The Impact of Age Pension Eligibility Age on Retirement and Program Dependence: Evidence from an Australian Experiment*

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Abstract
Population aging poses a challenge to the fiscal sustainability of social security systems around the world. As Baby-boomer generations approach retirement, governments have begun reforming key parameters of the social security systems. However, the behavioural and welfare impacts of many reforms are not well understood in part due to the difficulty of isolating exogenous variation in program parameters. In this paper we study the 1993 Australian Age Pension reform which increased the eligibility age for women to access social security benefits, which represented a decline in the social security wealth of the affected cohorts. We find economically significant responses to the program reform. An increase in the eligibility age of 1 year induced a decline in the probability of retirement by approximately 8 percent. In addition, we find that the Age Pension reform induced significant "program substitution." The rise in the Age Pension eligibility age had an unintended consequence of increasing enrolment in other social insurance programs, particularly the Disability Support Pension, which effectively functioned as an alternative income source for retirement.

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1 INTRODUCTION

Population aging poses an important challenge to the fiscal sustainability of social security systems in many industrialized economies. In addressing these challenges governments around the world continue to implement reforms to their social security programs. Restructuring the pension system, changing the level of benefit payments, and tightening access such as by increasing the eligibility age, are common examples of reforms that have recently been implemented. As the baby-boom generation begins making the transition to retirement, it is increasingly urgent that the effects of these reforms on the performance of the social security system be assessed to provide an evidence base for future policy development.

When the Australian government embarked on Age Pension reform in 1993 one explicit goal was to increase the labour force participation of older workers. The reform increased the eligibility age for women to access Age Pension benefit payments. The change to the Age Pension eligibility age represents a reduction in the social security wealth of the affected cohorts of women and provides an ideal natural experiment to study the incentives of the Age Pension program. We use this policy experiment to investigate two issues: (i) to what extent this policy reform contributed to an increase in the labour force participation of women, and (ii) the degree to which the reform had an unintended side-effect of inducing participation in alternative government programs, especially the Disability Support Pension.

The theoretical literature on the incentive effects of social security show that workers' retirement decisions are influenced through two main channels. The first is by directly changing the life-time income or expected wealth of an individual. If the program benefit exceeds the individual's contribution to the program, existence of the program increases the life-time income of the individual and therefore reduces the labour supply of the individual on the assumption that leisure is a normal good. This is known as the "wealth effect" of the program. The second channel operates when social security benefit payments increase with contributory earnings. In this case, an extra year of work also increases the future stream of expected social security benefits. When considering the optimal timing of retirement, workers will take account of the effect of an extra year of work on the level of retirement income when s/he eventually retires. This latter effect is known as the "accrual effect." When there is an increase in the eligibility age of the programs, the wealth and accrual effects work in the same direction, with both tending to induce later retirement, and as a consequence it is difficult to disentangle the separate influence of each on retirement choices.

A distinctive feature of the Australian Age Pension program is that is a non-contributory scheme; eligibility does not require prior employment nor are benefit levels conditional on prior earnings. Since pension benefits in Australian are independent of prior earnings the accrual effect of continued employment on social security wealth is absent. The effect of the Age Pension on labour supply operates through the wealth effect only. This makes the Australian experiment uniquely clean and transparent for studying the pure wealth effect, as comparable reforms in other industrial economies need to model potentially strong accrual effects, such as the increases in the Normal Retirement Age in the United States.

The key challenge in the empirical literature is to find a substantial and plausibly exogenous variation in the social security system to identify and gauge the behavioural impacts of public pensions. The majority of the empirical research attempting to estimate the effect of social security incentives on retirement is based on cross sectional variation. These studies, summarized in the detailed surveys by Coile and Gruber (2007) and Chan and Stevens (2004), typically find strong effects of social security incentives on retirement decision. A limitation with this approach is that since the social security policy is the same for everyone at a point in time, identification may be undermined by the correlation between program incentives and tastes for retirement. Therefore it is very difficult to reliably disentangle the effect of social security program parameters from differences in preferences across individuals, or from general trends in retirement and benefit levels over time.

One potential solution is to use a natural experiment and study the retirement decisions around actual social security reforms. The advantage of this approach is that the policy reforms generate exogenous variation in benefits within the similar groups of people. Moreover, if a suitable control group can be identified and used to control for general time effects under a 'common trends' assumption, this approach can isolate the behavioural impact of the change in social security rules. A well known example of this approach is Krueger and Pischke (1992) in which they investigate a change to U.S. Social Security provisions in 1977. In contrast to many cross sectional studies, Krueger and Pischke (1992) find a weak relationship between social security wealth and labour supply. Mastrobuoni (2009) studies the effects of a recent benefit cut, arising from the increase in the Normal Retirement Age (NRA) in the United States, on the retirement behaviour of individuals. He compares the labour force behaviour of "treated cohorts" with earlier cohorts that were not affected by the increase in the NRA. Mastrobuoni (2009) finds a substantial impact of the reform on retirement behaviour. He also highlights another advantage of the natural experiment methodology as providing an ex-post evaluation of the policy change, and argues that simulation studies which rely on out-of-sample projections may be inadequate as they may fail to account for possible behavioural effects associated with social norms (see for example Duflo and Saez 2003). Similar to this paper, Hanel and Riphahn (2012) investigate the Swiss Pension reform which affected the normal retirement age for females, and they find a strong effect on female employment similar in magnitude to that found in Mastrobuoni (2009). Note that these papers examine reforms that have potentially strong accrual effects. Gruber and Wise (2004) and Samwick (1998) argue that the accrual effect is the main driving source of retirement behavior in the reforms. Therefore these papers cannot distinguish separate wealth and accrual effects. The Australian reform is unique in that the accrual effect is absent and therefore represents an ideal experiment for examining the pure wealth effect.

Another strand of the literature uses the exogenous variation in benefits to study the interaction between different social insurance programs. Recent reforms to public pensions that reduce the relative generosity of pension programs provide incentives for individuals to seek benefits from other social insurance programs. There are several studies that try to quantify the magnitude of such spill-over effects. Duggan, Singleton and Song (2007) consider the same U.S. reform as Mastrobuoni (2009) and find that the increase in NRA increased the disability insurance beneficiary rate; Li and Maestas (2008), Borghans et al. (2010), Coe and Haverstick (2010) also examine program substitution effects stemming from pension reforms.

This paper contributes to the empirical literature on public pension incentive effects by exploiting the recent policy experiment in Australia, where the institutional features of the program allow us to isolate the pure wealth effect. We have two important findings. First, we show the rise in the eligibility age of the Australian Age Pension increased elderly female labour supply by approximately 8 percentage points. This behavioural response is smaller than the recent findings for US, and is explained by a combination of life-cycle wealth effects, changing norms and take-up of alternative public benefits. Second, we show that the policy reform had significant spill-over effects on other social insurance programs; the rise in eligibility age of the Age Pension led to greater enrolment in alternative social insurance programs, especially the Disability Support Pension, which effectively provided an alternative source of retirement income.

The paper is organized as follows. The next section briefly describes the Australian pension system and details the recent policy reform which is the focus of our analysis. In section 3 key aspects of the data are outlined and the recent trends in Australian labour market are summarized. Section 4 explains our empirical methodology and section 5 presents the results. The last section provides concluding comments.

2 AUSTRALIAN PROGRAM REFORM

The Australian retirement income system is based on three "pillars". First is a means-tested public pension; the second pillar is a mandatory, employer-contributed private retirement savings account (known locally as 'superannuation'); and the third pillar representing voluntary private retirement savings. In Australia there is no compulsory retirement age, and elderly Australians are able to supplement their retirement income through continued employment.

The Australian first pillar program known as the Age Pension was introduced in 1908. The primary objective of the Age Pension at that time was to alleviate the high incidence of poverty among the elderly population. From its inception the Age Pension has been a targeted program subject to a broad means test based on income and assets. Initially the means test was relatively strict, with only 30% of the elderly population receiving benefits. As the means test was relaxed over time, the participation rate increased, peaking at over 85% in the 1980's. In June 2010 approximately 69% of the elderly population received some benefit from the Age Pension, which also constituted the main source of income for a majority of beneficiaries.

The maximum benefit payment from the Age Pension is set at 25 percent of male total average earnings, plus a supplement to compensate for the introduction of the good and service tax in 2000. As at 1st July 2008, the end of our observation period, the maximum Age Pension benefit was AUD$546.80 per fortnight for individuals or AUD$913.60 (combined) per couple.[1] This maximum benefit is subject to an income test and asset test. The income test is based on a threshold ("income disregard") of $138 ($240) per fortnight for singles (couples), above which benefits are reduced by 40 cents (20 cents) for each dollar of income. The asset test depends on the home ownership status of the applicant. For homeowners, the threshold ("asset disregard") is $171,750 ($243,500) for singles (couples), and for non-homeowners the asset disregard is $296,500 ($368,000) for singles (couples). Pension benefits are reduced by $1.50 per fortnight for every $1,000 in excess of the asset disregard level. In 2008, two-thirds of all Age Pension recipients received the maximum pension payment.[2]

Eligibility for the Age Pension is subject to residency and age conditions. Individuals need to have been resident in Australia for 10 years prior to application. There are different age requirements for male and female applicants. Since inception, the Age Pension qualifying age for men has remained at 65 years. The qualifying age for female applicants, on the other hand, has undergone a gradual increase since 1995, from the initial 60 years of age to the current age requirement of 64.5 years (and will be 65 years in 2014) - which is the exogenous variation in social security wealth we exploit in analysing behavioural responses in retirement behaviour and program participation.

2.1 Raising the Qualifying Age for the Age Pension

When the *Invalid and Old Age Pensions Act 1908* first came in to effect the Age Pension was payable to both men and women at 65 years of age. In 1910, the qualifying age for women

[1]Benefit levels, and means test thresholds, are adjusted every six months in line with changes in the consumer price index or average (ordinary time) male earnings – whichever is greater. Recipients also receive subsidies for health care, pharmaceuticals, public transport, utilities and private rental assistance.

[2]For detailed information on the benefit structure see Diana Warren (2008).

was reduced to 60 years of age and then remained unchanged, for both men and women, for the next 80 years. The *Social Security Legislation Amendment Act 1993* announced that the qualifying age for women would progressively increase from 1st July 1995, and would be equal to the male eligibility age of 65 years by 2014. As seen from Table 1, the Age Pension eligibility age for women increased by six months every 2 years from mid-1995.

Table 1 shows that the progressive increase in the Age Pension eligibility age did not affect women born on or before 30 June 1935; however, for women born after this date, the qualifying age has gradually increased by six months for each subsequent 18-month birth cohort. The eligibility age will eventually reach 65 years for women born after 1st January 1949. For example, women born between 1st July 1935 and 31st December 1936 have to wait a further six months to become eligible for the Age Pension at 60 years and six months of age.[3]

This reform to the Australian social security system represents an unambiguous decline in the social security wealth of women. Each six month delay in the receipt of Age Pension benefits represents approximately a 2.5 per cent reduction in the discounted present value of expected social security wealth.[4] For the post Jan 1949 birth-cohort of women, who face an Age Pension eligibility age of 65 years, their expected social security wealth is effectively 23 per cent less than that of a member of the pre July 1935 birth-cohort of women. Therefore this reform to the Age Pension program represents a substantial, exogenous change in social security wealth.

The decline in social security wealth is expected to lead to an adjustment in the timing of retirement. The effect of the pension age reform can be demonstrated using a simple life-cycle model, such as the model presented in Burbidge and Robb (1980). Assume that the life-time utility of an individual is given by:

$$V = \int_0^R U\left(C_t, 0\right) e^{-\delta t} dt + \int_R^T U\left(C_t, 1\right) e^{-\delta t} dt \tag{1}$$

where V is the value of lifetime utility discounted with the rate of time preference δ. Assume an individual has T years to live and R is the age of retirement, so that an individual works R years and spends $(T - R)$ years in retirement. The felicity function is defined over consumption and leisure $U(C_t, L_t)$.

