Age Pension Eligibility and Female Labour Force Participation

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1. Introduction

Over the past decade governments around the world have become increasingly aware of the implications of ageing populations. In Australia, it has been estimated that over the next four decades the proportion of the population aged over 65 years will more than double to approximately one-quarter of the population (Productivity Commission 2005). Concomitant with this, the ratio of individuals potentially in the workforce to those aged over 65 will more than halve, falling from 5.2 to less than 2.5.

In Australia, the prospect of significant population ageing has led to the preparation of a number of reports to examine the economic implications of an ageing Australia (Australian Government Treasury 2010; Productivity Commission 2005). These reports noted that policy responses are available that can be put in place to address the challenges associated with population ageing. On one level, the problem may be addressed through actions designed to influence the demographic structure of the population directly such as migration or programs calculated to enhance fertility. Alternatively, measures could be put in place to increase the capacity of the economy to fund the projected rise in costs by lifting productivity and or labour market activity.

The Australian Government has responded to the challenge of an ageing population through a range of policy measures. The analysis in this paper will examine one particular policy initiative in the form of the increase in the pension age for females. Originally announced and legislated for in 1994, the policy raises the age at which females become eligible for the Age Pension (AP) from 60 years to 65 years. Beginning in 1996 the AP eligibility age for women has been increased by 6 months every 2 years. As a result, by 2014 the age at which males and females qualify for the AP will be equal to 65 years.[1] This policy change provides the opportunity to assess how changes in the age at which the AP is available may impact on labour market behaviour, especially labour force participation.

The analysis presented in this report uses the Household, Income and Labour Dynamics in Australia (HILDA) survey data.[2] In particular, the unconfidentialised version of the HILDA allows an individual's eligibility for the AP to be determined precisely by using information on the respondents date of birth. In this sense, the analysis has advantages over other studies which can identify eligibility for the AP

[1] The Commonwealth Government has announced that eligibility for the AP will be progressively increased to 67 years for males *and* females beginning 1 July 2017. At 1 July 2023, the qualifying age for *all* individuals will reach 67 years.

[2] This paper uses the unconfidentialised unit record file from the HILDA survey. The HILDA Project was initiated and is funded by the Commonwealth Department of Family, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (MIAESR). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either FaHCSIA or the MIAESR.

only imprecisely. In particular, the analysis compares the labour force participation behaviour of those affected by each ‘step’ change in the eligibility age with those just older than them not affected by the same change.

The remainder of this report is set out as follows. In section 2, we discuss the policy context by considering the challenge presented by an ageing population in the presence of a public pension program . Following this, we examine the literature that deals with the retirement issue. This discussion includes a consideration of economic models of retirement and difficulties associated with empirically modelling retirement behaviour. In section 4, the data and the methodology adopted in this study is described. The results of the empirical analyses are presented in section 5. Section 6 concludes and discusses policy implications of the analysis and further research.

We find that there is some evidence that the increase in APE age has resulted in a lower likelihood that some age groups are observed to be retired. the econometric analysis indicates that for some age groups the increase in the APE age was associated with a statistically significant decrease in the probability of being retired in the order of 10 per cent. The main impact of the change in the APE age appears to be on those whose age is close to those points where the APE age is altered.

2. Population Ageing and Pensions Policy

Over the past decade governments in industrialised countries have become increasingly aware of the demographic impact of falling fertility rates and greater longevity. In particular, such trends are likely to lead to a population profile that is ageing with an increasing proportion of older individuals among the total population (Productivity Commission 2005). In Australia, for example, at present individuals aged over 65 comprise one out of every eight individuals. Within four decades they will comprise one in four of the total population or around 7 million individuals.

Population ageing presents significant challenges to governments on a number of fronts. Perhaps most significantly, an older population requires substantially higher expenditures than younger individuals, especially for health and related services. While expenditures are likely to increase as the population ages, the opportunities to fund expenditures required by an older population are likely to be more limited as a greater proportion of individuals leave the workforce and enter retirement. This reduction in labour supply may impact adversely on economic growth over time unless offset by other trends such as higher productivity growth, higher female labour force participation or an extension of working lives. While estimates of the ‘fiscal gap’ associated with the ageing population vary and are dependent on assumptions around expenditures and productivity growth, the consensus is that in the absence of policy responses a substantial gap between government expenditures and revenue is likely to develop over time (Guest and McDonald 2000; Creedy and Taylor 1993).

The response on the part of the Australian government includes policies designed to enhance private saving through increases in private saving or superannuation, as well as measures designed to increase the labour market activity of individuals over the life-cycle. One particular policy initiative, namely the change in the age at which females become eligible for the AP, is the focus of the analysis in this paper. Historically individuals became eligible for the publicly funded AP at either 60 years of age (for females) or 65 years (for males) (Australian Bureau of Statistics (ABS)) (1988)[3]. Prior to that age, individuals who chose to retire or leave the work force were required to rely on private savings or some other government benefit. Although the parameters of the AP such as residency requirements have changed over time, the provision of a means-tested flat rate payment has remained largely unchanged since its inception.

The focus of the analysis in this paper, which predated much of the recent discussion about the ageing of the workforce, was a change in the eligibility for the AP for women announced in 1994. In short, the AP age for women was to be aligned with that for men over a 20 year period. [4] Specifically, beginning in 1995 the age at which females became eligible for the AP was increased at a rate of 6 months every two years. The effect of this change can be seen in Table 1. At the time when the Age Pension eligibility (APE) age is increased, there is a 'six-month gap' when no females become eligible for the AP by virtue of having attained the APE age. For example, consider what happens when the AP age is increased from 60.5 years to 61 years. Individuals born in December 1936 are eligible for the AP when they attain 60.5 years of age. For individuals born in January 1937, however, eligibility is not established until age 61. As a consequence of this discrete jump in the AP age, no females will became eligible for the AP as a result of 'becoming older' during the second half of 1997. Although some females may be observed to take up the AP for the first time during this time, those individuals will have already attained the new higher age threshold (61 years of age) by 1 July 1997.

The nature of this policy change and the implications for the behaviour of actual and potential recipients of the AP provides an opportunity to explore the consequences of changes in eligibility for public pensions on labour market behaviour around the time of retirement. In particular, the shift in the age at which individuals become eligible for the public pension provides variation in the retirement environment. Moreover, the nature of the change provides a well defined comparison group to assess the impact of varying the APE. That is, the behaviour of those who are affected by the change in the APE age can be compared to similar individuals unaffected by the change in policy..

TABLE 1: Age Pension Eligibility age for women

[3] The original legislation provided for the pension age for males and females to be 65. However, the eligibility age for women was lowered to 60 year in 1910 (Australian Government Treasury 2001).

[4] As part of its 2009 Budget, the Australian Government announced that the minimum age at which individuals are eligible for the Age Pension will increase for both males and females from 65 to 67 years between 2017 and 2023, again in six-monthly increments.

