the employment regression. Third, the F-statistic generated by the replacement rate regression should be significant and above the threshold of 10 in order to ensure that the instrument is not weak (Stock, Wright and Yogo, 2002).

We test for the validity of two instruments in turn. The first is a variable representing number of siblings. The second is an indicator of whether one or both parents had an early death, that is, whether either parent had died by the time the individual was aged 14. These instruments are expected to affect one's non-wage transfers and therefore one's incentive to work. For example, an individual with a large number of siblings will likely receive a smaller portion of his/her parents' wealth than an individual with no siblings. Inheritance is a potentially important influence on the level of non-wage income and therefore the replacement rate. However the number of siblings is unlikely to directly affect an individual's decision to undertake employment. Similarly, a parent's death when one is still young may result in early receipt of one's inheritance, or it may result in one having less inheritance because his/her parents' asset-accumulating years have been shortened by early death. However a parent's early death is unlikely to directly affect an individual's decision to undertake employment.

[9] The socio-demographic variables include the mature age indicator and the variables listed in table 2.
[10] The socio-demographic variables include the mature age indicator and the variables listed in table 2.

Results from the instrument validity test indicate that a parent's early death is a valid instrument in the case of males; number of siblings is a valid instrument in the case of females. The parent's early death (siblings) variable has explanatory power that is significant at the 1% (1%) level in the male (female) replacement rate regression, but is insignificant in the male (female) employment probit. Furthermore, the F-statistic generated by the male (female) replacement rate regression is 14.89 (14.77) and significant at the 1% level. The Chi^2 statistic generated by the Wald's test of exogeneity is insignificant in the case of both males ($P>Chi^2=0.106$) and females ($P>Chi^2=0.234$), indicating that the replacement rate variable can be treated as exogenous. Hence, the actual replacement rate variable is inserted into equation 1.

3.4 Estimating a panel model

A likelihood ratio test is conducted to determine whether the panel level variance component is important. The null hypothesis is that the panel level variance component is insignificant and that the panel estimator is not different from a pooled estimator. If the null hypothesis is not rejected, then results from a pooled probit will be presented. However, the likelihood ratio test statistic is found to be significant at the 1% level, indicating that a panel estimator generated by a random effects model would be significantly different from a pooled estimator. Hence, a random effects probit is estimated.

4 Descriptive Statistics

Our analysis employs waves 1 to 4 of the HILDA Survey covering the period 2001 to 2004. Employment outcomes in waves 2 to 4 (2002 to 2004) are modelled on endowment variables, that is, work incentive and socio-demographic variables from waves 1 to 3 (2001 to 2003).

Tables 2 and 3 highlight the differences in work incentives and socio-demographic characteristics between mature age and prime age persons. Table 2 clearly shows that among males, those who are mature age have higher replacement rates than those who are prime age and this observation is consistent and significant in each year. Among females, the difference in mean replacement rates across the two age groups is insignificant in 2001 and 2002; by 2003, mature age females have higher replacement rates than their younger counterparts and this difference is highly significant at the 1% level.

Table 2: Mean replacement rate, by gender and age group, 2001-03, per cent

	2001		2002		2003	
	Mature age	Prime age	Mature age	Prime age	Mature age	Prime age
Replacement rate						
Male	50.2*	59.1	49.9*	57.5	49.4*	64.3*
Female	36.3	60.2	35.8	58.8	33.1	59.8
Sample						
Male	1,247	1,856	1,171	1,678	1,133	1,538
Female	1,333	2,055	1,258	1,802	1,255	1,671

Source: Authors' calculations from the confidentialised unit record files of the HILDA Survey waves 1-3 Release 5.1

* Significantly different from prime age persons of same gender at the 1% level. Where there are no asterisks, differences are not significant at the 1, 5 or 10% level.

Differences in key socio-demographic characteristics between the two age groups are reported in table 3. In the interests of brevity, the differences are reported for the year 2003 only.

Trends in the previous two years are broadly similar to 2003. There are clearly significant differences in characteristics between mature age and prime age persons. Mature age males and females are more likely to be married, divorced or widowed. They are also more likely to be disabled, possess educational qualifications below year 12 and have spent more time out of the labour force (but less time in unemployment).