For simplicity assume retirement is a discrete decision, normalized to 0 for working life and 1 for retirement; leisure is then varied only by the retirement decision, R. Let

[3] The Australian Treasurer announced in the 2010 federal budget that from 1st July 2017, the qualifying age for both men and women will progressively increase to 67 years by 2023, rising by six months every two years.

[4] This calculation is based on the assumption of full benefit receipt, a life expectancy of 90 years and a discount rate of 3%. The reduction is the discounted present value of social security wealth is greater the higher the discount rate applied.

$U^w = U(C_t, 0)$ and $U^R = U(C_t, 1)$. The individual chooses the profile of consumption $\{C_t\}_{t=0}^{T}$ and R to maximize her life-time utility (1) subject to the life-time budget constraint:

$$\int_o^T C_t e^{-rt} dt = \int_o^R Y_t e^{-rt} dt + \int_R^T P(R) e^{-rt} dt + \int_{t_q}^T AP_t e^{-rt} dt \tag{2}$$

The budget constraint in (2) shows that the total value of discounted consumption at interest rate r must equal to three sources of income: total discounted value of labour income earned over the working life (Y_t), discounted value of private retirement savings $P(R)$, and public Age Pension wealth AP_t which is conditional on t_q, the age at which a person qualifies for the Age Pension benefit.[5] For simplicity we assume $\delta = r$.

The first order conditions for the individual's problem (apart from the budget constraint which is binding) are:

$$U_C^W = U_C^R = U_C = \mu \tag{3}$$

$$\frac{U^R - U^W}{U_C} = Y_t - P(R) + \int_R^T \frac{dP}{dR} e^{-rt} dt \tag{4}$$

Condition (3) states that marginal utility of consumption in retirement and while working are equal, and in turn will be equal to the Lagrange multiplier μ on the lifetime budget constraint, which corresponds to the marginal utility of wealth. Rearranging condition (4) gives $\frac{U^R - U^W}{U_C} = Y_t - P(R) + \frac{dP}{dR}\left(\frac{1-e^{-r(T-R)}}{r}\right)$,the left hand side of which is the marginal utility of one more year of retirement relative to the marginal utility of consumption. This expression for the marginal rate of substitution between retirement and consumption represents the slope of the indifference curve. The right hand side of the second equation is the slope of the budget constraint, which represents the individual's market opportunities for trading off one more year of full leisure in retirement against the decrease in the total working life earnings and private pension income. Note that the age-conditioned public pension plan AP_t does not affect the marginal rate of substitution or the tangency condition for the optimal solution. The unique features of the Australian Age Pension program - where benefit levels are not a function of prior contributory earnings nor the accrual of additional benefits with delayed retirement - means that a change in the qualifying age is equivalent to a change to total Age Pension wealth $\int_{t_q}^T AP_t e^{-rt} dt$ which affects the location, and not the slope, of the budget constraint.

Insert Figure 1: Maximization Problem and Shift in Wealth Constraint

The graphical presentation of the problem in Figure 1 illustrates the pure wealth effect on individual's retirement and consumption choices. An increase in the eligibility age of the Age Pension simply decreases social security wealth, shown in Figure 1 as a vertical shift

[5]The Age Pension benefit is "age-conditioned" since benefit payments begin at a specific age, and are independent of labour force status and prior earnings

down of the budget constraint, with the slope at B the same as that at A. Examination of the indifference curve (IC) map shows that the slope of the IC at B is lower than at A. The indifference curve therefore cuts the new budget constraint from below at B. A decline in social security wealth leads to an increase in the optimal retirement age, and an associated reduction in the entire consumption profile.

The comparative statics to the individual's optimal choice are straightforward to derive algebraically. Let $SSW = \int_{t_q}^{T} AP_t e^{-rt} dt$, then $\frac{\partial SSW}{\partial t_q} < 0$. It can be shown that $\frac{\partial R^*}{\partial SSW} < 0$ and hence $\frac{\partial R^*}{\partial t_q} = \frac{\partial R^*}{\partial SSW} . \frac{\partial SSW}{\partial t_q} > 0$, so that the optimal retirement age increases with an increase in the pension qualifying age (a decrease in the public Age Pension wealth) assuming leisure is a normal good. For completeness, $\frac{\partial C^*}{\partial SSW} > 0$ and it follows that $\frac{\partial C_t^*}{\partial t_q} < 0$.

In addition to the wealth effect of changes to the Age Pension eligibility age, recent papers have suggested a possible effect of eligibility age on social norms (Lumsadine et al. 1995). Although eligibility for the Australian Age Pension is independent of an individual's labour force status, people may perceive the eligibility age as a 'target' retirement age. This effect is neglected in the simple life-cycle and option value frameworks, and has been presented as a possible explanation of the increase in retirement propensities at focal point ages, such as early retirement age, as defined in social security program rules.

Apart from a direct impact on the labour force participation of affected cohorts of women, the Age Pension reform may have additional, unintended effects. The negative wealth effect created by the reform may lead individuals to adjust behaviour on other margins. Specifically, the reform may also provide an incentive for the affected women to enrol in other government programs that offer income replacement, and which thereby provide an alternative pathway to retirement[6]. In the next section we introduce the data with which we quantify these effects.

3 DATA AND EMPIRICAL METHODS

3.1 Data and Sample Construction

Our empirical analysis is based on eleven cross sections (1994/95 to 2009/10) of the nationally representative Australian Bureau of Statistics Income and Housing Costs Surveys (herein referred to as IHCS). The IHCSs were conducted on a sample of dwellings throughout Australia during a given fiscal year (for example from July 1994 to June 1995). As a result, our eleven cross sections overlap 17 calender years from 1994 to 2010.[7] The IHCS are a rich data source that contains detailed information on individual demographic characteristics,

[6]If this is the case, this would tend to reduce the impact of raising the Age Pension eligibility age on expected wealth and hence labour force participation.

[7]Note there is no public release IDHC Survey for the fiscal years 1998/99, 2001/02, 2004/05 and 2006/07.

labour supply, earnings and income for each member of the household aged 15 years and over. Pooling the cross-sectional survey provides a relatively large sample of observations on individuals in the target age range of 60-64 years, on which we focus in analyzing the effects of Age Pension reform.

A limitation of the IHCS data for our purpose is the lack of information on exact birth date. The data contain information on the quarter of the interview (September, December, March, June) and the individual's age at the time of the interview, but not birth date. Subtracting the age of the individual from year and quarter of the interview provides a 15 month window in which the birth date of the individual falls. As a result when we assign treatment group status based on the birth year, there is potential misclassification. In the empirical section we discuss this issue further and explicitly incorporate the misclassification probability into the estimation.

Another limitation of the data is that information in some dimensions is coarse. In particular, the education variable reports the level of highest post-school qualification for each individual. Many individuals in the birth cohorts examined do not have post-school qualifications: 70 percent of women and 50 percent of men in our sample report no post-school qualification. As a results, the controls for educational attainment are somewhat crude.

The main variable of interest in the analysis is the retirement status of individuals. In all IHCS data sets, there is a variable which indicates labour force status at the time of the interview. We classify people who report "Not in the labour force" as retired, and the remainder as participating in the labour force. There is detailed information on income sources, which includes government transfers with categories including Age Pension, Disability Support Pension, plus a range of additional income support programs. This information is used in the analysis of program substitution effects.

The main sample analyzed is composed of individuals who are aged 60 to 64 years old.[8] This restricts the sample to individuals born between 1929 and 1950. The sample represents the set of individuals at risk of retirement and most likely impacted by the Age Pension reform.[9] The sample also contains birth cohorts that were not affected by the Age Pension reform, by virtue of being born before July 1935, thereby forming one potential control group. The main sample for the analysis contains observations on 5838 women and 5600 men. For part of the analysis we concentrate on single individuals; for this sub-sample we have observations on 1087 men and 1726 women. Table 2 presents summary statistics for

[8]We excluded immigrants that arrive to Australia less than 10 years from the time of interview. These individuals are not eligible to receive age pension benefits due to the residency requirement. This represents less than 1 percentage of the overall sample. Our results are robust to the inclusion of these observations.

[9]Although individuals' retirement decisions before age 60 may be less affected by the Age Pension reform, we also analyse the wider age range of 55-64 years, as a part of the sensitivity analysis.

the full sample and the subset of single adults by birth-cohort. The cohorts are similar in terms of marital status and household size, though younger cohorts are more educated. Comparing male and female shows that a higher percentage of males are married and have bachelor degree, in each cohort. The difference in educational attainment between males and females diminishes among younger cohorts. These trends are similar in the single and full samples.

Turning to retirement trends, Figure 2 depicts the labour force participation rates over time for men and women in Australia aged 60 to 64 years. The solid lines for men and women plots aggregate time series data from the Australian Bureau of Statistics Labour Force Survey, and the connected lines plots our calculations based on the IHCS data. It is clear that our pooled data sample replicates the macro trends observed in aggregate data series.

Insert Figure 2 - Participation Rates by Year, Aggregate Time Series and Micro data

Figure 2 shows that participation rates of older women in Australia had been increasing substantially in the last two decades. Since the mid 1980s, participation rates of women aged 60-64 increased by almost 30 percentage points. Contrary to this, older male participation rates declined substantially over the 1970s and 1980s, although through the 1990s participation again increased and exhibited a parallel trend to women's labour force participation. Similar trends in the participation rates of elder men and women are, to some extent, observed in US, Canada, the U.K. and several other European countries. Often the aggregate pattern has been largely attributed to cohort differences. To investigate this in detail we divide the data from the IHCS into birth cohorts. Figure 3 shows the participation rates by age for each birth cohort of males and females.

Insert Figure 3. Cohort Participation Rates, for Male and Female

It is clear from Figure 3 that participation rates of the younger cohorts of women are substantially higher than the older cohorts. The gap between each cohort increases as you move to younger cohorts, particularly at older ages. These clear gaps may be a product of differences in cohort characteristics, such as education levels,[10] or changes in labour market demand conditions. One of the main factors that may also affect the participation rates of women by cohort is the increase in the pension qualifying age. Another important trend evident from this figure is that, in contrast to trends observed for the female cohorts, there are no differences in the participation-age profiles for males across birth cohort. This observation, in conjunction with the fact that men and women faced similar time trends in

[10] Although summary statistics show that the educational attainment of adjacent cohorts are not substantially different from each other.

aggregate participation during our observation period supports the use of the male group as a comparison group to control for general time effects in investigating the impact of Age Pension rules on female labour force participation patterns.

Insert Figure 4. Cohort Participation Rates, for Martial Status

Figure 4 shows the participation rates by age for each birth cohort of married and single individuals. Several studies have documented a strong correlation in the timing of spouses' retirement decisions. As a result one challenge to using men as a control group is the assumption that APA reform has no spillover effects on married men. Figure 4 shows that even when we constraint our sample to the single individuals, we still observe cohort discontinuities in cohorts of women but not men. The cost of restricting our sample to singles is the reduction in number of observations; for some birth cohorts we end up with less than 50 observations. Nevertheless, in our analysis we perform the empirical analysis first using the full sample, and then for the subsample of single adults as a robustness check.

In Figures 5 and 6 we plot participation rates in different government programs by birth cohort. For women we plot four different categories, with the first showing the percentage of women who receive benefits from any government program, including the Age Pension. As expected, participation rates are decreasing across younger cohorts coincident with the increase in the labour force participation; this cohort discontinuity is especially pronounced over the ages 60-64 years - which are the ages affected by the Age Pension reform. In panel (b) the Age Pension is excluded from the set of government programs; in contrast to the graph in panel (a), this shows that participation rates in other income support programs combined among recent cohorts of women is substantially greater than that for previous cohorts, specifically at ages of 60-64 years. Panel (c) of Figure 5 compares the participation rates for the disability support pension by cohort, and similar to the second panel, there is an upward trend in participation among more recent birth cohorts. For males, shown in Figure 6, we see no cohort differences in participation, neither for all government programs collectively[11] nor specifically for the Disability Support Pension. Thus these enrolment trends for women aged 60-64 strongly suggest that Age Pension reform has an effect on program substitution.