Date of birth	Age eligible for Age Pension (years)	Earliest date of retirement
1/06/1935	60	1/06/1995
1/07/1935	60.5	1/01/1996
1/08/1935	60.5	1/02/1996
1/11/1936	60.5	1/05/1997
1/12/1936	60.5	1/06/1997
1/01/1937	61	1/01/1998
1/02/1937	61	1/02/1998
.	.	.
.	.	.
.	.	.
.	.	.
1/05/1947	64	1/05/2011
1/06/1947	64	1/06/2011
1/07/1947	64.5	1/01/2012
1/08/1947	64.5	1/02/2012
.	.	.
.	.	.
1/11/1948	64.5	1/05/2013
1/12/1948	64.5	1/06/2013
1/01/1949	65	1/01/2014

3. Literature Review

The economic model of retirement is described briefly below to provide a theoretical context for the empirical analysis set out in sections four and five of the paper. Following this, we describe some of the peculiarities of the retirement decision which pose challenges for the analysis of retirement behaviour. Finally, we set out existing evidence on the impact of changes in the eligibility rules on the retirement decision.

Economic models of the retirement decisions of individuals that focus on the life-cycle generally assume optimising behaviour whereby individuals maximise utility subject to a lifetime budget constraint. The budget constraint reflects the individual's initial stock of assets and their labour income, from which they can both consume and save towards their retirement (Gustman and Steinmeier 1986). Alternative models, such as 'option value models', consider how individuals retire at the age that achieves the maximum gain in utility from postponing retirement versus retiring in the current period (Stock and Wise 1990). The term 'option value' captures the idea that for workers who continue to work preserve the 'option' of retiring later and potentially taking advantage of benefits that may accrue at a future point in time.

Central to any analysis of understanding differences between the retirement behaviour of individuals are their access to sources of non-labour income at older ages; patterns of asset accumulation over their working lives; and., preferences between consumption and leisure (or attitudes to work), along with their ability to achieve or follow their optimal consumption and leisure choices during their working life. A key consideration in any decision to withdraw from the labour market and retire is the availability and adequacy of income available post-retirement. The Australian system of income support in retirement is generally characterised as consisting of 'three pillars':

(i) the publicly funded means-tested, non-contributory AP;
(ii) income from funds generated via compulsory or mandated superannuation contributions under the Superannuation Guarantee (SG); and,
(iii) income generated from non-compulsory savings, such as voluntary superannuation, income-producing assets and other private savings.

The three principal components of retirement incomes in Australia have evolved largely independently of one another, though in recent years concerns about the sustainability of the publicly funded AP have led to a number of measures designed to encourage alternative sources of retirement income. Similarly, eligibility for the AP has been progressively limited through the imposition of more stringent means tests and the increase in eligibility age described in section 2. The means test for the AP remains relatively generous with the consequence that many aged Australians continue to work in 'retirement' while maintaining receipt of at least a part pension.

In addition to the AP, current patterns of labour force participation among senior Australians have been influenced by three main government allowances or pensions that have been available to the mature age population who were not employed (O'Brien 2001). These include the Australian Service Pension (ASP) available to the war veterans aged 60 years or over; the Disability Support Pension (DSP) available to persons with an assessed medical impairment; and, the Mature Age Allowance (MAA), a payment available to the population aged 60 to 64 years (males) who were dependent on income assistance. The MAA has been closed to new entrants since 2003 (OECD 2005) and more stringent conditions attached to DSP have sought to limit the number of users (Centrelink 2006b).

A key question in the retirement literature is how 'retirement' is defined. In short, there is no settled definition of what constitutes 'retirement' notwithstanding that the definition used is likely to have important implications for any analysis of the labour market behaviour of older individuals. In Blöndal and Scarpetta (1999) for example, retirement is defined 'as complete withdrawal from work as recorded in labour force surveys'. At the same time, alternative definitions, such as departures from prime-age employment, a move towards shorter working hours, and, acceptance of a pension or social security benefits have also been offered as defining the point at which an individual can be characterised as retired (Lumsdaine, Stock and Wise 1996). In the HILDA dataset, a number of individuals who identify themselves as retired continue to engage in paid employment. Similarly, among those who are not eligible for the AP because they have not attained the eligibility age consider themselves retired. Similar patterns have been identified for the United States (Maestas 2007).

The need for understanding what constitutes 'retirement' is highlighted by an examination of the HILDA dataset. Across eight waves there is no consistent question which asks individuals if they are (or at least consider themselves) retired. Alternative definitions such as those using age, engagement in employment and receipt of AP payments do not lead to the same conclusions about an individual's retirement status. The figures in Table 2 indicate that among females in the HILDA dataset, the proportion that is defined as retired can vary substantially according to the definition adopted. Among females aged 55-65 years around 40 percent report that they consider themselves *'completely retired from the workforce'*. When an alternative definition of retirement available in waves 1, and, 3 to 8 of HILDA is used in which retired status is not self-reported, a similar proportion of individuals are identified as 'retired' (42 per cent). Conversely, when what may be considered as more objective measures of retirement are used, the proportion of individuals identified as retired does vary somewhat. For example, if an individual is considered to be retired if they are not working or looking for work, around 50 percent of this group are defined as retired. In comparison only 11 per cent of this group report receipt of the AP.[5]

TABLE 2: Retirement Status, females aged 55-65 years

Criteria	**Proportion retired**
*Identify themselves as retired**	0.40
Identified as retired†	0.42
Not working and not searching for employment	0.50
Receipt of Age Pension^	0.11

Explanatory notes:

* In waves 1, 2, 5, 6 and 8 of HILDA individuals aged over 45 years of age are asked if they are 'completely retired from the workforce'.

† In waves 1, 3-8 of HILDA individuals in HILDA are identified as being in various labour market states. One possible 'state' is being 'retired'. The question is not necessarily answered by the individual themselves so that retirement status is not necessarily self-reported.

^ The figure reported in Table 3.1 includes all females aged between 55-65 years. When conditioned upon being eligible for the AP as a result of having attained the qualifying age the proportion retired is equal to 0.59.

[5] Care should be exercised when interpreting 'receipt of the AP' as a literal measure of retirement status. Recall that the AP is a targeted (means-tested benefit), retirees may draw other payments such as DVA or DSP for which age eligibility is even younger, and, individuals who receive AP may have other earnings. As is highlighted in the text, retired status is not a well-defined concept and the receipt of any payment (such as the AP) should simply be considered as one indicator when determining an individual's status.

The challenge when undertaking empirical analysis of the retirement decision is twofold. First, as noted there is no generally accepted meaning of retirement in the literature. Second, where the information is available it may not be consistent. One advantage of the HILDA data is that the extensive information that is available allows the researchers to acknowledge the problem of defining retirement and investigate the implications of the definition adopted. The approach adopted in this paper is to consider alternative definitions and compare the robustness of results derived. Additional information on the approach adopted and the different definitions of retirement available in the HILDA dataset are described in section four.