Table 3: Socio-demographic characteristics, by gender and age group, 2003, per cent unless stated otherwise

Socio-demographic Characteristics		Male		Female	
		Mature age	Prime age	Mature age	Prime age
Marital status	Married	66.6*	48.7	58.5*	51.5
	Single never married	9.2*	27.3	6.7*	19.7
	De facto	6.2*	17.2	4.8*	14.5
	Separated	5.6*	2.9	6.5	5.3
	Divorced	11.4*	3.8	16.3*	8.4
	Widowed	1.1*	0.1	7.2*	0.6
	Disabled	37.2*	17.5	31.4*	17.4
	Aboriginal	1.6	2.1	1.8^{+}	3.1
Number of children	Aged 0-4	0.0*	0.4	0.0*	0.4
	Aged 5-9	0.1*	0.3	0.1*	0.4
	Aged 10-14	0.2^{+}	0.3	0.2*	0.4
Highest educational Qualification	Postgraduate	4.4	3.6	1.7*	3.3
	Graduate diploma or graduate certificate	4.1	4.3	4.3^{+}	6.2
	Bachelor degree	10.8*	14.9	10.4*	17.3
	Advanced diploma or diploma	9.9	8.3	7.6*	10.7
	Certificate III or IV	28.6	29.8	12.7	12.7
	Certificate I or II	1.2	1.8	1.8	2.2
	Certificate not defined	0.6^{+}	0.1	1.3$^{\#}$	0.6
	Year 12	8.5*	12.6	10.3*	17.7
	Year 11 and below	32.0*	24.6	50.0*	29.3
Time spent out of work	Years in unemployment as a percentage of time since left full-time education	2.8*	6.1	6.2*	10.5
	Years not in the labour force as a percentage of time since left full-time education	8.1	7.9	28.0*	26.4
English proficiency	Speaks only English at home	88.2	89.4	88.4	87.1
	Speaks language other than English at home but speaks English well or very well	9.7	9.2	8.4^{+}	11.1
	Speaks language other than English at home and speaks English poorly or not at all	2.1	1.4	3.3^{+}	1.9
Region	Sydney	14.4	16.7	15.8	17.7
	Balance of New South Wales	14.5	13.5	14.2	12.4
	Melbourne	18.3	18.5	17.1	18.3
	Balance of Victoria	7.8$^{\#}$	6.1	8.0*	6.3
	Brisbane	9.0	9.2	9.2	10.2
	Balance of Queensland	11.0	11.0	10.8	11.6
	Adelaide	7.0	6.7	7.6$^{\#}$	5.9
	Balance of South Australia	2.9	2.4	2.7	2.6
	Perth	8.0	7.5	7.3	7.1
	Balance of Western Australia	2.6	2.3	2.8	2.2
	Tasmania	2.9	3.3	2.3	3.3
	Northern territory	0.3	0.5	0.7	0.5
	Australian capital territory	1.4	2.3	1.6	1.9

Source: Authors' calculations from the confidentialised unit record files of the HILDA Survey waves 1-3 Release 5.1

* Significantly different from prime age persons of same gender at the 1% level.

$^{+}$ Significantly different from prime age persons of same gender at the 5% level.

$^{\#}$ Significantly different from prime age persons of same gender at the 10% level.

Where there are no asterisks, differences are not significant at the 1, 5 or 10% level.

Overall, the descriptive statistics reported in tables 2 and 3 indicate that mature age persons may have poorer endowments compared to prime age persons. However, the relatively low employment participation of mature age persons illustrated in figure 1 is not only attributable to endowments but may also be attributable to behavioural effects representing the role of preferences of mature age workers or age discrimination that impedes access to suitable job and career prospects. Section 5 presents findings from estimation of the employment participation model outlined in section 3, which provides some insight into the relative importance of endowment and behaviour in contributing to low employment participation among mature age persons.

5 Findings

The regression results are reported separately for males and females in table 4. The precise quantitative impact of a particular explanatory variable on participation probability is then measured by employing marginal effect estimates. When the explanatory variable is binary, the marginal effect is the percentage point impact on employment participation probability of going from 0 to 1. When the explanatory variable is continuous, the marginal effect is the percentage point impact on employment participation probability of a unit increase in the explanatory variable.