Insert Figures 5 and 6. Government Program Participation

[11]For men this also provides the counterpart to Graph 5b, since it plots male cohorts at ages between 55 and 64 years. At these ages males are not eligible for the Age Pension.

3.2 Empirical Methods

Comparing the variation in APA for women to the constant APA for men of the same birth cohort provides a natural experiment for examining the impact of the APA policy parameter on the labour force behaviour of women. The identification strategy exploits the exogenous variation in APA (and hence social security wealth) by implementing a difference in difference empirical model. This strategy compares the changes in the labour supply outcomes of the female cohorts (treatment groups) with the male cohorts (control group) under the assumption that in the absence of the AP reform the two cohorts would have experience the same change in their labour supply. The "before" and "after" demarcation is aligned with the 1st July 1935 cohort birth date. We also take account of multiple treatments - or different treatment intensities - with the ratcheting up of eligibility age for more recent cohorts in this policy experiment. There are several concerns with using the difference-in-difference estimator in this context. First, our treatment and the control group may differ in time trends of observable and unobservable characteristics. As Meyer (1995) notes, the bias that arise from the differential change in observable variables can be reduced through using the regression-adjusted difference-in-difference methodology by conditioning on additional explanatory variables. This also results in an efficiency improvement compared to the simple difference-in-difference strategy. Thus we employ the augmented difference-in-difference strategy in our analysis.

A second concern is that there should be no shocks which affect women's labour supply differentially to that of men. For example, differences in wage growth between the male (control) and female (treatment) groups may bias the result. Since we are concentrating on older age groups, this is less of a concern. That is, the 60-64 year old age groups are more homogeneous than broader groupings. Second, since the policy affects 18-month wide birth cohorts, in our regression adjusted difference-in-difference analysis we can control for year-specific effects.[12] By interacting the year effects with the treatment group indicator we can also allow for differential macroeconomic shocks for women and men, which we employ in testing the sensitivity of the main estimation results. We demonstrate that our results are robust to this specification issue.

Thirdly, there could be some family spillover effects which may bias our results. If the retirement decisions of spouses are interdependent. Men who are married to women in the affected cohorts are also facing some incentives that may impact their retirement decision. For robustness checks, we restrict our sample to individuals who are not subject to within family spillovers; that is, single men and women.

Finally, another concern is whether our control group – male cohorts – constitute a

[12]This would not be feasible if we use yearly birth cohort variables, instead of the 18 month birth cohorts to which as the policy applies, because of the colinearity between cohort and year.

suitable comparison group for the difference-in-difference identification strategy. This concern is that males may have experienced different time trends or changes in institutional regimes relative to females. As can be seen from Figure 2 , throughout our sample period male and female groups exhibited similar trends in labour force participation; further, the age-participation profiles in Figure 3 shows comparable parallel trends by cohort. This reduces the concern about different time trends. With respect to differences in policy regimes, apart from the APA change, there were no social security or labour regulation changes that affected the 60-64 age group differentially for males and females during the sample period. Nevertheless, as an alternative strategy, we use a similar methodology to Mastrobuoni (2009) and investigate the cohort differences of male and female groups separately. Although this strategy is not based on a male-female comparison[13], it is more restrictive in terms of separating general time effects from the impact of the APA reform.

We estimate a linear probability model[14] for an individual's binary choice of whether or not to participate in the labour force. The model specification is based on:

$$LFP_i = \beta x_i + \alpha_0 Female_i + \alpha_1 CohortA_i + \delta Female_i \times CohortA_i + u_i \qquad (5)$$

where labour force participation (LFP_i) is an indicator variable that equals 0 if individual i is retired and equals 1 if the individual participates to labour force. The vector x_i is a set of control variables which includes age, education, marital status, state of residence dummies and household size. The variable $Female_i$ indicates the gender of individual and is equal to one for females, who constitute the treatment group. Any difference in labour supply preferences of treatment and control group are represented by the coefficient α_0 which we expect to be negative, because women on average have lower lifetime labour force participation than men. The birth cohort indicator variable $CohortA_i$ is equal to 1 if an individual was born *after* 01/07/1935, and 0 otherwise.[15] To assess the impact of the pension reform we test whether affected cohorts of women increased their labour force participation relative to the male cohorts. The interaction term $Female_i \times CohortA_i$ captures the treatment effect; we expect to the coefficient δ to have a positive sign.

As mentioned above, due to the lack of an exact birth date variable in our data, the 18-months birth cohorts indicator variables are subject to misclassification error. For each individual, subtracting age in years from the date of interview gives a 15 months window for date of birth. Assuming that 'quarters of birth' is uniformly distributed over a year[16]

[13]Also note that this strategy does not face the family spillover problem as discussed above.

[14]We obtain very similar results when we a probit estimator is applied. The probit estimation results are available on request.

[15]For all our regressions, we omit the constant and include all age dummies, and we exclude the cohort variable for individuals born prior to 01/07/1935.

[16]This is consistent with birth registry data.

this gives us a known probability of misclassification which we can take into account in the estimation. Mastrobuoni (2008) shows that equation (5) can be modified as follows:[17]

$$\begin{aligned} LFP_i &= \beta x_i + \alpha_0 Female_i + \alpha_1 \Pr(CohortA_i^* = 1) \\ &\quad + \delta \left[Female_i \times \Pr(CohortA_i^* = 1) \right] + u_i \end{aligned} \tag{6}$$

where the cohort dummies are replaced by the *probability* ($\Pr(CohortA_i^* = 1)$) that a given individual belongs to the birth cohort affected by the program reform. Specification (6) is the baseline model for the analysis.

The base model specification estimates a mean impact across the affected cohorts. Since the magnitude of the treatment varies by cohort, it is useful to extend the model specification by allowing the impact to vary by birth-cohort. The baseline specification is extended by substituting the probability of being born post - June 1935, with a series of variables reporting the probability of being in a specific birth cohort. For the main analysis, five birth cohorts are distinguished: AC_1 for who the eligibility age is 60.5-61 (those born between 01/07/1935 and 30/6/1938), AC_2 for who the eligibility age is 61.5-62 (those born between 01/07/1938 and 30/06/1941), AC_3 for who the eligibility age is 62.5-63 (those born between 01/07/1941 and 30/06/1944), AC_4 for who the eligibility age is 63.5-64 (those born after 01/07/1944 prior to 30/06/1947) and AC_5 for who the eligibility age is 64.5-65 (those born after 01/07/1947). This model specification is given by

$$\begin{aligned} LFP_i &= \beta x_i + \alpha_0 Female_i + \sum_{k=1}^{5} \alpha_k \Pr(AC_k^* = 1) \\ &\quad + \sum_{k=1}^{5} \delta_k Female_i \times \Pr(AC_k^* = 1) + u_i \end{aligned} \tag{7}$$

A property of specification (7) is that the program reform is restricted to have a uniform impact across the age range considered (60-64 years). This assumption can be relaxed by permitting the treatment effect to vary by age within each birth cohort. The impact can be differentiated by age since the reform affects birth-cohorts as defined by 18-month categories, rather than single years. The most general specification which allows for different treatment effects by birth cohort and age is given by:

$$\begin{aligned} LFP_i &= \beta x_i + \alpha_0 Female_i + \sum_{k=1}^{5} \alpha_k \Pr(AC_k^* = 1) \\ &\quad + \sum_{k=1}^{5} \sum_{j=60}^{64} \delta_{jk} age_{ij} \times Female_i \times \Pr(AC_k^* = 1) + u_i \end{aligned} \tag{8}$$

This specification permits testing of Age Pension reform impacts within cohorts at ages not directly targeted by the reform.

[17] We also check our main results by restricting our sample to observation where the probability of misclassification are 0. Although the sample size decreases to one-half, our main results are entirely robust to this specification. Tables with the full set of results are available upon request.

We also estimate the linear probability model for labour force participation separately for men and women using the following specification:

$$LFP_i = \beta x_i + \sum_{k=1}^{5} \alpha_k \Pr(AC_k^* = 1) + \sum_{k=1}^{5} \sum_{j=60}^{64} \delta_{jk} age_{ij} \times \Pr(AC_k^* = 1) + u_i \tag{9}$$

where all the age dummies are included (the constant term is suppressed) and the cohort variable for individuals born prior to 01/07/1935 is excluded. The δ_{jk} coefficient measures the difference in the likelihood of being in the labour force for members of cohort AC_k at age_j relative to the control group which, for this model, corresponds to the pre-July 1935 cohorts, conditional on the observed covariates. This is analogous to the specification and identification strategy used by Mastrobuoni (2009) in studying the reform to the NRA in the US. Since younger cohorts of women face higher APAs, we expect increasing labour force participation at older ages for more recent cohorts (for example, for women born after 01/07/1944, we expect a positive effect at all ages in the range 60-64 years). Estimating the model separately for males provides a "placebo test" of the reform. The Age Pension reform did not change the qualifying age for men hence we expect to find no impact, which in turn provides a test of the validity of the identification strategy underlying the difference-in-difference estimator.[18]

We also use specification (9) to investigate potential program substitution impacts. The fact that men and women exhibit quite different trends in participation in government programs (Figures 5 and 6) implies that the difference-in-difference strategy that uses males as a control group may be less justified in this context. For this series of models the dependent variable is an indicator of an individual's participation in 'any government program', 'any government program except the Age Pension' and the 'Disability Support Pension program.' The identification assumption in this specification is that after controlling the observable characteristics, cohort differences in the participation rates in government programs are driven by the APA reform. As a result, we should observe APA impacts on women, and not on the male pattern of participation. As for the analysis of labour force participation, estimating the treatment effect on participation in alternative programs with the male sample provides a "placebo test" of the identification strategy. Furthermore, if pre-existing trends are the driving force of the cohort variation in women's program participation then we are more likely to observe the effect at all ages rather than only at the ages affected by the reform. In the next section we present the estimation results.

[18]This specification also provides a robustness check of the common trend assumption of the difference in difference methodology. If our male and female groups experience different time trends, or if our control group shows a decreasing or constant labour force participation trend while the female group shows an increasing participation trend, this will result in larger estimated effects than that identified with the prior difference-in-difference strategy.

4 RESULTS

4.1 Labour Force Participation

4.1.1 Single Treatment, Regression Adjusted Difference-in-Difference Estimates

Table 3 reports the regression adjusted difference-in-difference estimates of the Age Pension reform on the labour force participation of women. Columns 1 to 4 provide results for full sample and columns 5 to 8 display analogous results for the sample of Single women and men. For each sample there are four specifications in the table; each model include controls for age, education, marital status, state of residence and household size.[19] Column (1) presents the base specification for full sample and compares the difference in the labour force participation of elderly women and elderly men across the affected birth cohorts. This series of models estimates an average impact across all affected cohorts of women.[20] For the base model in (1) the coefficient on the treatment dummy variables (female) is significantly negative, and the coefficient on the after-cohort dummy variable specification is positive and significant. The interaction of cohort and female dummy variables, which captures the effect of policy reform, is positive and statistically significant at 1 percent level. Our results show that the difference-in-difference estimate of the APA reform on the cohorts of affected women on average led to an economically significant increase in labour force participation of 8 percentage points.

One threat to the identification strategy is the possibility of differences in the time trends for men and women. We address this issue by introducing year dummies and interacting them with the treatment group indicator variable. This specification in effect allows for differential macroeconomic shocks for women and men. The estimation results for this model are presented in column (2). The difference-in-difference estimate of the reform on labour force participation is essentially unchanged from the base specification. In column (3) we introduce a constructed variable which measures the labour force participation for each birth cohort and gender at the age of 40.[21] We introduce this variable as an additional control for cohort heterogeneity (apart from a cohort-specific intercept) which may have a time trend component. The resulting difference-in-difference estimate indicates a significant 3.5 percentage point increase in participation due to the APA change, which is smaller than the estimate for the base specifications. The AP treatment impact is positively correlated with the mean cohort differences in prior participation, hence the smaller measured treatment

[19] The results for the covariates are not reported for reasons of brevity. Tables with the full set of estimation results are available upon request. In summary, as expected, being less educated and being older reduce the probability of labour force participation.