In an empirical sense, a key challenge in identifying the effect of a change in policy or program parameters such as an increase in the APE age on behaviour is the construction of counterfactuals. One way to perceive the problem is to characterise those who are subject to the program (or a change in the rules around a program) as the 'treated' group and those who are not as the 'untreated' or control group. In turn, it may be possible to simply compare the outcomes of the treated and control groups. A key benefit of the changes in the APE age is that it provides an opportunity to exploit a 'natural experiment' which creates treatment and control groups. In effect, an individual's date of birth is exogenous and randomly assigns them to treatment or control groups, where treatment can be characterised as being subject to a higher APE age. The effect of the program is then given by the mean difference of the mean changes for the treated and untreated groups.

Consider the specific policy change that is the subject of investigation, namely the increase in the APE age for females. The effect of the program is measured as the difference in the average change in the outcomes of interest (such as the employment rate) for treated persons and the mean change in the outcomes of the untreated persons. In the analysis we adopt this difference-in-difference approach. Intuitively, females born at later dates can be characterised as the 'treated group' in that they are impacted by the policy change associated with a higher APE age. In comparison, females born at earlier times are not impacted by increases in the APE age and therefore can be considered the 'control' group. Moreover, the empirical analysis will control for a range of other characteristics of individuals, such as partnered status and education levels, that may be expected to impact on the retirement decision.

Empirical Evidence

There is a large literature, mainly dealing with the United States, on the retirement behaviour of older workers. The methodology employed varies across studies, but many attempt to incorporate dynamic lifecycle frameworks (Stock and Wise 1990) or dynamic programming techniques (Berkovec and Stern 1991; Lumsdaine *et al*., 1992). The key premise in most of these studies, as described earlier, being that individuals optimise in a life-cycle context.

Lumsdaine and Mitchell (1999) describe a pattern whereby large numbers of individuals are observed to withdraw from the labour force when they are first entitled to draw on pensions. There is also a spike in retirement at the point when pensions can be drawn on without penalty. An analogous pattern for Australia may be one in which individuals are observed to retire at high rates when they can access private superannuation savings and or public pensions. Nonetheless, early studies for the United States that examined policy changes such as extending the normal retirement age or increasing the benefit from delaying retirement beyond a particular age found only modest effects of these changes on retirement (Lumsdaine and Mitchell 1999).

Recent studies have identified more substantial impacts of policy on behaviour. Changes examined include increasing the age of retirement, raising the delayed retirement credit in the United States[6], and eliminating the earnings test for recipients of social security. In some cases, the effects of such changes are found to be statistically significant but their magnitude varies across countries (OECD 2006; Gruber and Wise 1999, 2005; Schils 2005, Burnaiux *et al*. 2004; Duval 2003). Gruber and Wise (1999) provide some cross-country evidence and conclude that social security law changes in the United States, Japan, and Europe had large effects on retirement patterns in these countries. For example, in Germany for example, the introduction of early retirement age in 1972 was accompanied by a decrease of 5.5 years in the average retirement age among white-collar workers.

There has been less empirical analysis of the impact of retirement incomes policy (public and private pensions) on the labour supply of older Australians. Early studies generally used cross sectional data or aggregate time-series data to identify how the value and or availability of payments for older Australians influenced labour force participation. Studies include those by Merrilees (1982; 1983), Miller (1983) and Woodland (1987). More recently, attempts have been made to identify the impact of the introduction of the SG levy and its likely implications for labour market behaviour, including work and retirement decisions over the long term (Atkinson and Creedy 1997; Freebairn 1998; 2004; and Turner 2000).

It is also important to recognise that retirement behaviour is likely to be influenced by the availability and value of social security payments other than just the AP. Merrilees (1982) argues that the decline in the labour force participation of males aged 55-59 between 1973 and 1980 was largely due to greater take-up rates of the DSP. Similarly, around one-half of the fall in the participation of males aged 60-64 years over the same period was caused by take-up of the ASP. In a similar fashion Merrilees (1983) identifies the increase in the real value of the AP as a key factor driving down participation rates of males aged over 65 years in the early to mid 1970s. Studies by Miller (1983) and Woodland (1987) have highlighted the effect that wealth levels

[6] Like the Pension Bonus Scheme in Australia this provides additional benefits for workers who delay taking up social security benefits beyond the regular retirement age.

have on retirement intentions and the decision to cease working. This aspect of behaviour is particularly important because public benefits in Australia, especially those available for older Australians, are means-tested.

It should be stressed that early studies examining the labour market behaviour of older Australians suffered from a number of methodological limitations. The analyses by Merrilees (1982, 1983) and Miller (1983) used aggregate labour force data. Although Woodland (1987) exploits individual level data, the cross sectional approach in that paper is subject to the methodological problems discussed above. One study by Lim-Applegate (2004) has attempted to identify the effect of social security, especially MAA on the labour market supply of older Australians using a more rigorous methodology. Using the HILDA dataset, the analysis attempted to isolate the incentive provided by MAA on the retirement decision of workers aged 60-64 years old. Although the analysis used both propensity score matching methods (PSM) and difference-in-differences methods, the results were inconclusive. Whereas the PSM approach indicated that MAA recipients were 10 per cent less likely to participate in the labour force, the difference-in-differences approach suggests that MAA recipients are 14 per cent *more* likely to participate in the labour force.

Other recent analysis of the effect of changes in retirement incomes policy in Australia has drawn on dynamic modelling approaches that simulate the effect of various policy changes (Burnaiux *et al*. 2004). For example, consider a move to actuarial neutrality whereby payments are increased if retirement is delayed in such a way that the net present value of payments is left unchanged. There is evidence that such a change may increase labour force participation rates by approximately 1 percentage point among individuals aged between 55 and 64 years. Similarly, increasing the retirement age to 67 years for men and women aged 55 to 64 years is projected to lead to a substantial increase in the participation rates among individuals in the order of 14 per cent. The effect of actuarial neutrality on workers aged over 65 is estimated to be slightly larger, though an increase in the retirement age has a somewhat lower impact.

One recent study has sought to analyse the same natural experiment considered in this paper. Atalay and Kadir (2012) use successive waves of the Survey of Income and Housing Costs to assess the impact of the increase in the APE age to assess its impact on labour market activity and the use of other income support programs. They find an increase in the APE age by 1 year led to an 8 per cent decline in the probability of retirement, and induced significant program substitution. In particular, an increase in use of DSP was identified among those made ineligible to collect the Age Pension. One limitation of the analysis in that paper, relative to the HILDA data used in this paper, is that it was not possible to identify exact birth dates and therefore eligibility for the Age Pension.

4. Data and Methodology

The question considered in this paper is how changes in AP eligibility have impacted on female labour force participation (LFP). This study uses waves one to eight of the unconfidentialised Household Income and Labour Dynamics in Australia (HILDA) dataset. The HILDA survey provides information on the characteristics and behaviour of Australian households and individuals who reside in those households, over time. The first wave of the HILDA dataset collected in 2001 contains information on approximately 7,500 households and over 13,000 responding individuals. Subsequent waves, which have been collected on an annual basis, contain somewhat fewer though still significant numbers of observations.