The non-interaction variables reflect the impacts of observable factors on the employment probability of prime age persons. Prime age males and females who are married are much more likely to be employed than those in other marital states. Household dissolution in the form of separation and divorce has a sizable negative impact on employment. Prime age males (females) who are separated or divorced in wave *t* are 35-42 (22-27) percentage points less likely to be employed than their married counterparts in the subsequent wave. Single prime age males (females) who have never married are also significantly less likely to be employed than married individuals. Educational qualifications above certificate level 2 are associated with higher employment probabilities. A longer time spent in unemployment or out of the labour force lowers employment probability, an indicator of human capital depreciation during time not spent in paid work[11]. Lower employment probabilities are also associated with poorer English proficiency and disability, particularly in the case of females. The presence of young children aged 0 to 4 years also reduces females' participation by a significant 27 percentage points due to child-caring responsibilities.

Differences in labour market behaviour between mature age and prime age individuals can be observed from the *MA* and interaction variables. The negative and significant coefficient on *MA* captures the permanent differences between mature age and prime age individuals that result in the former being less likely to work than the latter. The marginal effect estimate on the variable *MA* shows that average permanent differences between the two groups lowers employment probability by 24 percentage points among mature age males; among mature age females the effect is twice as great at over 50 percentage points.

The marginal effect estimates on the interaction variables capture the differential behaviour of mature age persons in response to changes in socio-demographic characteristics and work incentives. In general, the interaction variables indicate that mature age females' employment participation are significantly more sensitive than prime age females to disability status,

[11] Time in paid work is not included due to collinearity with time in unemployment time NILF and the mature age indicator.

English proficiency levels and location. When mature age, the effect of being disabled is amplified; disabled mature age females face an additional 17 percentage point reduction in employment probability than disabled prime age females. Mature age females who have poor English proficiency levels have a 53 percentage point lower employment probability than prime age females with similarly poor English proficiency skills. Mature age females in non-metropolitan regions are also much less likely to be engaged in employment than prime age females in the same regions. A noteworthy exception to this general trend is that when mature age, the negative effects of household dissolution are largely reversed, as indicated by the large positive marginal effects of the marital status interaction terms. A potential explanation could be that most mature age women who are separated or divorced no longer have children who are solely dependent on their care. Furthermore, a longer amount of time would have passed since separation or divorce for mature age women than younger women, hence diminishing the negative impact of household dissolution for the former[12].

While the marginal effects of the interaction variables indicate that mature age females' labour market behaviour are significantly different from younger females, the behaviour of mature age males and prime age males appear to be much less divergent. For example, the effects of household dissolution are not largely reversed for mature age males as for females. Divorced mature age males are only 3 percentage points more likely to be employed than divorced prime age males. This may be due to the fact that for men household dissolution tends to occur at an older age[13]. Mature age men with postgraduate degree qualifications are only slightly more likely to engage in employment than prime age males with the same qualification levels.

RR and *MA.RR* are key variables capturing the impacts of work incentives on employment participation. The marginal effect of the variable *RR* measures the relationship between work incentives and employment probability among prime age persons. The marginal effect of the variable *MA.RR* measures the differential response of mature age persons to changes in work incentives. As expected, the marginal effect of *RR* is negative. This indicates an inverse relationship between replacement rates and employment probability, that is, as a prime age person's replacement rate rises, the financial incentive to work becomes blunter and employment probability falls. The impact of work incentives on employment participation is four times as large for prime age females than males; a one percentage point increase in replacement rate decreases the employment probability of prime age females (males) by 1.1 (0.3) percentage points. The positive marginal effects of the *MA.RR* interaction terms offset the negative marginal effects of the *RR* variable to an extent, suggesting that males and females are less sensitive to changes in work incentives when mature age. However, the negative marginal effects of the *RR* variables still outweigh the positive marginal effects of the *MA.RR* variables, indicating that overall the relationship between replacement rates and employment probability is still inverse for mature age persons.