[20] In the next subsection we consider models which allow for differences in treatment intensity across cohorts

[21] This variable is constructed by using the historical information in Australian Bureau of Statistics (2009).

effect estimated in (3). This proxy variable approach attributes all differences in mean cohort participation at an earlier age to preferences and therefore the estimates for model (3) provide a lower bound on the APA reform impact. [22] Model estimates in column (4) reports the results when we extend the sample from the 60-64 year age range to 55-64 years, and again the results are very similar to our base specification.

The models where estimated for the samples restricted to single men and women, with the results presents in table 3, columns (5) to (8). The results for the sample of singles are stronger compared to the corresponding specifications for the full sample. For example, column (6) shows that the increase in the APA increased the labour force participation of single females by 13 percentage points, which is larger than the 8 percentage point impact found with the sample including couples. This larger estimated treatment effect may be due to (i) the reform having a larger effect on the overall wealth of single women relative to married women thereby inducing a larger participation response, and (ii) potentially a cleaner control group based on the subsample of single adults. In relation to the latter point, if couple households act according to the unitary model with complete income pooling, then the AP reform can be considered as impacting males who have a female partner in the targeted cohorts. Consequently, treatment effect estimator based on males as a control group may be downward biased due to incorrect assignment of married males. In either case, the results from the robustness checks reinforce the finding that the AP reform led to a statistically significant increase on the labour force participation of approximately 8 percentage points for full sample, and 13 percentage points among single women.

4.1.2 Multiple Treatments, Regression adjusted Difference-in-Difference Estimates

We now consider the variation in treatment intensity and allow for multiple treatment groups. In this specification we substitute the single treatment variable with five cohort dummy variables. This specification allows us to investigate the pattern of responses across different birth cohorts of women. As described in the theoretical section, if the wealth effect is the driver of the labour supply response we expect to see a larger response by the younger cohorts who experience a larger decline in pension wealth. As an alternative, Mastrobuoni (2009) has shown that in a life-cycle framework the response may be more intense in the cohorts which have shorter notice of the policy change and therefore have less margin, or opportunities, for adjusting their behaviour to mitigate the wealth impact. By this reasoning, since younger cohorts are informed earlier relative to their prospective retirement date, they have more time to adjust their consumption and saving profile and we

[22] Not surprisingly, the inclusion of this cohort and gender specific labour force history variable also leads to a reduction in the coefficient on the female treatment dummy variable.

may find a smaller response in the retirement behaviour of the more recent birth cohorts. In addition, the APA may also represent a focal point for individuals in deciding when to retire. According to this hypothesis, the APA reform causes a change in the 'social norm' concerning the appropriate retirement age, and we would also see an intensifying response across cohorts as retirement around the APA becomes common practice over time.

Table 4 presents the results for the expanded specification which allows for multiple treatments. The interaction terms of the different cohort dummy variables with gender capture the APA treatment impact on specific cohorts of women. We present the results for the full and singles samples, as well as two more restrictive subsamples. The model in column (3) restricts the singles sample to homeowners who do not have mortgage debt - the main form of debt balances among Australian households - and are therefore less likely to be credit constrained. The model presented in column (4) is estimated with the subset of singles who are university graduates, and by virtue of their human capital are likely to represent the segment of the population with highest lifetime income and personal wealth. We consider these two subsamples to assess if the APA reform has an impact on individuals who are less likely to be liquidity constrained. The change in APA may have a heterogenous impact according to wealth levels. In particular, one may expect a smaller effect of the reform on individuals who are less dependent on public pension income and have alternative, private income sources to fund retirement.

From the results presented in table 4, first note that when we allow for heterogeneous impacts, the treatment effect of the APA changes are much more pronounced in the younger cohorts. This finding across the samples considered is consistent with the magnitude of the wealth effects of the APA changes, and is contrary to the effect hypothesized by Mastrobuoni (2009). A second feature of the results is that, similar to the results in table 3, the magnitude of the estimates are larger for the singles sample as evidenced by a comparison on the results for models (1) and (2). Third, considering models (3) and (4), it is clear that the APA reform had a significant effect on subgroups that are less likely to be liquidity constrained. With the exception of the oldest cohort, who experienced the smallest reduction in their social security wealth, all the treated cohorts increased their labour force participations similar to the magnitudes in model (2). As shown in the lower panel of table 4, the hypothesis of uniform impacts of the APA change across the cohorts of singles, and across the four younger cohorts in the full sample of singles and couples. Thus, we can conclude although there is heterogeneity of the APA treatment, the reform has a significant and comparable impact across groups with differing human capital and wealth.

There may be a remaining concern with the common trend assumption in our difference-in-difference empirical strategy. As illustrated in the figures, throughout our observation period male and female groups show comparable time trends in labour force participation.

Nevertheless, to further explore this possibility, we follow the approach of Mastrobuoni (2009) and estimate specification (9) for male and female groups separately. In this specification all the age dummy variables are included (the constant term is suppressed) and the cohort variable for individuals born prior to 01/07/1935 is excluded. The coefficient estimates in table 5 should be interpreted as the difference in the likelihood of being in the labour force between the treated cohorts and the unaffected cohort at the indicated age.

There are two important patterns revealed by the results shown in table 5. First, the male group coefficients are generally small and statistically insignificant; although several are individually significant, the set of 23 coefficients are jointly insignificant. The average estimated response by men is 0.004 and clearly statistically insignificant.[23] Finding no 'placebo effect' of the AP change among males provides one check on the validity to our identification strategy. Second, we see large and statistically significant positive effects for all post-reform cohorts for female group. The increase in labour forces participation for women is common to all ages and it does not peak at the APA threshold. For example, the group of women faced with an eligibility age of 61.5-62 years, the estimates show that the program reform led to a statistically significant increase of 11 percentage points in labour force participation at age 64. To aid interpretation of the results, and provide comparability with the difference - in - difference results, we follow Mastrobuoni (2009)'s calculation to aggregate these coefficients into a summary statistic, the weighted average of the impact across cohorts $\frac{1}{5}\sum_{t=1}^{5}\left(\frac{\sum_{i=60}^{64}\delta_{Age_i Cohort_t}}{t}\right)$. This statistic is the average response to a common, hypothetical 1-year increase in the APA reported in the bottom panel of table 5. We find that APA increases on average led to an increase in labour force participation by 18 percentage points for the affected women.[24] The results are actually larger than our difference-in- difference results presented in table 4, especially for more recent cohorts and at older ages. These results further validate the identification strategy underlying the difference-in-difference framework.

The final model specifications were the most comprehensive, allowing for separate effects by age within cohorts based on the difference-in-differences strategy. The results are presented in table 6. The estimates are in line with the results in tables 4 and 5. The APA reform impacts tended to have a greater impact on more recent cohorts and, consistent with that effect, the impact was greatest within cohorts at the ages directly targeted by the reform. The difference - in - difference estimates imply that a 1-year increase in the

[23]The F-test statistics is 1.21 with p-value of 0.231. The test statistic has as F distribution with degrees of freedom $(23,\infty)$ under the null.

[24]In the appendix table 1, we test the robustness of these results first by distinguishing 10 treatment groups.The results are consistent with our findings in Table 5, the signs and magnitudes stays the same as our base specification when we allow for 10 treatment groups, though some coefficients lose their significance due to the reduction in the number of observation in several age - cohort cells.

APA on average induces a 13 percentage point increase in labour force participation at the affect age. This point estimate of the impact is somewhat smaller than the single difference estimates in table 5, and suggests that the difference-in-difference approach may be somewhat conservative and represent the lower bound of the policy impact. Overall, across the array of model specifications and sample definitions, we find a significant effect of Age Pension reform on the women's participation to labor force among the affected cohorts. In the next subsection we investigate the effect of the reform on the individual's decision to participation in alternative government programs.

4.2 Government Program Substitution

Age Pension reform may also lead women to enrol in other government programs that offer income replacement at the ages at which they are no longer eligible for the Age Pension. To investigate this we use the specification in (3) and estimate the model for men and women separately. Table 7 presents the estimates for dependent variables which indicate whether the individual participated in *any* government program, and in *any* government program *other than the Age Pension program.* For men the probability of participating in any government program compared to men that are born before July 1935, at any age, does not show any specific time trend. Though the younger cohorts and older ages are less likely to be beneficiaries of the government programs, this is because these cohorts of males exhibit an increase in the labour force participation (as shown in Figures 3 and Table 5). When we examine the results for females, we see that the estimated effects are larger compared to those for the male group. In addition, the negative effects are more pronounced at the ages which the APA reform directly affected. From the results in column (3), which presents the results for participation in any government program apart from the Age Pension, it is clear that the ages most affected by the reform witnessed substantial increases in participation in other government programs. For example, for the cohort where eligibility age increased from 60.5 to 61 years old, the participation in other government programs increased 15 percentage points at age 60. For the cohort with eligibility age 61.5 to 62 years, the participation in other programs increased by 18 percentage point at age 60 and 13 percentage points at age 61. Furthermore, there is very few significant increase in the probability of participation in other programs after the AP eligibility age threshold is reached, which further supports the previous finding that there is no common underlying trend driving women's program participation across cohort. The variation in participation rates by age across cohorts is aligned with the Age Pension reform.

In Table 8, we focus specifically on participation in the Disability Support Pension program. This government program has the highest participation rate after the Age Pension in our sample. Cai and Gregory (2005) present evidence that 60 percent of the inflows to this program involves people that are transferring from other government programs, mainly unemployment assistance programs. In this table we test whether individuals who face a higher Age Pension eligibility age are more likely to use the disability insurance program as a substitute, effectively using this as an alternative source of income to support retirement. Again, running the model on the male sample and testing for a "placebo effect" provides a check on the identification strategy. A positive and significant placebo among males would indicate an underlying time trend in participation in the disability support program. As evident from the results in the table, the estimates are in line with the predictions of the theoretical model. First, there is no placebo effect for men; the coefficient estimates are generally small, very close to zero and statistically insignificant.[25] For women, there is a significant increase in participation at the ages directly impacted affected by the reform and no effect at the other ages. The average treatment effect of the APA reform on Disability Support participation is approximately 12 percentage points, reported in the bottom panel of table 8, and is significantly larger for younger cohorts over the affected ages. Column (3) of table 8 also reports the results for the sample of single females, which again use provides a check on the robustness of the results to potential family spillover effects. The results are stronger among single adults compared to the base model with a 21 percentage point increase in participation in the Disability Support Program.

In summary, we studied the effect of a recent reform to a key parameter of the Australian security system - the ratcheting up of the eligibility age for Age Pension benefits for women. Our difference-in-difference estimation results show an economically and statistically significant increase of 8 to 13 percentage points in labour force participation in the affected cohort of women. This is a smaller magnitude compare to the recent US findings. Part of this smaller impact of this reform in Australia is explained by the unintended effect of inducing higher participation in other public assistance programs, especially disability support. More specifically, we find an increase of 12 to 21 percentage points in participation in other government programs at ages impacted by the Age Pension reform.

5 CONCLUSION

Identifying the effect of social security systems on retirement behaviour of individuals requires plausibly exogenous variation in the social security systems. In this paper we analyze the 1993 Australian Age Pension reform which increased the eligibility age for Australian women. In particular, the Age Pension age for women has increased from 60 years for women born prior to July 1935, by 6 months increments for each subsequent 18-month birth co-

[25]For some cohorts there was a negative effect at a specific age - which coincided with a higher incidence of labour force participation at those ages. {Note sure of the point here: this is a significant treatment effect ?}

hort. The eligibility age will be equal to 65 years for women born after 1948. This change in eligibility age represents a decline in the social security wealth of later cohorts of women. Variation in the Age Pension eligibility age of adjacent cohorts of women, and in comparison of to the constant eligibility age for men, provides a natural experiment for assessing the impact of the change in this key program parameter on retirement behaviour. We use a difference-in-difference specification to exploit this reform, and analyse the robustness of our result with respect to alternative model specification.