Significantly, the unconfidentialised version of the HILDA contains information on an individual's date of birth. This information makes it possible to identify if an individual has attained APE age at any given date, especially the date of the interview, and thereby more accurately model retirement behaviour. Given the way in which the APE age was increased it is possible to compare the behaviour of similar groups where one group (the 'treatment') experienced an increase in APE age while the remaining individuals (the 'control group) did not experience an increase in APE age.

The empirical analysis in this paper adopts a difference-in-differences approach. A similar methodology has been used to examine changes in the retirement and earnings test in Canada by Baker and Benjamin (1999) and Disney and Smith (2002) for the United Kingdom. In the analysis we examine the retirement status of older female Australians. The dichotomous outcome variable $\left(Y_t^i\right)$ indicates that the individual i in year t reports being retired $\left(Y_t^i = 1\right)$ or not $\left(Y_t^i = 0\right)$ at the time of the HILDA survey.[7] Underlying the theoretical model and the econometric analysis presented in this paper is the notion that the various outcomes of interest will be affected by the availability of the Age Pension. Between 2001 and 2008 when the HILDA data was collected the age at which females became eligible for the AP increased from 62 to 63.5 years (Table 2). The nature and timing of the changes in the APE age that is traversed by waves 1 to 8 of the HILDA dataset are set out in Table 3.

[7] The definitions of 'retirement' used are described below.

TABLE 3: Changes in the APE age across waves of HILDA

HILDA wave	APE age	Date when increase in APE occurred
1	62.0	1 July 2001
2	62.0	-
3	62.5	1 July 2003
4	62.5	-
5	63.0	1 July 2005
6	63.0	-
7	63.5	1 July 2007
8	63.5	-

A key advantage of the policy change being examined is that an individual's eligibility for the AP is influenced by a change in policy that relies on their date of birth. This results in individuals being allocated into treatment and control groups (those who are and are not impacted by the change in APE age) through exogenous variation in their date of birth. By using the information on the individual's date of birth which is available in the unconfidentialised version of HILDA and the date of interview, it is possible to identify if they are eligible for the AP at the date of the interview. In turn it is possible to undertake comparisons of behaviour as the APE age is increased over time.

To identify the effect of the increase in APE age we estimate a series of linear probability models of the following form:

$$Y_t^i = b_1 \cdot T_t + b_2 \cdot tmti^{APE\_age} + b_3 \cdot X_t^i + u_t^i \qquad (1)$$

where

Y_t^i represents the LFP (retirement status) of individual i in year t;

t = 2001-2008;

T_t are a series of year dummies;

$tmti^{APE\_age}$ is a series of dummy variables that identifies the relationship between the age of individual i and the APE age. In terms of the difference-in-difference approach they can be interpreted as the 'treatment' variables. Recall that conditional on the individual's date of birth, the age at which a female qualified for the AP was increased from 62.0 years to 63.5 years between 2001 and 2008. Each 6 month increase in AP eligibility age may be interpreted as a separate treatment. Hence, $tmti^{625\_615} = 1$ if the individual's date of birth meant that at the time of the HILDA interview the individual was aged between 61.0 and 61.5 years of age and the APE age was 62.5 years. For all other individuals, $tmti^{625-615}=0$. Similarly, $tmti^{635-615}=1$ if the individual's date of birth meant that at the time of the HILDA interview the individual was aged between 61.0 and 61.5 years of age and the AP eligibility age was 63.5 years. For all other individuals $tmti^{635-615}=0$. Effectively the $tmti^{APE-age}$ variables are interactions between age dummy variables (measured in half-year intervals) and dummy variables that capture the minimum APE age for females.[8]

In addition to AP eligibility, other factors are likely to influence the LFP decision. Hence, the specifications include X_t^i, a vector of time-variant and invariant characteristics of individuals included in year t. These include characteristics of the individual such as age (measured in half years), education, partnered status, presence of a retired spouse, location variables, nature of housing tenure and migrant status.

Finally, u_t^i is a time-variant error term clustered at the individual level. That is, we allow for serial correlation of the error term for the same female over time, but the error term of different females are assumed to be independent.

In this specification, the coefficient on the dummy variables $tmti^{APE-age}$ captures the impact of the effect of the changes in AP eligibility age on the likelihood that an individual of a particular age is retired. Recall that general trends in the AP eligibility age are captured by the set of year dummy variables.[9] The $tmti^{APE-age}$ variables indicate how the change in AP eligibility age impacts on individuals of various ages. For example, the coefficient on $tmti^{625-615}$ indicates how the behaviour of individuals aged between 61.0 years and 61.5 years differs from that of the base category when the APE age is 62.5 years.[10] In general, we would expect such

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[8] The $tmti^{APE-age}$ variables are may also be interpreted as interactions between age dummy variables and birth cohort dummy variables. Recall that depending on an individual's date of birth, eligibility for the AP varies. In fact. APE age increases for those who belong to birth cohorts who are 'born later'. At any given point in time, the individuals age will also define the age cohort they belong to. For example, consider someone who at the time of the interview in September 2001 is 61.0 years of age. Given the manner in which we define age, this means they are between 61.0 and 61.5 years of age. In turn, they belong to the birth cohort born after March 1941 and before March 1942.

[9] In alternative empirical specifications reported in section 5 the year dummy variables are replaced by 'AP eligibility' variables. This alternative specification captures the same trend increase in the APE age over time. For example, consider the variable APE_625 such that $APE\_625=1$ in the periods in which the AP eligibility age is 62.5 years, and zero otherwise. Given the nature of the policy change, $APE\_625=1$ in waves 3 and 4 of HILDA which correspond with data collection years 2003 and 2004. Hence, the empirical specifications include either a series of year dummy variables or a series of 'AP eligibility' variables.

[10] For the base category the APE age is defined to be 62.0 years or less. Additional characteristics of the base category are described in section 5.

individuals to be less likely to be retired because relative to the base category the APE age is higher.

The sample used consists of females in waves 1 to 8 of HILDA aged between 55 and 65 years of age. For individuals born at later dates in this sample the change in AP eligibility affects them by increasing the horizon before they can actually retire and collect the AP. Effectively these individuals (the later birth cohorts) who are the treated group in the HILDA for the purpose of this change in policy. In contrast, it is those individuals who belong to earlier birth cohorts who represent the control group and whose retirement behaviour the treated group will be compared to.

Summary statistics for individuals from HILDA used in the empirical analysis are reported in Table 4. Characteristics of males aged between 55 and 65 years of age across the eight waves of HILDA are also reported for comparison purposes. Recall that during this period the APE age for males was unchanged at 65 years. Summary statistics for females are shown separately for those who are identified as being retired and those who are not classified as retired.

Females (70 per cent) are far less likely to report being married or partnered relative to males (83 per cent). While the geographic distribution of males and females is similar, average levels of education vary by gender. For example, approximately 51 per cent of females report less than high school education compared to 34 per cent of males. For both males and females, tertiary education rates are low reflecting the relatively low level of education attained for those cohorts of individuals.[11] As expected, the average retirement rate of females exceeds that of males. Using the *retd_1* definition, 45 per cent of females in sample from HILDA report being retired compared to around 34 per cent of males.[12] A similar pattern is apparent for the *retd_2* definition of retirement.