Two key differences in responses to changes in work incentives can be noted between males and females. First, the differences in behavioural response to changes in work incentives is smaller between mature age and prime age males, than between mature age and prime age females. Among males, the negative impact of the replacement rate is offset by one-third when mature age[14]. Among females, however, the negative impact of the replacement rate is

[12] The median age of women at divorce was 41 years in 2006. (Australian Bureau of Statistics, 2007).
[13] The median age of men at divorce was 44 years in 2006. (Australian Bureau of Statistics, 2007).
[14] The marginal effect of *MA.RR* (0.001), that is, one-third of the marginal effect of *RR* (-0.003).

offset by over 70% when mature age[15]. Second, while the employment participation of prime age females is much more sensitive to changes in work incentives than prime age males, this gender difference narrows to almost zero when mature age[16].

Table 4: Probit regression estimates of the probability of employment participation, 2002-04

Explanatory variable	Male				Female			
	Coef.	Std. error	Sig.	Marg. effect	Coef.	Std. error	Sig.	Marg. effect
W2	0.258	0.105	0.014	0.014	0.006	0.078	0.935	0.002
W3	0.195	0.108	0.071	0.011	0.070	0.083	0.397	0.022
SINGLE	-1.665	0.193	0.000	-0.265	-0.940	0.181	0.000	-0.340
DEF	-0.495	0.168	0.003	-0.043	-0.208	0.160	0.194	-0.068
SEPAR	-1.697	0.340	0.000	-0.354	-0.622	0.207	0.003	-0.224
DIVOR	-1.918	0.299	0.000	-0.419	-0.743	0.211	0.000	-0.268
WIDOW	-2.538	1.751	0.147	-0.694	-0.856	0.538	0.111	-0.318
DISAB	-0.798	0.134	0.000	-0.074	-0.620	0.125	0.000	-0.213
ABOR	-0.391	0.378	0.302	-0.034	-0.042	0.328	0.898	-0.013
K0T4	-0.058	0.095	0.539	-0.004	-0.854	0.083	0.000	-0.267
K5T9	-0.019	0.098	0.846	-0.001	0.113	0.076	0.137	0.035
K10T14	-0.005	0.104	0.965	0.000	0.159	0.078	0.041	0.050
QPGRAD	0.747	0.370	0.043	0.024	1.277	0.373	0.001	0.225
QGRAD	0.799	0.374	0.033	0.025	1.223	0.281	0.000	0.231
QBACH	0.787	0.226	0.000	0.028	0.959	0.187	0.000	0.222
QDIP	0.631	0.249	0.011	0.024	0.497	0.199	0.013	0.132
QCERT34	0.328	0.163	0.044	0.017	0.530	0.183	0.004	0.140
QCERT12	-0.068	0.447	0.879	-0.004	0.238	0.343	0.488	0.068
QCERTN	-0.751	1.120	0.502	-0.090	-0.304	0.704	0.666	-0.104
QYR12	0.871	0.215	0.000	0.029	0.560	0.168	0.001	0.149
TUNEMR	-0.036	0.005	0.000	-0.002	-0.037	0.006	0.000	-0.011
TNILFR	-0.036	0.004	0.000	-0.002	-0.044	0.003	0.000	-0.014
ENGWELL	-0.254	0.194	0.192	-0.019	-0.192	0.164	0.244	-0.063
ENGPOOR	-0.772	0.401	0.054	-0.093	-0.897	0.385	0.020	-0.334
NSWB	-0.193	0.228	0.398	-0.013	0.297	0.209	0.156	0.085
MEL	-0.050	0.215	0.816	-0.003	-0.018	0.186	0.922	-0.006
VICB	-0.089	0.291	0.761	-0.006	0.307	0.259	0.237	0.087
BRI	-0.095	0.256	0.709	-0.006	0.473	0.227	0.037	0.127
QLDB	-0.068	0.238	0.776	-0.004	0.238	0.214	0.266	0.069
ADE	-0.114	0.278	0.682	-0.008	-0.100	0.268	0.710	-0.032
SAB	0.029	0.397	0.942	0.002	0.250	0.375	0.506	0.071
PER	-0.034	0.271	0.899	-0.002	-0.309	0.242	0.202	-0.105
WAB	0.058	0.433	0.893	0.003	0.384	0.380	0.313	0.104
TAS	-0.513	0.330	0.120	-0.049	0.137	0.334	0.682	0.041
NT	0.550	1.117	0.622	0.020	1.189	0.721	0.099	0.214
ACT	-0.678	0.452	0.134	-0.075	-0.286	0.428	0.505	-0.097
RR	-0.042	0.003	0.000	-0.003	-0.035	0.002	0.000	-0.011
MA	-2.092	0.363	0.000	-0.235	-1.601	0.347	0.000	-0.509
MA .W2	-0.115	0.147	0.434	-0.008	-0.115	0.123	0.352	-0.037
MA .W3	-0.002	0.149	0.987	0.000	0.013	0.129	0.918	0.004
MA .SINGLE	0.986	0.303	0.001	0.026	0.500	0.342	0.143	0.128
MA .DEF	0.408	0.301	0.175	0.017	0.576	0.332	0.083	0.142
MA .SEPAR	0.624	0.423	0.140	0.021	0.628	0.321	0.051	0.152
MA .DIVOR	1.603	0.361	0.000	0.030	0.784	0.282	0.005	0.182
MA .WIDOW	1.444	1.844	0.433	0.026	0.666	0.585	0.255	0.159