We find economically and statistically significant responses to increase in the eligibility age of Age Pension. An increase in the Pension eligibility age by 1 year induces a decline in retirement probability by 8 - 13 percentage points for women. Further, we find that the institutional reform caused significant "program substitution." The rise in eligibility age of the first pillar program led to greater enrolment in other social insurance programs, especially disability support, that may have unintentionally functioned as a alternative source of income for individuals to fund retirement.

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Figure 1: Maximisation Problem and Shift in Wealth Constraint

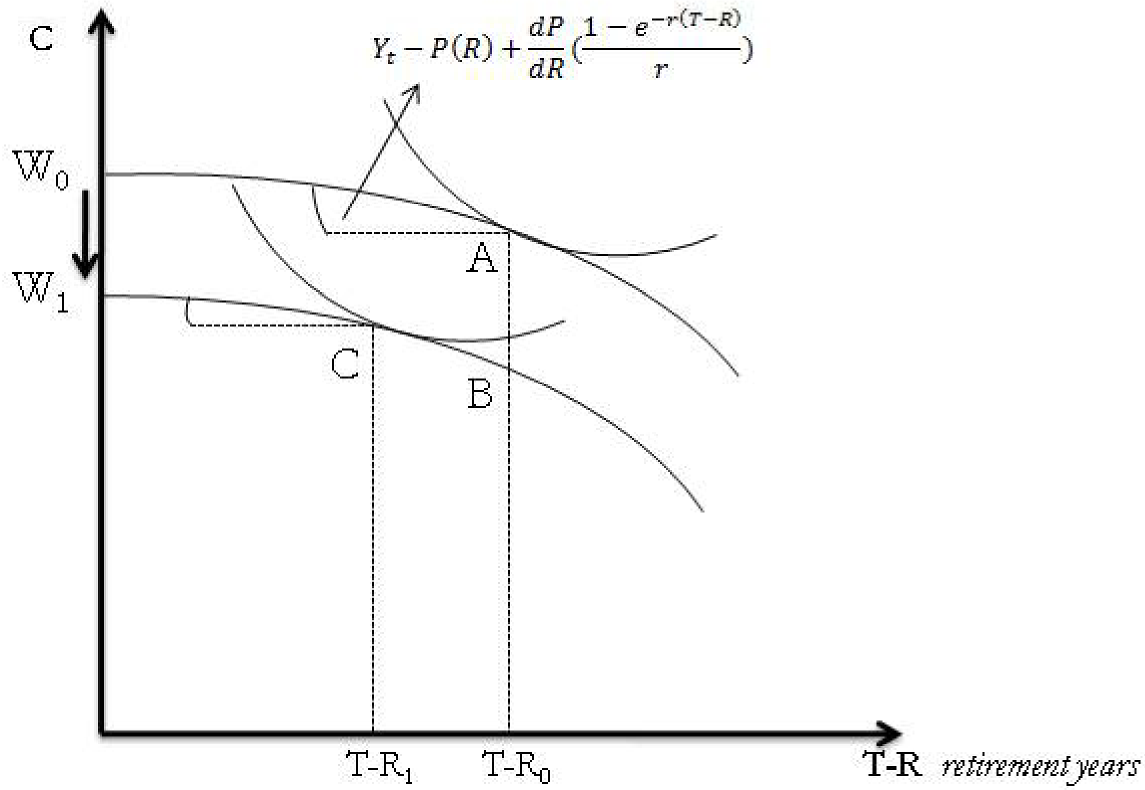


Figure 2 : Participation Rates by Year, Aggregate Time Series and Micro data

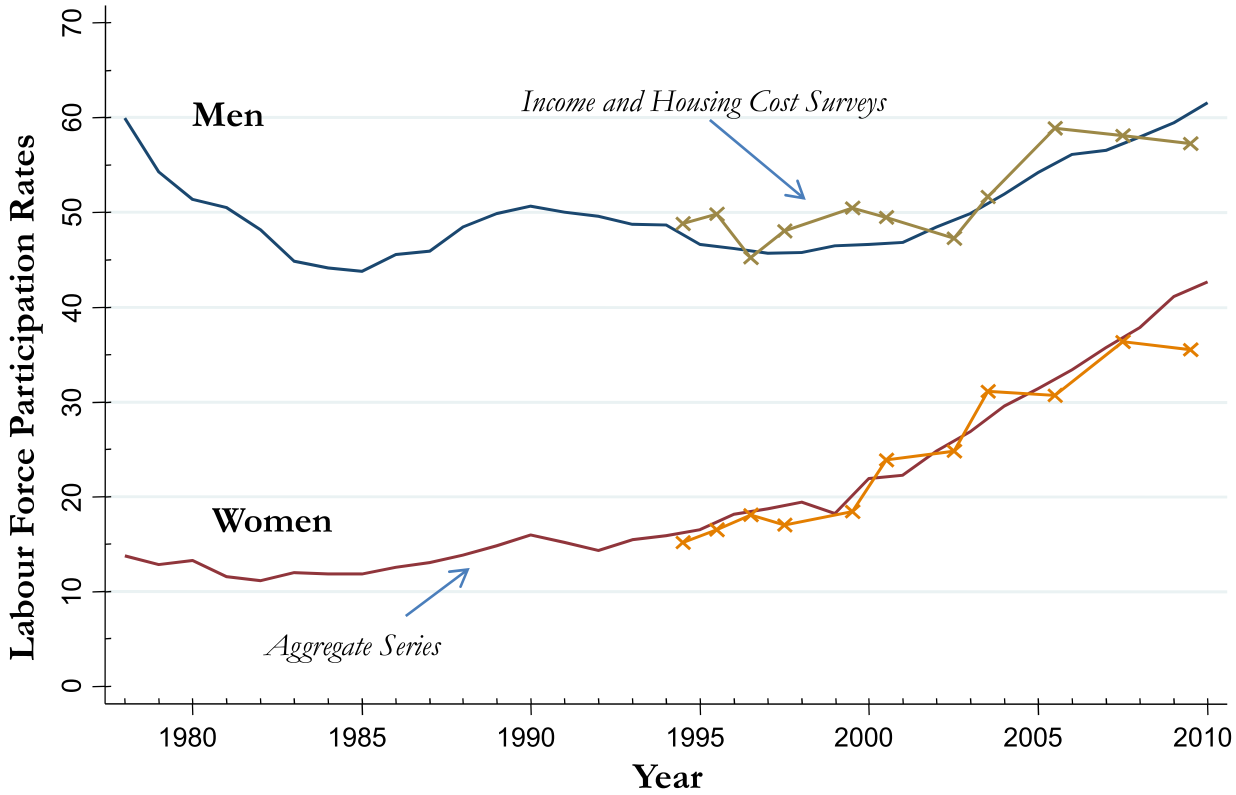


Figure 3: Cohort Participation Rates, for Male and Female

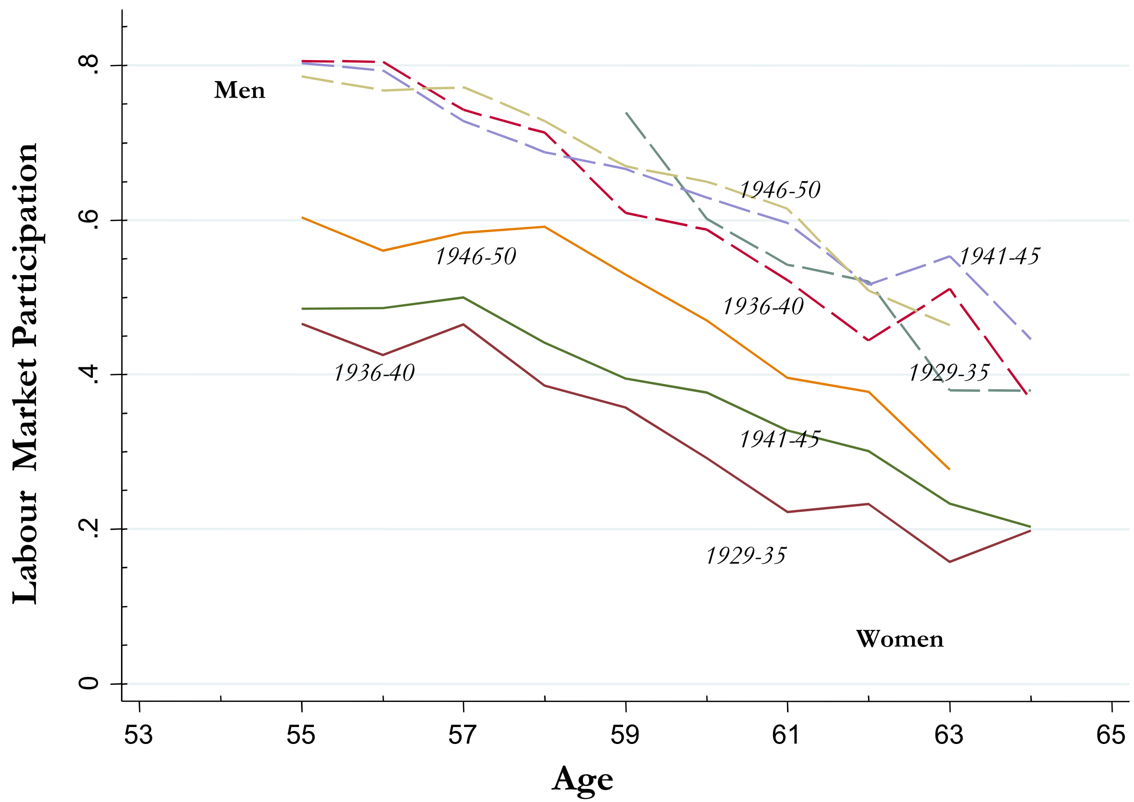


Figure 4: Cohort Participation Rates, for Marital Status and Gender

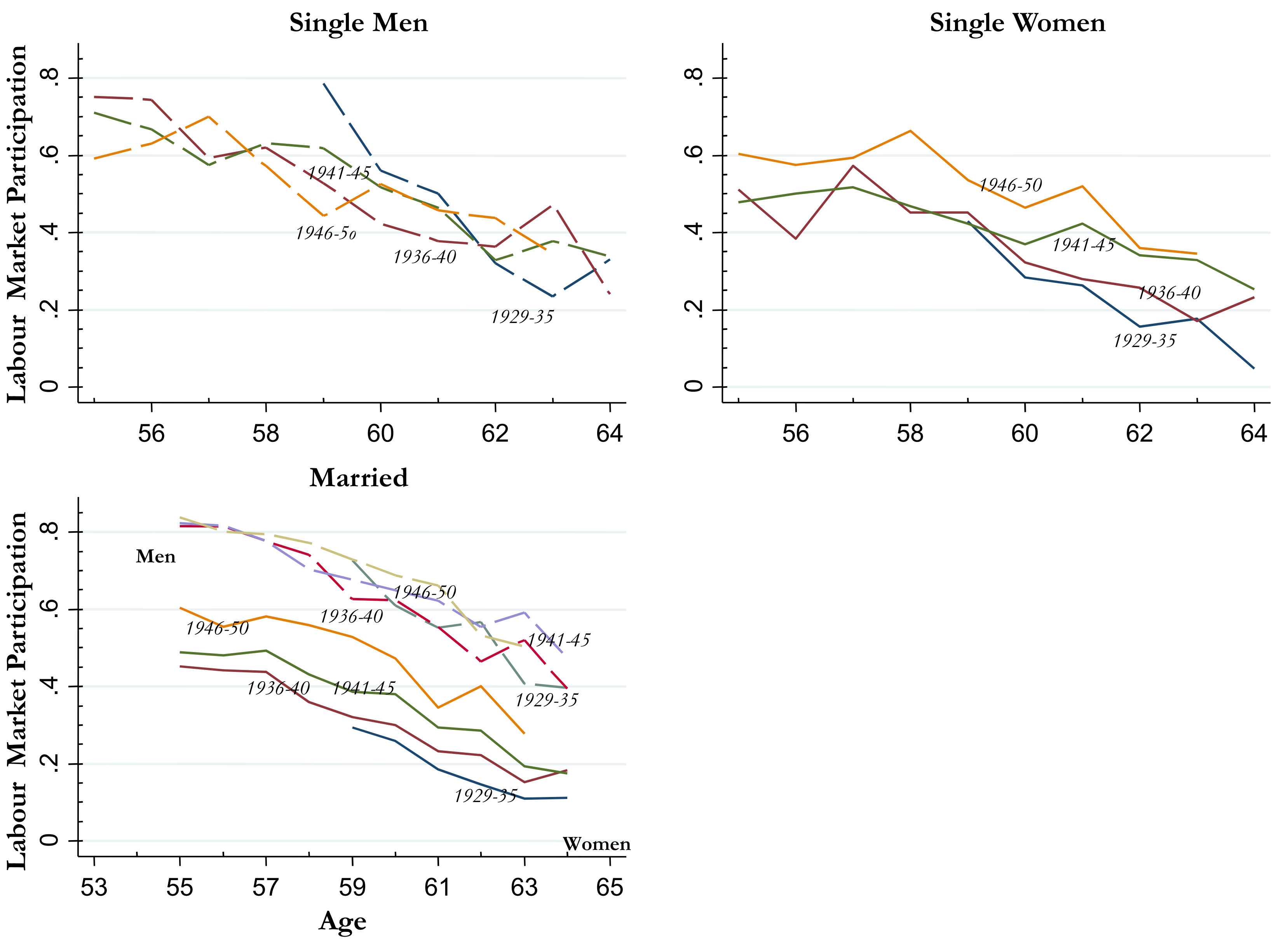


Figure 5: Female Government Program Participation

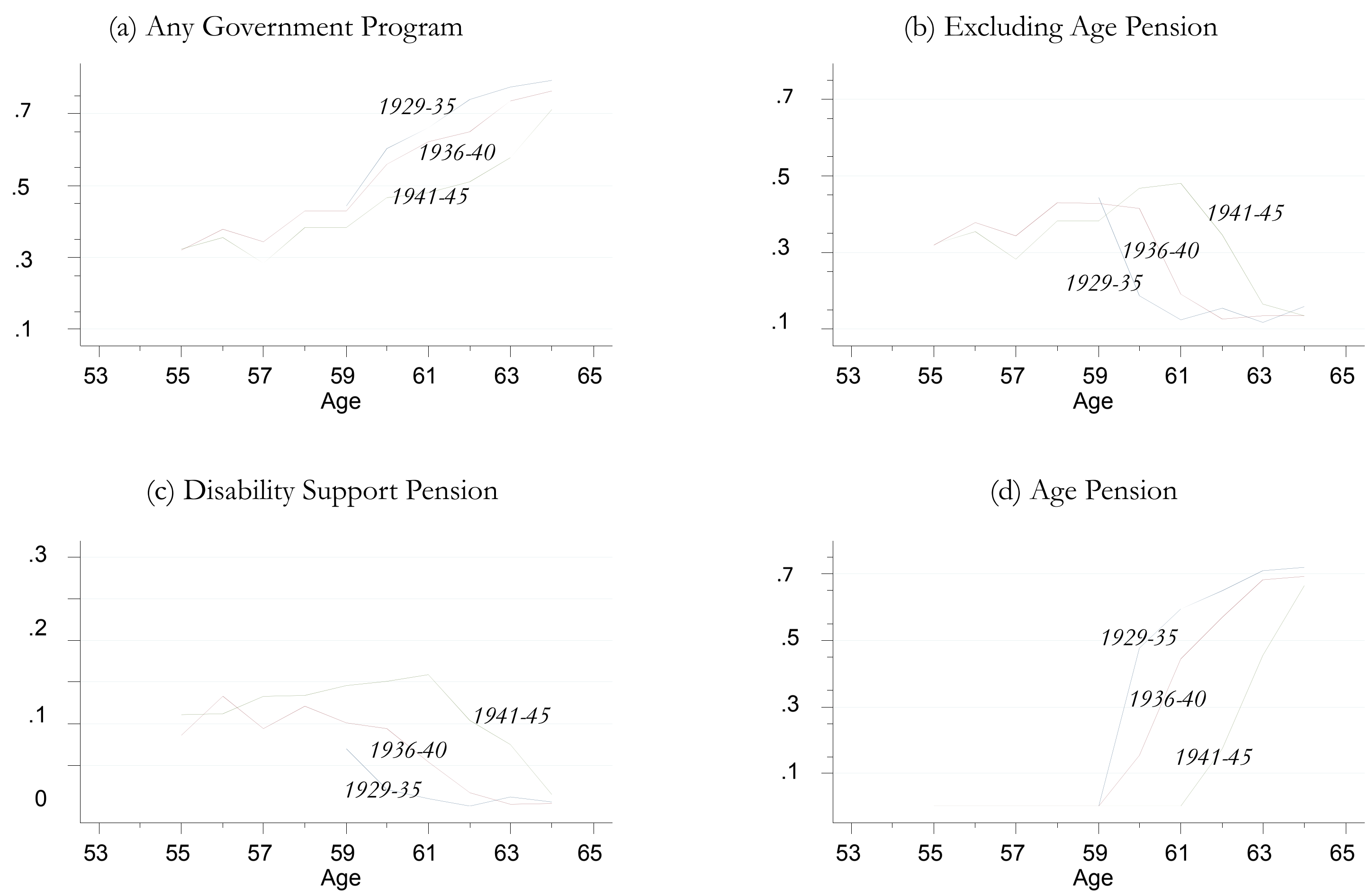
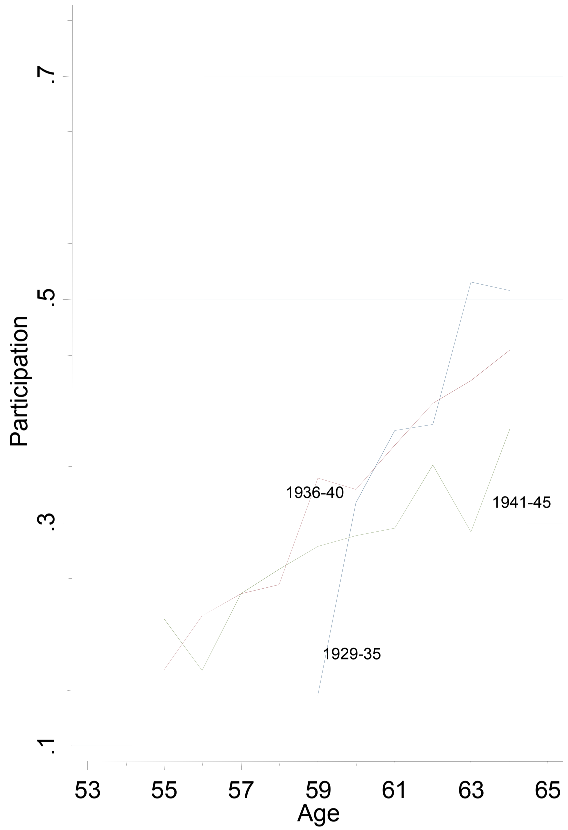


Figure 6: Male Government Program Participation

(a) Any Government Program



(b) Disability Support Pension

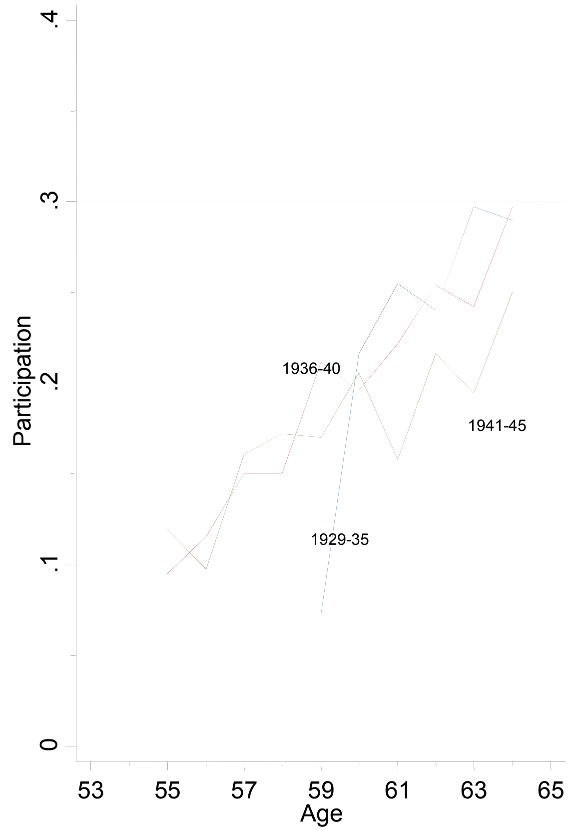


Table 1. Australian Age Pension Eligibility Age

	Age Pension Eligibility Age		
Birth Cohort	Women	Men	Effective Date
Before 1 July 1935	60.0	65.0	Pre 1 July 1995
From 1 July 1935 to 31 December 1936	60.5	65.0	1/01/1996 - 1/07/1997
From 1 January 1937 to 30 June 1938	61.0	65.0	1/01/1998 - 1/07/1999