As expected, females who are identified as retired are on average older (60.2 years) compared to their non retired counterparts (58.2 years). Retired females are also more likely to be married or partnered compared to their non-retired females (75 per cent and 66 per cent respectively) possibly reflecting the additional source of income and wealth associated with being partnered. Non-retired individuals are significantly more likely to have a tertiary qualification, a pattern that likely reflects the investment in human capital and the desire to ensure that an adequate return is earned on that investment by working over an extended period of the life-cycle. The pattern also likely reflects the slightly higher education levels attained by individuals born at later dates. One other pattern reported in Table 4 is noteworthy. The likelihood that a

[11] For individuals in waves 1 to 8 of the HILDA dataset the year of birth varied between 1935 and 1953. Rates of tertiary education are somewhat lower among those birth cohorts than later birth cohorts.

[12] A detailed description on how retirement is defined is set out in section 5.

retired female reports having a retired spouse is significantly higher (59 per cent) compared to the non retired female (13 per cent). This pattern highlights the 'household nature' of the retirement decision. Within a household, existing research indicates that retirement decisions are often made jointly by cohabitating individuals. Moreover, here there is suggestive evidence that the female partner retires if the male partner in a couple has also ceased to engage in the labour force.

In Table 5 and 6 we report the retirement rates for females and males across eight waves of HILDA.[13] The final column (row) report the column (row) averages. Note that for each age group retirement rates are somewhat higher for females (Table 5) than males (Table 6). For example, among individuals aged between 55 and 60 years of age around 30 (21) per cent of females (males) are identified as retired across all eight waves of HILDA. The pattern is repeated for different age groups and reflects the historical propensity of females to retire earlier than their male counterparts likely due, in part, to the lower APE age for females.

The second pattern of interest relates to how the average likelihood that females (and males) aged between 55 and 65 years are retired has varied over the course of eight waves of HILDA. First, note that there is some variation in any given wave of HILDA. For females, the trend between 2001 and 2008 is for the average rates of retirement to decline. The numbers in Table 5 suggest that during this period the average proportion of females aged between 55 and 65 years who are retired has declined from around 68 per cent to 60 per cent. A similar trend is apparent for males (Table 6) with a decline in average retirement rates from 48 per cent to 44 per cent during the same period. The trend for males is not as pronounced as that exhibited by females and this difference is likely due in part to the increase in APE for females during this period.

[13] For the purpose of Tables 5 and 6 retirement is defined using the *retd_1* definition.

TABLE 4: Females, wave 1-8 HILDA, summary stats.

	Females		**Males**
	Retired	Non-retired	
Age (years)	60.176	58.158	59.081
Married/ partnered	0.747	0.663	0.833
Location			
New South Wales	0.361	0.366	0.332
Victoria	0.239	0.252	0.252
Queensland	0.176	0.155	0.191
South Australia	0.085	0.074	0.075
West Australia	0.103	0.101	0.109
Tas., NT and ACT	0.035	0.051	0.041
Major city	0.611	0.651	0.638
Inner regional	0.287	0.225	0.231
Outer regional	0.092	0.106	0.112
Remote	0.010	0.019	0.019
Education			
Less than high school	0.627	0.423	0.335
No post HS qual.	0.151	0.185	0.293
Completed high school	0.070	0.087	0.093
HS qualification	0.052	0.081	0.098
Undergraduate	0.057	0.121	0.088
Post graduate	0.044	0.103	0.093
Australian	0.656	0.721	0.636
English speaking immigrant	0.144	0.129	0.163
Non English speaking imm.	0.200	0.151	0.201
Tenure			
Homeowner	0.847	0.848	0.852
Renter	0.139	0.133	0.130
Other tenure	0.014	0.018	0.017
Retirement status			
retd_1	1.000	0.000	0.335
retd_2	1.000	0.000	0.339
partret_1	0.590	0.128	0.241
partret_2	0.590	0.128	0.347
Age Pension eligibility age			
60.0 years	0.000	0.000	0.000
60.5 years	0.004	0.000	0.000
61.0 years	0.035	0.010	0.000
61.5 years	0.079	0.020	0.000
62.0 years	0.133	0.042	0.000
62.5 years	0.136	0.053	0.000
63.0 years	0.160	0.096	0.000
63.5 years	0.127	0.170	0.000
64.0 years	0.157	0.204	0.000
64.5 years	0.087	0.142	0.000
65.0 years	0.081	0.263	1.000
Number of observations (person years)	2,555	2,948	6,190

TABLE 5: Retirement rates, females aged 55-65 years

	Year								
Age (years)	2001	2002	2003	2004	2005	2006	2007	2008	
<60	0.32	0.41	0.33	0.28	0.33	0.29	0.24	0.20	*0.30*
60.0	0.44	0.74	0.45	0.51	0.24	0.27	0.39	0.36	*0.43*
60.5	0.63	0.61	0.59	0.68	0.49	0.50	0.50	0.38	*0.55*
61.0	0.70	0.60	0.73	0.44	0.64	0.24	0.37	0.55	*0.53*
61.5	0.65	0.74	0.74	0.45	0.75	0.52	0.36	0.43	*0.58*
62.0	0.65	0.75	0.60	0.63	0.54	0.60	0.38	0.35	*0.56*
62.5	0.88	0.66	0.72	0.61	0.62	0.70	0.55	0.52	*0.66*
63.0	0.88	0.75	0.80	0.82	0.87	0.63	0.75	0.43	*0.74*
63.5	0.64	0.68	0.93	0.72	0.71	0.73	0.71	0.55	*0.71*
64.0	0.92	0.85	0.64	0.82	0.80	0.84	0.63	0.79	*0.78*
64.5	0.88	0.67	0.76	0.89	0.80	0.85	0.69	0.78	*0.79*
	0.68	*0.66*	*0.62*	*0.62*	*0.56*	*0.51*	*0.49*	*0.60*	

TABLE 6. – Retirement rates, males aged 55-65 years

	Year								
Age (years)	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	
*<**60***	0.19	0.24	0.22	0.23	0.21	0.21	0.19	0.20	*0.21*
60.0	0.48	0.37	0.27	0.16	0.49	0.35	0.51	0.18	*0.35*
60.5	0.34	0.40	0.40	0.48	0.55	0.63	0.39	0.45	*0.45*
61.0	0.45	0.47	0.48	0.20	0.39	0.63	0.34	0.45	*0.43*
61.5	0.40	0.49	0.46	0.42	0.44	0.34	0.59	0.42	*0.44*
62.0	0.42	0.60	0.61	0.44	0.35	0.29	0.65	0.43	*0.47*
62.5	0.55	0.51	0.45	0.35	0.56	0.45	0.55	0.65	*0.51*
63.0	0.48	0.43	0.72	0.57	0.32	0.39	0.50	0.67	*0.51*
63.5	0.67	0.64	0.42	0.51	0.61	0.52	0.50	0.54	*0.55*
64.0	0.57	0.52	0.62	0.61	0.64	0.28	0.39	0.32	*0.49*
64.5	0.78	0.51	0.74	0.56	0.48	0.68	0.58	0.58	*0.61*
	0.48	*0.47*	*0.49*	*0.41*	*0.46*	*0.43*	*0.47*	*0.44*	