[15] The marginal effect of *MA.RR* (0.008), that is, over 70% of the marginal effect of *RR* (-0.011).

[16] The marginal effect of *RR* for prime age males (-0.003) is far lower than the marginal effect of *RR* for prime age females (-0.011). However, the total impact of *RR* on mature age persons as captured by the sum of the marginal effects of *RR* and *MA.RR* is equivalent to -0.002 for mature age males and -0.003 for mature age females.

Explanatory variable	Male				Female			
	Coef.	Std. error	Sig.	Marg. effect	Coef.	Std. error	Sig.	Marg. effect
MA .DISAB	-0.267	0.174	0.125	-0.019	-0.483	0.173	0.005	-0.167
MA .ABOR	0.619	0.684	0.366	0.021	-0.907	0.676	0.179	-0.340
MA .K0T4	0.308	0.253	0.224	0.019	-0.875	0.563	0.121	-0.273
MA .K5T9	0.133	0.191	0.487	0.008	0.089	0.252	0.724	0.028
MA .K10T14	0.704	0.165	0.000	0.042	0.211	0.158	0.181	0.066
MA .QPGRAD	2.186	0.564	0.000	0.028	-0.145	0.619	0.814	-0.048
MA .QGRAD	0.560	0.527	0.287	0.020	-0.014	0.430	0.974	-0.004
MA .QBACH	0.601	0.330	0.069	0.022	-0.218	0.292	0.455	-0.073
MA .QDIP	-0.677	0.323	0.036	-0.073	-0.047	0.319	0.882	-0.015
MA .QCERT34	-0.184	0.223	0.409	-0.013	-0.107	0.281	0.704	-0.034
MA .QCERT12	0.917	0.737	0.213	0.024	0.479	0.604	0.428	0.123
MA .QCERTN	0.609	1.423	0.669	0.021	-0.125	0.905	0.890	-0.041
MA .QYR12	-0.382	0.325	0.241	-0.032	-0.364	0.281	0.195	-0.125
MA .TUNEMR	-0.012	0.010	0.258	-0.001	0.007	0.012	0.579	0.002
MA .TNILFR	-0.073	0.008	0.000	-0.004	-0.010	0.004	0.008	-0.003
MA .ENGWELL	-0.007	0.279	0.980	0.000	-0.893	0.266	0.001	-0.332
MA .ENGPOOR	0.119	0.576	0.836	0.006	-1.440	0.583	0.014	-0.528
MA .NSWB	-0.129	0.322	0.689	-0.009	-0.963	0.317	0.002	-0.357
MA .MEL	-0.245	0.308	0.426	-0.018	-0.217	0.290	0.453	-0.072
MA .VICB	-0.113	0.399	0.777	-0.008	-0.784	0.378	0.038	-0.289
MA .BRI	0.049	0.369	0.894	0.003	-0.730	0.356	0.040	-0.268
MA .QLDB	-0.335	0.346	0.333	-0.027	-1.159	0.337	0.001	-0.432
MA .ADE	0.300	0.400	0.452	0.014	0.010	0.394	0.979	0.003
MA .SAB	-0.928	0.546	0.089	-0.127	-1.108	0.558	0.047	-0.415
MA .PER	-0.070	0.384	0.856	-0.004	0.306	0.377	0.418	0.085
MA .WAB	0.381	0.613	0.534	0.016	-0.938	0.564	0.096	-0.351
MA .TAS	-0.119	0.497	0.811	-0.008	-0.202	0.568	0.722	-0.067
MA .NT	-0.156	1.706	0.927	-0.011	-0.724	1.144	0.527	-0.267
MA .ACT	1.303	0.777	0.094	0.026	-0.261	0.657	0.691	-0.088
MA .RR	0.021	0.003	0.000	0.001	0.027	0.003	0.000	0.008
Constant	5.048	0.306	0.000		4.628	0.268	0.000	
Log of variance[a]	0.914	0.110			1.362	0.085		
Standard deviation	1.580	0.087			1.976	0.084		
Rho[a]	0.714	0.023			0.796	0.014		
Diagnostics								
Number of observations	8,623				9,374			
Number of groups	3,948				4,207			
Wald $Chi^2(75)$	715.73		0.000		886.59		0.000	
Likelihood-ratio test of ρ=0: $Chibar^2$	540.44		0.000		1,294.12		0.000	