From 1 July 1938 to 31 December 1939	61.5	65.0	1/01/2000 - 1/07/2001
From 1 January 1940 to 30 June 1941	62.0	65.0	1/01/2002 - 1/07/2003
From 1 July 1941 to 31 December 1942	62.5	65.0	1/01/2004 - 1/07/2005
From 1 January 1943 to 30 June 1944	63.0	65.0	1/01/2006 - 1/07/2007
From 1 July 1944 to 31 December 1945	63.5	65.0	1/01/2008 - 1/07/2009
From 1 January 1946 to 30 June 1947	64.0	65.0	1/01/2010 - 1/07/2011
From 1 July 1947 to 31 December 1948	64.5	65.0	1/01/2012 - 1/07/2013
From 1 January 1949 to 30 June 1952	65.0	65.0	1/01/2014 - 1/07/2017

Table 2 : Summary Statistics

A - ALL HOUSEHOLDS

Birth Cohort	All		1929-35		1936-40		1941-45		1946-49	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age (years)	61.9	61.9	62.4	62.4	62.1	62.1	61.9	62.0	61.3	61.3
Bachelor Degree +	0.19	0.17	0.17	0.12	0.13	0.1	0.23	0.21	0.25	0.24
Single	0.19	0.29	0.19	0.30	0.19	0.29	0.17	0.30	0.23	0.29
Household Size	1.90	1.73	1.87	1.71	1.89	1.73	1.91	1.72	1.74	1.87
Home Owner	0.85	0.85	0.84	0.85	0.87	0.86	0.86	0.85	0.83	0.86
Home Owner Without Mortgage	0.67	0.72	0.76	0.79	0.7	0.75	0.64	0.7	0.58	0.65
Observations	5,600	5,838	1,256	1,269	1,420	1,392	1,721	1,798	1,190	1,392

B- SINGLES

Birth Cohort	All		1929-35		1936-40		1941-45		1946-49	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age (years)	62.0	62.0	62.5	62.3	62.1	62.1	62.1	62.1	61.3	61.3
Bachelor Degree +	0.16	0.19	0.13	0.13	0.1	0.11	0.19	0.23	0.20	0.26
Household Size	1.02	1.02	1.03	1.03	1.01	1.02	1.01	1.02	1.03	1.03
Home Owner	0.63	0.71	0.62	0.71	0.67	0.73	0.64	0.7	0.58	0.7
Home Owner Without Mortgage	0.49	0.58	0.52	0.64	0.55	0.61	0.47	0.55	0.43	0.53
Observations	1,087	1,726	245	381	266	400	297	545	279	400