5. Results

The results from the analysis are presented in Tables 7 and 8. Those results represent the empirical estimates of equation (1) described in section 4 using a linear probability specification. In Table 7, data from all eight waves of the HILDA are used. In Table 8, the analysis is repeated excluding wave 2 of HILDA. The reason for repeating the analysis but excluding 2002 (wave 2) data relates to the definition of retirement used in the analysis reported in Tables 7 and 8. The definition of retirement used in the specifications reported in Tables 7 and 8 relies on the variable *_hges* in HILDA. The *_hges* variable is reported in the HILDA household file and uses the identification of the 'labour market state' of each household member reported by one household respondent. In particular, individuals in the household are identified as being in various states including employed (full time or part time) and unemployed. Individuals may also be identified as being 'retired'. For the purpose of the analysis in Tables 7 and 8 the dependent variable is equal to one if *_hges='retired'*, and zero otherwise.

In using this definition of retired status, one constraint is that the variable *_hges* is not available in wave 2 of HILDA. Instead, for wave 2 the variable *brtcomp* is used to define retired status. This variable is available in the individual file in HILDA and uses a question put to individuals who are over 45 years of age and are not currently working. In particular, individuals can identify themselves as having *'retired completely from the workforce'*. That is, for the purpose of the analysis reported in Table 7, individuals in wave 2 of HILDA are identified as retired (the dependent variable is equal to one) if they report that they have 'completely retired from the workforce'.[14] The alternative approach reported in Table 8 is to repeat the analysis and exclude wave 2 data. Alternative approaches that use different (and consistent) definitions of retirement are discussed in Appendix I.

In Tables 7 and 8 three specifications are reported. In the first specification (column 1) there is no control for calendar time included in the empirical specification. In the second specification, a series of year dummy variables are included. In the final specification, the year dummy variables are replaced by a series of dummy variables indicating the APE age. Recall that the APE age was increased from 62.0 years to 63.5 years between 2001 and 2008. The inclusion of year dummy variable (as in the second reported specification) or APE age dummy variables (as in the third specification) represent alternative ways to control for the gradual increase in the APE age over time.

When interpreting the results of analysis reported in Tables 7 and 8 the base or omitted category is females who are: aged less than 61 years of age; single or unpartnered; live in Tasmania, the Northern Territory or the ACT; have no high school education; live in an outer regional or remote area; Australian born; reside in an 'other tenure'; do not have a partner who is retired, and, for whom the APE is 62.0 years of age or less. The main variables of interest are those that capture the effect of changes in the APE age on different age groups. That is, the group of variables that have the prefix *tmti_*. These variables effectively represent the interaction between age dummy variables and dummy variables that capture the change in the APE age during the period 2001 to 2008.

[14] The variable *_rtcomp* cannot be used to define retirement consistently across all waves of HILDA as this particular variable is available only in waves 1, 2, 5, 6 and 8.

Consider the likelihood that an individual aged between 62.5 years and 63.0 years of age is retired and how this changes when the APE age was increased. First, note that in specification (1) reported in Table 7 the coefficient on the *Age at int. 62½ -63 yrs* indicates relative to the base category individual a female aged between 62.5 and 63.0 years of age is 29.7 percentage points more likely to be retired, *ceteris paribus*. This result is consistent with *a priori* expectations given that the base category individual is aged less than 61 years of age and the propensity to retire increases as individuals get older. Further, we can consider the impact of a higher APE age on the likelihood that an individual aged between 62.5 and 63.0 years of age is observed to be retired by examining the variables *tmti625_625*, *tmti630_625* and *tmti635_625*. These coefficients indicate that *ceteris paribus*, relative to the omitted category the likelihood that an individual aged between 62.5 years and 63.0 years of age is observed to be retired as the APE age is increased. For example, to ask how much more likely it is that an individual aged between 62.5 and 63.0 is retired when the APE age is 62.5 years we add the coefficient on the *Age at int. 62½ -63 yrs* and *tmti625_625*. The sum of these two coefficients is 18.6, indicating that an individual of this age is 18.6 percentage points more likely to be retired (relative to the base category) when the APE age is 62.5 years. Similarly, the same approach suggests that a female aged between 62.5 and 63.0 years of age is 22.7 (8.1) percentage points more likely to be retired relative to the base category when the APE age is 63.0 (63.5) years of age.

The results from the empirical analysis presented in Table 7 and 8 are generally consistent with *a priori* expectations. The discussion below will focus on those results reported in column 2 of Table 7. The first set of coefficients which capture the age of individuals at the time they are interviewed suggests that the likelihood of being retired increases with age. For example an individual aged between 63.0 and 63.5 years of age is 26.9 percentage points more likely to be observed to be retired relative to a base category individual, *ceteris paribus*. Married or partnered individuals are less likely to be retired (coefficient of -0.152) but are significantly more likely to be retired if they have a spouse who is retired (coefficient 0.506). These results serve to highlight the importance of joint decision making in a household around the retirement decision. In terms of education, higher levels of education are associated with a lower likelihood of being observed to be retired. Further, the coefficients on the year dummy variables indicate that the likelihood of retiring decreases over time for the group of females aged between 55 and 65 years of age.

TABLE 7 – Results from analysis of HILDA (waves 1-8)

	(1)	Std. errors	(2)	Std. errors	(3)	Std. errors
Age at int. 61-61½ yrs	0.131**	0.056	0.070	0.058	0.069	0.057
Age at int. 61½ -62 yrs	0.189***	0.050	0.123**	0.051	0.128**	0.050
Age at int. 62-62½ yrs	0.297***	0.056	0.237***	0.057	0.237***	0.057
Age at int. 62½ -63 yrs	0.319***	0.056	0.261***	0.057	0.258***	0.057
Age at int. 63-63½ yrs	0.332***	0.050	0.269***	0.051	0.271***	0.051
Age at int. 63½ -64 yrs	0.217***	0.055	0.162***	0.056	0.155***	0.056
Age at int. 64-64½ yrs	0.338***	0.044	0.279***	0.046	0.277***	0.046
Age at int. 64½ -65 yrs	0.275***	0.056	0.212***	0.057	0.214***	0.057
Married/ partnered	-0.150***	0.027	-0.152***	0.027	-0.152***	0.027
New South Wales	-0.001	0.051	-0.004	0.051	-0.004	0.051
Victoria	-0.029	0.052	-0.032	0.052	-0.032	0.053
Queensland	-0.013	0.053	-0.015	0.053	-0.015	0.053
South Australia	0.021	0.058	0.019	0.057	0.019	0.057
West Australia	0.006	0.056	0.004	0.056	0.004	0.056
Less than HS	0.076**	0.031	0.070**	0.031	0.070**	0.031
Completed HS	-0.004	0.052	-0.002	0.051	-0.002	0.051
Post HS qualification	-0.045	0.044	-0.046	0.044	-0.047	0.044
Undergraduate	-0.079*	0.044	-0.078*	0.044	-0.079*	0.044
Postgraduate	-0.085**	0.042	-0.080*	0.042	-0.081*	0.042
Major city	0.031	0.031	0.033	0.031	0.033	0.031
Inner regional	0.056*	0.033	0.058*	0.033	0.058*	0.033
Eng. immigrant	0.049*	0.030	0.050***	0.029	0.050*	0.029
NESB immigrant	0.057	0.035	0.057	0.035	0.058*	0.035
Homeowner	-0.005	0.059	-0.007	0.059	-0.007	0.059
Renter	0.083	0.064	0.082	0.063	0.082	0.064
Partner retired	0.505***	0.025	0.506***	0.025	0.505***	0.025
Year_2002	-	-	0.048***	0.017	-	-
Year_2003	-	-	-0.005	0.022	-	-
Year_2004	-	-	-0.040*	0.024	-	-
Year_2005	-	-	-0.064***	0.025	-	-
Year_2006	-	-	-0.069***	0.026	-	-
Year_2007	-	-	-0.067***	0.026	-	-
Year_2008	-	-	-0.089***	0.027	-	-