Source: Authors' calculations from the confidentialised unit record files of the HILDA Survey waves 1- 4 Release 5.1

Note:

a. The log of variance or $\ln(\sigma_\upsilon^2)$ is the panel-level variance component. Rho or ρ represents the proportion of the total variance contributed by the panel-level variance component, that is, $\rho = \sigma_\upsilon^2/(\sigma_\upsilon^2 + 1)$.

Overall the model findings suggest that mature age females' behavioural response to changes in socio-demographic characteristics and work incentives are significantly different from prime age females; in comparison, the behavioural differences between mature age and prime age males appear to be much less divergent. The descriptive statistics presented in section 3 show that there are also significant differences in endowments between mature age and prime age individuals. A decomposition analysis is carried out to determine the relative importance of endowment and behaviour in contributing to the relatively poor employment outcomes of

mature age persons. The decomposition analysis is conducted separately for males and females.

First, the values of the observable socio-demographic characteristics of all males (females) are set equal to the mean values for prime age males (females). This controls for differences in endowment between the two age groups. The predicted employment probabilities of mature age and prime age males (females) are then computed at these means. The difference in the two predicted probabilities reflects the difference in employment participation attributable to disparities in the behaviour of the two age groups.

Second, the coefficients of the *MA* variable and variables interacted with *MA* are set equal to zero. This controls for differences in behaviour between the two groups by restricting behavioural responses of both groups to that of prime age persons. The predicted employment probability of prime age males (females) is calculated using the mean values of the socio-demographic characteristics of prime age males (females); the predicted employment probability of mature age males (females) is calculated using the mean values of the socio-demographic characteristics of mature age males (females). The difference in the two predicted probabilities reflects the difference in employment participation attributable to variances in the endowment of the two age groups.

The results from the decomposition analysis in table 5 show that the lower employment participation of mature age persons is due to both behavioural and endowment differences between the two age groups. Clearly, though, the contribution of behavioural factors outweighs the contribution of endowment factors. Among males (females), when differences in differences in endowment are controlled for, the employment probability of mature age males attributable to behaviour is 8 (25) percentage points lower than prime age males; when behaviour is held constant, the difference attributable to endowment is only 1 (6) percentage point. Hence, while mature age males and females are both less endowed with characteristics that favour employment participation than their younger counterparts, their lower employment participation outcomes are primarily due to behavioural, rather than endowment, factors. These may include greater preferences for leisure over work or age discrimination that impedes access to suitable job and career prospects.

Table 5: Decomposition analysis results, by gender, per cent, 2002-04

	Males	Females
Employment probability holding endowment constant at prime age levels		
Prime age	99.6	87.9
Mature age	91.3	62.7
Difference attributable to behaviour (percentage points)	-8.3	-25.2
Employment probability holding behaviour constant at prime age levels		
Prime age employment probability	99.6	87.9
Mature age employment probability	98.5	81.8
Difference attributable to endowment (percentage points)	-1.1	-6.1

Source: Authors' calculations from the confidentialised unit record files of the HILDA Survey waves 1- 4 Release 5.1

6 Conclusion

This paper has analysed the impacts of work incentives, socio-demographic characteristics and behavioural factors on mature age employment participation. A decomposition analysis has been performed to determine whether the lower participation of mature age persons is due

to an endowment effect or a behavioural effect. The endowment effect represents the role of human capital and work incentives as determinants of employment participation; the behavioural effect represents the effect of preferences of mature age workers or age discrimination that impedes access to suitable job and career prospects.