Table 3. Regression Adjusted Difference in Difference Estimate of APA Reform Impact , Single Treatment [1]

	Full Sample			Full Sample Aged 55-64	Singles Sample			Singles Sample Aged 55-64
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
After Cohort	0.034**	-0.063**	0.030	0.028*	-0.009	-0.145***	-0.097*	-0.015
(Born After July 1935)	[0.0173]	[0.028]	[0.031]	[0.016]	[0.042]	[0.058]	[0.051]	[0.032]
Treatment Group	-0.292***	-0.291***	-0.047	-0.290***	-0.223***	-0.211***	0.086	-0.218***
(Females)	[0.017]	[0.020]	[0.069]	[0.016]	[0.047]	[0.029]	[0.128]	[0.032]
Treatment Effect	0.081***	0.079***	0.035*	0.087***	0.143***	0.128***	0.060*	0.142***
(Treatment - After Cohort Interaction)	[0.023]	[0.025]	[0.021]	[0.016]	[0.049]	[0.038]	[0.034]	[0.031]
Average Cohort Participation [2] (Between Ages 40 to 45 years)			✓				✓	
Year Effects		✓	✓			✓	✓	
Observations	11,438	11,438	11,438	24,762	2,813	2,813	2,813	6,054
Adjusted R^2	0.466	0.471	0.472	0.598	0.392	0.400	0.401	0.534

1. All regressions include controls for age, educational attainment, state of residence, household size and, for the full sample, marital status.
2. Constructed from historical information in Australian Bureau of Statistics Labour Force Survey, Australia (Cat. No. 6202.0)
3. Bootstraped standard errors, based on 999 replications, are in square brackets [].
4. *** significant at 1%, ** significant at 5%; * significant at 10%

Table 4. Regression Adjusted Difference in Difference Treatment Effects by Age [1]

	Full Sample	Singles Sample	Single + Own Home Outright	Single + Bachelor degree
	(1)	(2)	(3)	(4)
AC1 (eligibility age 60.5 to 61)	-0.006	-0.057	-0.069	0.047
	[0.024]	[0.059]	[0.071]	[0.187]
AC2 (eligibility age 61.5 to 62)	0.016	0.017	-0.059	0.009
	[0.023]	[0.047]	[0.064]	[0.146]
AC3 (eligibility age 62.5 to 63)	0.04*	-0.033	-0.172*	-0.0139
	[0.021]	[0.049]	[0.083]	[0.132]
AC4 (eligibility age 63.5 to 64)	0.059***	0.012	-0.099	-0.005
	[0.021]	[0.045]	[0.062]	[0.121]
AC5 (eligibility age 64.5 to 65)	0.046*	-0.022	-0.078	0.065
	[0.024]	[0.052]	[0.077]	[0.142]
Female (TG)	-0.289***	-0.218***	-0.249***	-0.214*
	[0.02]	[0.051]	[0.052]	[0.123]
Treatment Effects				
AC1 x TG	0.037*	0.071*	0.047	-0.011
	[0.020]	[0.042]	[0.062]	[0.237]
AC2 x TG	0.071**	0.104*	0.179**	0.097
	[0.029]	[0.061]	[0.081]	[0.188]
AC3 x TG	0.032*	0.131**	0.263***	0.294*
	[0.019]	[0.062]	[0.085]	[0.167]
AC4 x TG	0.109***	0.190***	0.289***	0.272*
	[0.028]	[0.057]	[0.077]	[0.154]
AC5 x TG	0.133***	0.169***	0.213**	0.182
	[0.033]	[0.05]	[0.092]	[0.172]
Observations	11438	2813	1533	495
Adjusted R^2	0.470	0.400	0.372	0.556

Tests of Equality of Treatment Effects across Cohorts

Hypothesis	P-values			
AC1-AC5 Impacts Equal [4]	0.035	0.626	0.617	0.648
AC2-AC5 Impacts Equal [5]	0.234	0.735	0.505	0.514

Notes:

1. All regressions include controls for age, educational attainment, state of residence, household size and, for the full sample, marital status.
2. Bootstraped standard errors, based on 999 replications, are in square brackets [].
3. *** significant at 1%, ** significant at 5%; * significant at 10%
4. The null hypothesis is that the treatment effects are equal across birth cohorts. The test statistic has an F distribution with df=(5,∞)
5. The null hypothesis is that the treatment effects are equal across cohorts AC2-AC5. The test statistic has an F distribution with df=(4,∞)

Table 5. Separate Male-Female Specifications, Labor Force Participation

	Males	Females
AC1 (eligibility age 60.5 to 61)		
AC1 x (Age 60)	-0.068 [0.070]	0.050 [0.028]
AC1 x (Age 61)	-0.091 [0.058]	-0.024 [0.051]
AC1 x (Age 62)	-0.068 [0.064]	0.078 [0.048]
AC1 x (Age 63)	0.119** [0.049]	0.033 [0.030]
AC1 x (Age 64)	0.002 [0.054]	0.063 [0.047]
AC2 (eligibility age 61.5 to 62)		
AC2 x (Age 60)	-0.016 [0.059]	0.099* [0.054]
AC2 x (Age 61)	-0.0238 [0.054]	0.111** [0.049]
AC2 x (Age 62)	-0.104** [0.047]	0.121*** [0.046]
AC2 x (Age 63)	0.134*** [0.045]	0.021 [0.029]
AC2 x (Age 64)	-0.003 [0.049]	0.118*** [0.029]
AC3 (eligibility age 62.5 to 63)		
AC3 x (Age 60)	-0.041 [0.061]	0.078* [0.042]
AC3 x (Age 61)	-0.031 [0.054]	0.089* [0.046]
AC3 x (Age 62)	0.001 [0.049]	0.064 [0.044]
AC3 x (Age 63)	0.175*** [0.044]	0.048 [0.036]
AC3 x (Age 64)	0.102* [0.054]	0.113*** [0.042]
AC4 (eligibility age 63.5 to 64)		
AC4 x (Age 60)	0.084 [0.064]	0.239*** [0.060]
AC4 x (Age 61)	0.096 [0.063]	0.177*** [0.044]
AC4 x (Age 62)	0.013 [0.048]	0.273*** [0.056]
AC4 x (Age 63)	0.085** [0.037]	0.134*** [0.027]
AC4 x (Age 64)	0.035 [0.036]	0.082*** [0.027]
AC5 (eligibility age 64.5 to 65)		
AC5 x (Age 60)	-0.006 [0.058]	0.023*** [0.054]
AC5 x (Age 61)	0.0522 [0.0542]	0.158*** [0.047]
AC5 x (Age 62)	-0.105 [0.057]	0.160*** [0.056]
Observations	5600	5838
Adjusted R^2	0.450	0.343
Total Estimated Cohort Impact[4]		
AC1	-0.108 [.167]	0.199** [0.095]
AC2	-0.014 [0.119]	0.471*** [0.096]
AC3	0.202 [0.135]	0.395*** [0.095]
AC4	0.317*** [0.105]	0.906*** [0.097]
AC5	-0.046 [0.106]	0.542*** [0.094]
Estimated Average Response to Homogenous Treatment[5]		
Treatment (AC1-AC5)	0.004 [0.053]	0.180*** [0.031]

1. All regressions include controls for age, educational attainment, state of residence, household size and, for the full sample, marital status.

2. Bootstraped standard errors, based on 999 replications, are in square brackets [].

3. *** significant at 1%, ** significant at 5%; * significant at 10%

4. The total cohort impact is the sum of the treatment effects across the age categories for a cohort.

5. Estimate of Mean Impact Across Cohorts in Response to 1 Year Increase in APA.

Table 6. Difference in Difference Estimates for Labor Force Participation Impact

AC1 (eligibility age 60.5 to 61)		
AC1 x (Age 60)	0.015	[0.046]
AC1 x (Age 61)	-0.040	[0.048]
AC1 x (Age 62)	0.075	[0.051]
AC1 x (Age 63)	0.042	[0.035]
AC1 x (Age 64)	0.102**	[0.044]
AC2 (eligibility age 61.5 to 62)		
AC2 x (Age 60)	0.043	[0.040]
AC2 x (Age 61)	0.077*	[0.041]
AC2 x (Age 62)	0.095***	[0.037]
AC2 x (Age 63)	0.007	[0.037]
AC2 x (Age 64)	0.129***	[0.035]
AC3 (eligibility age 62.5 to 63)		
AC3 x (Age 60)	0.001	[0.035]
AC3 x (Age 61)	0.027	[0.047]
AC3 x (Age 62)	0.023	[0.048]
AC3 x (Age 63)	0.019	[0.046]
AC3 x (Age 64)	0.109**	[0.052]
AC4 (eligibility age 63.5 to 64)		
AC4 x (Age 60)	0.143***	[0.046]
AC4 x (Age 61)	0.103***	[0.037]
AC4 x (Age 62)	0.209***	[0.047]
AC4 x (Age 63)	0.085**	[0.040]
AC4 x (Age 64)	0.057	[0.042]
AC5 (eligibility age 64.5 to 65)		
AC5 x (Age 60)	0.147***	[0.039]
AC5 x (Age 61)	0.098**	[0.039]
AC5 x (Age 62)	0.113*	[0.067]
Age 60	0.469***	[0.037]
Age 61	0.430***	[0.040]
Age 62	0.357***	[0.035]
Age 63	0.337***	[0.034]
Age 64	0.277***	[0.038]
AC1 (eligibility age 60.5 to 61)	-0.007	[0.025]
AC2 (eligibility age 61.5 to 62)	0.016	[[0.019]
AC3(eligibility age 62.5 to 63)	0.038*	[0.022]
AC4(eligibility age 63.5 to 64)	0.058***	[0.021]
AC5 (eligibility age 64.5)	0.043	[0.027]
Female (TG)	-0.289***	[0.016]
Bachelor +	0.183***	[0.012]
Other Non-School Qualifications	0.083***	[0.011]
Household Size	0.021	[0.015]
Single	-0.016	[0.019]

Observations	11438	
Adjusted R^2	0.471	
Total Estimated Cohort Impact[4]		
AC1	0.194	[0.157]
AC2	0.351***	[0.126]
AC3	0.178	[0.155]
AC4	0.596***	[0.148]
AC5	0.358***	[0.103]
Estimated Average Response to Homogenous Treatment[5]		
Treatment (AC1-AC5)	0.130***	[0.049]

Table 7. Program Subsitution Impacts of APA Change

	Males	Females	
	Beneficiary of Any Government Program	Beneficiary of Any Government Program	Beneficiary of Any Government Programs Excluding Age Pension
	(1)	(2)	(3)
AC1 (APA 60.5 to 61)			
AC1 x (Age 60)	0.017	-0.067	0.146***
	[0.051]	[0.073]	[0.050]
AC1 x (Age 61)	0.086	0.022	0.003
	[0.055]	[0.063]	[0.017]
AC1 x (Age 62)	0.032	-0.051	-0.008
	[0.049]	[0.058]	[0.017]
AC1 x (Age 63)	-0.098*	-0.029	-0.009
	[0.054]	[0.049]	[0.014]
AC1 x (Age 64)	-0.132**	-0.016	0.007
	[0.056]	[0.051]	[0.014]
AC2 (APA 61.5 to 62)			
AC2 x (Age 60)	-0.066	-0.335***	0.184***
	[0.052]	[0.053]	[0.043]
AC2 x (Age 61)	-0.058	-0.25***	0.128***
	[0.057]	[0.063]	[0.031]
AC2 x (Age 62)	0.018	-0.063	0.047**
	[0.049]	[0.048]	[0.022]
AC2 x (Age 63)	-0.062*	-0.009	0.027*
	[0.035]	[0.029]	[0.015]
AC2 x (Age 64)	-0.063	-0.017	0.047*
	[0.043]	[0.038]	[0.028]
AC3 (APA 62.5 to 63)			
AC3 x (Age 60)	-0.036	-0.271***	0.247***
	[0.048]	[0.052]	[0.036]
AC3 x (Age 61)	-0.030	-0.324***	0.272***
	[0.050]	[0.057]	[0.033]
AC3 x (Age 62)	-0.043	-0.343***	0.161***
	[0.053]	[0.046]	[0.033]
AC3 x (Age 63)	-0.162***	-0.078	0.028
	[0.041]	[0.049]	[0.021]
AC3 x (Age 64)	-0.141	-0.056	0.041*
	[0.060]	[0.050]	[0.022]
AC4 (APA 63.5 to 64)			
AC4 x (Age 60)	-0.122***	-0.299***	0.214***
	[0.049]	[0.061]	[0.044]
AC4 x (Age 61)	-0.179***	-0.310***	0.252***
	[0.0475]	[0.054]	[0.029]
AC4 x (Age 62)	-0.126**	-0.364***	0.267***
	[0.049]	[0.047]	[0.039]
AC4 x (Age 63)	-0.128***	-0.310***	0.289
	[0.029]	[0.038]	[0.025]
AC4 x (Age 64)	-0.161***	0.002	0.108***
	[0.046]	[0.033]	[0.017]