TABLE 7 – Results from analysis of HILDA (waves 1-8) (*cont.*)

	(1)	Std. errors	(2)	Std. errors	(3)	Std. errors
APE @ int. (62½ years)	-	-	-	-	-0.050***	0.019
APE @ int. (63 years)	-	-	-	-	-0.094***	0.022
APE @ int. (63½ years)	-	-	-	-	-0.106***	0.024
tmti625_610	0.045	0.077	0.097	0.082	0.094	0.081
tmti630_610	-0.096	0.077	-0.003	0.081	-0.002	0.080
tmti635_610	0.000	0.077	0.106	0.080	0.104	0.079
tmti625_615	-0.007	0.082	0.047	0.085	0.042	0.086
tmti630_615	-0.018	0.071	0.081	0.076	0.076	0.076
tmti635_615	-0.083	0.068	0.031	0.072	0.021	0.072
tmti625_620	-0.204***	0.077	-0.157*	0.082	-0.154*	0.082
tmti630_620	-0.137*	0.077	-0.045	0.082	-0.044	0.082
tmti635_620	-0.263***	0.076	-0.160*	0.082	-0.159*	0.082
tmti625_625	-0.111	0.075	-0.070	0.080	-0.063	0.079
tmti630_625	-0.070	0.076	0.021	0.083	0.024	0.082
tmti635_625	-0.216***	0.075	-0.115	0.081	-0.112	0.081
tmti625_630	-0.086	0.068	-0.033	0.071	-0.036	0.072
tmti630_630	-0.052	0.066	0.043	0.072	0.042	0.072
tmti635_630	-0.128*	0.075	-0.021	0.080	-0.023	0.080
tmti625_635	0.070	0.070	0.119	0.073	0.120	0.074
tmti630_635	0.031	0.080	0.119	0.085	0.125	0.085
tmti635_635	-0.019	0.074	0.079	0.080	0.087	0.080
tmti625_640	-0.059	0.066	-0.013	0.069	-0.009	0.068
tmti630_640	-0.087	0.068	0.005	0.073	0.007	0.073
tmti635_640	-0.028	0.062	0.076	0.069	0.077	0.069
tmti625_645	0.062	0.072	0.113	0.076	0.112	0.075
tmti630_645	0.046	0.071	0.140*	0.076	0.139*	0.076
tmti635_645	0.026	0.072	0.134*	0.079	0.131*	0.078
Constant	0.237***	0.080	0.276***	0.080	0.304***	0.080
R^2	0.325		0.330		0.330	
No. observation			5,203			

Notes: *** p<0.01, ** p<0.05, * p<0.1

TABLE 8 – Results from analysis of HILDA (waves 1, 3-8)

	(1)	Std. errors	(2)	Std. errors	(3)	Std. errors
Age at int. 61-61½ yrs	0.279***	0.076	0.255***	0.078	0.255***	0.078
Age at int. 61½ -62 yrs	0.208***	0.078	0.184***	0.080	0.184**	0.080
Age at int. 62-62½ yrs	0.265***	0.077	0.241***	0.079	0.241***	0.079
Age at int. 62½ -63 yrs	0.337***	0.069	0.312***	0.071	0.312***	0.071
Age at int. 63-63½ yrs	0.312***	0.072	0.288***	0.074	0.288***	0.074
Age at int. 63½ -64 yrs	0.224***	0.069	0.199***	0.071	0.199***	0.071
Age at int. 64-64½ yrs	0.365***	0.054	0.341***	0.056	0.341***	0.056
Age at int. 64½ -65 yrs	0.356***	0.076	0.331***	0.078	0.330***	0.078
Married/ partnered	-0.168***	0.027	-0.168***	0.027	-0.168***	0.027
New South Wales	-0.015	0.053	-0.015	0.053	-0.016	0.053
Victoria	-0.033	0.054	-0.034	0.054	-0.034	0.054
Queensland	-0.027	0.055	-0.027	0.055	-0.027	0.055
South Australia	0.013	0.060	0.013	0.060	0.013	0.060
West Australia	0.007	0.057	0.007	0.057	0.007	0.057
Less than HS	0.079**	0.032	0.076**	0.032	0.077**	0.032
Completed HS	0.001	0.053	0.001	0.053	0.002	0.053
Post HS qualification	-0.030	0.046	-0.031	0.046	-0.031	0.046
Undergraduate	-0.067	0.044	-0.068	0.044	-0.067	0.044
Postgraduate	-0.062	0.043	-0.060	0.043	-0.060	0.043
Major city	0.033	0.032	0.034	0.032	0.034	0.032
Inner regional	0.072**	0.035	0.073**	0.035	0.073**	0.035
Eng. immigrant	0.053*	0.030	0.053*	0.030	0.053**	0.030
NESB immigrant	0.057	0.036	0.058	0.036	0.058	0.036
Homeowner	0.020	0.057	0.016	0.057	0.016	0.057
Renter	0.104*	0.062	0.101	0.062	0.101*	0.062
Partner retired	0.524***	0.026	0.523***	0.026	0.524	0.026
Year_2002	-	-	-	-	-	-
Year_2003	-	-	0.022	0.024	-	-
Year_2004	-	-	-0.014	0.026	-	-
Year_2005	-	-	-0.038	0.026	-	-
Year_2006	-	-	-0.042	0.028	-	-
Year_2007	-	-	-0.040	0.028	-	-
Year_2008	-	-	-0.062**	0.029	-	-

TABLE 8 – Results from analysis of HILDA (waves 1, 3-8) (*cont.*)