The analysis offers three important innovations over previous Australian mature age participation studies. First, the replacement rate has been introduced as an exogenous determinant of mature age employment participation through instrumental variable and panel data approaches. Second, it addresses the current lack of empirical research on mature age women's participation decision by modelling and analysing the participation decision of mature age men and women separately. Third, the paper has added a longitudinal dimension to the micro data literature on mature age participation that has so far been largely cross-section in nature.

The work incentive findings indicate that mature age males and females have higher replacement rates than prime age males and females. However, the employment participation of mature age males and females appear to be less sensitive to changes in replacement rates. In general, mature age females' labour market behaviour is significantly different from younger females, though the behaviours of mature age and prime age males appear to be much less divergent.

The results from the decomposition exercise show that the lower employment participation of mature age persons is due to both behavioural and endowment differences between the two age groups. Clearly, though, the contribution of behavioural factors to the lower employment participation of mature age persons outweighs the contribution of endowment factors. While mature age males and females are both less endowed with characteristics that favour employment participation than their younger counterparts, their lower employment participation outcomes are still primarily due to behavioural, rather than endowment, factors.

The results presented in this paper have implications for policies aimed at increasing employment participation within the ageing Australian population. The findings indicate that measures to improve the work incentives and human capital attributes of mature age persons are unlikely to be highly effective. Focusing on improving the job and career prospects of mature age persons may yield more positive outcomes, as compared to fiscal measures that offer monetary incentives.

References

Austen, S. (2006), *Employment Transitions by Mid Life Australian Women*, Women in Social and Economic Research Working Paper, August, Curtin University of Technology, Perth.

Austen, S. and Birch, E. (2005), *The Determinants of Labour Force Participation by Older Australian Women: A Literature Review*, Women in Social and Economic Research Working Paper, September, Curtin University of Technology, Perth.

Australian Bureau of Statistics (2006), *Population Projections, Australia*, Cat. No. 3222.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics (2007), *Divorces, Australia, 2006*, Cat. No. 3307.0.55.001., Australian Bureau of Statistics, Canberra.

Birch, E. (2005), *The Determinants of Labour Supply and Fertility Behaviour: A Study of Australian Women*, PhD thesis, University of Western Australia, Perth.

Dockery, A.M., Ong, R. and Wood, G. (2007), *Welfare Traps in Australia: Do They Bite?*, Paper presented at the HILDA Survey Conference, Melbourne, 19-20 July.

Kelley, J. and Evans, M.D.R. (2002), 'Women's Employment in Middle and Old Age', *Australian Social Monitor*, 5(2), 39-51.

Merrilees, W. (1982), 'The Mass Exodus of Older Males from the Labour Force: An Exploratory Analysis', *Australian Bulletin of Labour*, 8, 81-94.

Merrilees, W.J. (1983), 'Pension Benefits and the Decline in Elderly Male Labour force participation', *Economic Record*, 59, 260-270.

Miller, P.W. (1983), *On Explanations of Declining Labour force participation among Older Males*, Discussion Paper No. 74, Centre for Economic Policy Research, Australian National University, Canberra.

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

O'Brien, M. (2003), *A Unit Record Analysis of Older Male Labour Force Participation*, Economics Working Paper, December, University of Wollongong, Wollongong.

O'Brien, M.J. (2001), 'Older Male Labour force participation: The Role of Social Security and Hidden Unemployment, *Australian Journal of Labour Economics*, 4(3), 206-23.

Ong, R. (2004), *Ageing in Australia: Financial Independence and Work Disincentive Issues*, PhD thesis, Murdoch University, Perth.

Stock, J.H., Wright, J.H. and Yogo, M. (2002), 'A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments', *Journal of Business and Economic Statistics*, 20, 518-529.

Woodland, A. 1987, 'Determinants of the Labour Force Status of the Aged', *Economic Record*, 63(181), 97-114.