	(1)	Std. errors	(2)	Std. errors	(3)	Std. errors
APE @ int. (62½ years)	-	-	-	-	0.005	0.024
APE @ int. (63 years)	-	-	-	-	-0.040	0.026
APE @ int. (63½ years)	-	-	-	-	-0.051*	0.027
tmti625_610	-0.089	0.092	-0.090	0.097	-0.094	0.097
tmti630_610	-0.230**	0.092	-0.190**	0.096	-0.190*	0.096
tmti635_610	-0.133	0.092	-0.081	0.095	-0.083	0.095
tmti625_615	-0.011	0.102	-0.017	0.106	-0.017	0.106
tmti630_615	-0.021	0.093	0.018	0.098	0.018	0.098
tmti635_615	-0.087	0.090	-0.033	0.094	-0.037	0.094
tmti625_620	-0.158*	0.094	-0.166*	0.101	-0.163*	0.100
tmti630_620	-0.090	0.094	-0.051	0.099	-0.051	0.099
tmti635_620	-0.213**	0.093	-0.164	0.098	-0.163*	0.098
tmti625_625	-0.116	0.086	-0.125	0.091	-0.121	0.091
tmti630_625	-0.072	0.086	-0.032	0.092	-0.032	0.092
tmti635_625	-0.219**	0.086	-0.169*	0.092	-0.168*	0.092
tmti625_630	-0.053	0.086	-0.055	0.090	-0.058	0.090
tmti630_630	-0.019	0.083	0.020	0.089	0.020	0.089
tmti635_630	-0.092	0.091	-0.041	0.096	-0.042	0.096
tmti625_635	0.075	0.082	0.076	0.087	0.070	0.087
tmti630_635	0.037	0.090	0.077	0.095	0.077	0.095
tmti635_635	-0.012	0.086	0.039	0.091	0.039	0.091
tmti625_640	-0.070	0.072	-0.078	0.076	-0.075	0.076
tmti630_640	-0.101	0.075	-0.062	0.081	-0.062	0.081
tmti635_640	-0.041	0.069	0.009	0.076	0.009	0.076
tmti625_645	-0.003	0.089	-0.008	0.092	-0.008	0.092
tmti630_645	-0.025	0.088	0.014	0.093	0.015	0.093
tmti635_645	-0.037	0.089	0.015	0.095	0.014	0.094
Constant	0.199***	0.078	0.228***	0.079	0.228***	0.079
R^2	0.345		0.347		0.347	
No. observation			4,451			

Notes: *** p<0.01, ** p<0.05, * p<0.1

In general the set of variables prefixed by *tmti_* are statistically insignificant. An exception are those estimates on the variables *tmti625_620*, *tmti630_620* (specification in column 1 only) and *tmti635_620*. As noted above, these are negative and suggest that the increase in the APE age was associated with a lower likelihood that females between 62.0 and 62.5 are retired. The empirical estimates indicate that females of this age have lower probabilities of being retired equal to 15.7, 4.5 and 16.0 percentage points respectively, *ceteris paribus*. That is, for this age group the increase in the APE age did indeed reduce the propensity to enter retirement for those who were not eligible for the AP. At the same time, there is some evidence (columns 2 and 3) that for older individual's retirement is more likely. The coefficients on *tmti630_645* and *tmti635_645* are positive though only statistically significant at the 10 per cent level.

Arguably, those individuals aged between 62.0 and 63.0 years are most likely to have been impacted by the increase in APE age over the period of analysis. Therefore a behavioural response on the part of this group is not unexpected. Nonetheless, it does suggest that amongst other age groups the increase in the APE age had little or no impact on retirement behaviour. A similar pattern is observed for the results reported in Table 8. Here there is some additional evidence that the change in APE to 63.5 years of age decreased the likelihood that females aged 62.5 years were observed to be retired. Similarly, the coefficients on *tmti630_610* are significant in table 5.2 whereas they are not significant in Table 7.

6. Conclusions and Policy Implications

The analysis in this paper has examined a particular policy change, namely the increase in the APE age for females that began in 1996. Recall that this change, amongst others, was instituted in response to a concern about the impact of population ageing. The analysis has considered how this increase in the APE age impacted on female labour market participation using the HILDA data. The econometric approach relied on a difference-in-difference methodology. In effect, the behaviour of individuals (or groups of individuals) impacted by successive increases in the APE age were compared to those in a control group who were not affected by the change in the APE age.

The empirical analysis of the HILDA data indicates that the increase in APE age has been accompanied by a statistically significant impact on the likelihood that females aged around 62.0 years of age are observed to be retired. The marginal impact of the increase in the APE age on individuals aged around 62.0 years is estimated to be in the order of 15 percentage points. The result is consistent with a pattern whereby those most directly impacted by the increase in APE age between 2001 and 2008 did in fact delay their retirement. One question that has not been addressed in this paper is how limiting the availability of the AP for certain groups has been offset with greater use of other income support programs. Analysis in Ryan and Whelan (2011) suggests that it does not appear that they were able to access other income support payments in large numbers in the six months prior to them becoming eligible for the Age Pension.

While the analysis has provided some insight into this issue, clearly there are a number of limitations. For example, the period spanned by the data traverses only part of the period when the increase in APE was implemented. Future waves of HILDA will allow the analysis to be extended and provide more robust estimates of the impact of the change in APE age including changes to APE age that have been announced for males *and* females. Moreover, as discussed in section 2, retirement is a complex process rather than a simple dichotomous outcome. A range of considerations are likely to influence individual retirement behaviour including the availability of resources (wealth), individual preferences and the household context in which retirement is being considered. Features such as wealth have not been included in the analysis to this point. Nor have other features of the retirement environment such as amendments in rules relating to superannuation. In a similar vein analysis that more comprehensively considers the joint nature of the retirement decision in a household context, is beyond the scope of the analysis presented in this report. Nonetheless, such avenues may provide fruitful opportunities in future work.

Appendix I: Additional Results from analysis of the HILDA data

In addition to the results reported in the main part of the paper, a series of other specifications was used to test the robustness of the results with alternative measures of retirement. Recall that the definition there (Tables 7 and 8) used the variable *_hges* from HILDA (waves 1, 3-9) and *brtcomp* (wave 2) to identify if an individual was classified as retired. In the variable *_hges*, the various categories which an individual can be classified as includes '*Home duties*'. In the analysis reported in Tables 7 and 8, individuals who engaged in '*Home duties*' were not classified as being retired. An alternative approach identifies those individuals as being retired. A comparison of the results in Tables 7 and 8with those from this alternative specification are similar and are available on request.

Further, an approach is used to define retirement based on the individual's observed behaviour. In particular, where the individual aged between 55 years and 65 years of age are identified as being neither employed nor looking for work, they are considered to be retired. While this is likely to misclassify some individuals who are temporarily out of the labour force as retired, it does have the advantage of being an objective criterion rather than one based on a subjective assessment of the individual or someone else about retirement status. That is, it does not rely on an individual classifying themselves (or another individual classifying them) as retired. As this measure is available over all eight waves of HILDA it is not necessary to estimate these models excluding wave 2 data. The results which are available on request are similar to the specifications reported in the main part of the paper.

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