AC5 (APA 64.5 to 65)			
AC5 x (Age 60)	-0.026	-0.226***	0.285***
	[0.049]	[0.051]	[0.032]
AC5 x (Age 61)	-0.075	-0.280***	0.291***
	[0.048]	[0.052]	[0.027]
AC5 x (Age 62)	0.069	-0.309***	0.337***
	[0.068]	[0.054]	[0.045]
Age 60	0.311***	0.560***	-0.021
	[0.056]	[0.084]	[0.05]
Age 61	0.324***	0.614***	-0.024
	[0.047]	[0.079]	[0.043]
Age 62	0.338***	0.686***	-0.013
	[0.037]	[0.073]	[0.044]
Age 63	0.434***	0.737***	-0.018
	[0.038]	[0.070]	[0.046]
Age 64	0.479***	0.748***	-0.036
	[0.042]	[0.061]	[0.042]
Bachelor +	-0.230***	-0.211***	-0.095***
	[0.014]	[0.017]	[0.012]
Other Post-School	-0.053	-0.107***	-0.035
Qualification	[0.015]	[0.019]	[0.011]
Single	0.188	0.114***	0.085***
	[0.021]	[0.037]	[0.021]
Household Size	0.009	-0.018	0.01
	[0.011]	[0.032]	[0.02]
Observations	5600	5838	5838
Adjusted R^2	0.378	0.587	0.255
Total Estimated Cohort Impact[4]			
AC1 (APA 60.5-61)	-0.091	-0.146*	0.136***
	[0.128]	[0.086]	[0.049]
AC2 (APA 61.5-62)	-0.233	-0.674***	0.435***
	[0.148]	[0.118]	[0.066]
AC3 (APA 62.5-63)	-0.419***	-1.076***	0.748***
	[0.116]	[0.084]	[0.062]
AC4 (APA 63.5-64)	-0.710***	-1.281	1.129***
	[0.125]	[0.087]	[0.076]
AC5 (APA 64.5-65)	-0.009	-0.812***	0.917***
	[0.109]	[0.106]	[0.079]
Estimated Average Response to Homogenous Treatment[5]			
Treatment (AC1-AC5)	-0.105**	-0.264***	0.213***
	[0.049]	[0.040]	[0.019]

Notes:

1. Regressions include controls for state of residence.
2. Bootstraped standard errors, based on 999 replications, are in square brackets [].
3. *** significant at 1%, ** significant at 5%; * significant at 10%
4. The total cohort impact is the sum of the treatment effects across the age categories for a cohort.
5. Estimate of Mean Impact Across Cohorts in Response to 1 Year Increase in APA.

Table 8. Disability Support Pension Program Partcipation

	Males	Females	
	All	All	Singles
	(1)	(2)	(3)
AC1 (eligibility age 60.5 to 61)			
AC1 x (Age 60)	0.004	0.063*	0.046
	[0.054]	[0.034]	[0.032]
AC1 x (Age 61)	0.003	0.010	-0.021
	[0.050]	[0.008]	[0.044]
AC1 x (Age 62)	-0.009	0.008	-0.004
	[0.051]	[0.011]	[0.010]
AC1 x (Age 63)	-0.072	-0.013*	-0.003
	[0.052]	[0.008]	[0.010]
AC1 x (Age 64)	-0.036	-0.014	-0.014
	[0.053]	[0.009]	[0.015]
AC2 (eligibility age 61.5 to 62)			
AC2 x (Age 60)	-0.061	0.105***	0.200**
	[0.054]	[0.034]	[0.078]
AC2 x (Age 61)	-0.062	0.075***	0.146
	[0.051]	[0.026]	[0.069]
AC2 x (Age 62)	0.005	0.013	0.009
	[0.040]	[0.013]	[0.021]
AC2 x (Age 63)	-0.047	0.00001	0.023
	[0.042]	[0.008]	[0.018]
AC2 x (Age 64)	0.0171	0.003	-0.003
	[0.046]	[0.008]	[0.016]
AC3 (eligibility age 62.5 to 63)			
AC3 x (Age 60)	0.0004	0.160***	0.352***
	[0.045]	[0.033]	[0.052]
AC3 x (Age 61)	-0.066	0.182	0.340***
	[0.045]	[0.031]	[0.085]
AC3 x (Age 62)	-0.029	0.129***	0.255***
	[0.042]	[0.026]	[0.070]
AC3 x (Age 63)	-0.113**	0.026	0.102**
	[0.056]	[0.020]	[0.044]
AC3 x (Age 64)	-0.024	0.005	0.052*
	[0.045]	[0.009]	[0.030]
AC4 (eligibility age 63.5 to 64)			
AC4 x (Age 60)	-0.011	0.143***	0.304***
	[0.049]	[0.040]	[0.072]
AC4 x (Age 61)	-0.102	0.143***	0.155***
	[0.044]	[0.025]	[0.053]
AC4 x (Age 62)	-0.030	0.152***	0.320***
	[0.044]	[0.029]	[0.066]
AC4 x (Age 63)	0.033	0.202***	0.325***
	[0.041]	[0.022]	[0.048]
AC4 x (Age 64)	0.051	0.025	0.051**
	[0.037]	[0.015]	[0.022]
AC5 (eligibility age 64.5)			
AC5 x (Age 60)	0.058	0.145***	0.282***

	[0.045]	[0.033]	[0.052]
AC5 x (Age 61)	0.005	0.198***	0.306***
	[0.038]	[0.027]	[0.055]
AC5 x (Age 62)	0.076	0.272***	0.458***
	[0.058]	[0.046]	[0.089]
Age 60	0.246***	-0.004	0.072
	[0.048]	[0.053]	[0.053]
Age 61	0.279***	-0.001	0.079*
	[0.043]	[0.045]	[0.044]
Age 62	0.274***	-0.012	0.058
	[0.045]	[0.042]	[0.057]
Age 63	0.321***	-0.002	0.057
	[0.044]	[0.042]	[0.048]
Age 64	0.313***	-0.005	0.058
	[0.037]	[0.004]	[0.043]
Bachelor +	-0.219***	-0.068***	-0.113***
	[0.012]	[0.010]	[0.018]
Other Post-School Qualifications	-0.068***	-0.029***	-0.027
	[0.016]	[0.010]	[0.026]
Household Size	0.004	-0.005	-0.037
	[0.013]	[0.022]	[0.039]
Single	0.129***	0.085***	
	[0.020]	[0.022]	
Observations	5600	5838	1726
Adjusted R^2	0.286	0.181	0.285
Total Estimated Cohort Impact[4]			
	Male	Female	Female Single
AC1 (eligibility age 60.5 to 61)	-0.11	0.055*	0.003
	[0.127]	[0.033]	[0.062]
AC2 (eligibility age 61.5 to 62)	-0.147	0.196***	0.377***
	[0.112]	[0.048]	[0.114]
AC3 (eligibility age 62.5 to 63)	-0.233**	0.502***	1.102***
	[0.108]	[0.045]	[0.132]
AC4 (eligibility age 63.5 to 64)	-0.059	0.665***	1.156***
	[0.108]	[0.071]	[0.143]
AC5 (eligibility age 64.5 to 65)	0.139	0.615***	1.049***
	[0.088]	[0.056]	[0.156]
Estimated Average Response to Homogenous Treatment[5]			
Treatment (AC1-AC5)	-0.049	0.122***	0.212***
	[0.041]	[0.013]	[0.027]

Notes:

1. Regressions include controls for state of residence.
2. Bootstraped standard errors, based on 999 replications, are in square brackets [].
3. *** significant at 1%, ** significant at 5%; * significant at 10%
4. The total cohort impact is the sum of the treatment effects across the age categories for a cohort.
5. Estimate of Mean Impact Across Cohorts in Response to 1 Year Increase in APA.

Appendix Table 1. Extended Specification for Multiple APA Treatment Effects

	Men	*Women*
Treatment Group x Birth Cohort: APA treatment		
AC1 (eligibility age 60.5)		
AC1 x TG x (Age 60)	-0.125 [0.080]	0.062 [0.054]
x (Age 61)	-0.192*** [0.072]	0.078 [0.060]
x (Age 62)	-0.147 [0.109]	0.061 [0.121]
x (Age 63)	0.077 [0.078]	0.049 [0.065]
x (Age 64)	0.032 [0.073]	0.016 [0.061]
AC2 (eligibility age 61)		
AC2 x TG x (Age 60)	-0.005 [0.082]	0.040 [0.078]
x (Age 61)	0.186 [0.117]	-0.120 [0.156]
x (Age 62)	-0.023 [0.066]	0.093 [0.060]
x (Age 63)	0.156** [0.072]	0.019 [0.061]
x (Age 64)	-0.009 [0.093]	0.158* [0.088]
AC3 (eligibility age 61.5)		
AC3x TG x (Age 60)	-0.002 [0.083]	0.073 [0.062]
x (Age 61)	-0.117 [0.076]	0.174*** [0.062]
x (Age 62)	-0.239* [0.145]	0.059 [0.089]
x (Age 63)	0.134 [0.064]	0.044 [0.056]
x (Age 64)	-0.077 [0.055]	0.106** [0.048]
AC4 (eligibility age 62)		
AC4 x TG x (Age 60)	-0.041 [0.081]	0.128** [0.054]
x (Age 61)	0.025 [0.091]	0.106 [0.079]
x (Age 62)	-0.047 [0.059]	0.130*** [0.042]
x (Age 63)	0.134** [0.054]	0.004 [0.049]
x (Age 64)	0.236** [0.117]	0.102 [0.091]
AC5 (eligibility age 62.5)		
AC5 x TG x (Age 60)	-0.162* [0.071]	0.072* [0.043]
x (Age 61)	-0.045 [0.062]	0.096* [0.054]
x (Age 62)	-0.142 [0.081]	0.105 [0.072]
x (Age 63)	0.170*** [0.063]	0.033 [0.050]
x (Age 64)	0.116 [0.123]	0.117 [0.093]
AC6 (eligibility age 63)		
AC6 x TG x (Age 60)	0.054 [0.068]	0.089* [0.047]
x (Age 61)	-0.129 [0.120]	0.113 [0.086]
x (Age 62)	0.060 [0.061]	0.033 [0.058]
x (Age 63)	0.140 [0.113]	0.051 [0.097]
x (Age 64)	0.059 [0.060]	0.111** [0.054]
AC7 (eligibility age 63.5)		
AC7x TG x (Age 60)	0.039 [0.70]	0.260*** [0.063]
x (Age 61)	0.262 [0.101]	0.174** [0.087]
x (Age 62)	-0.081 [0.065]	0.256*** [0.61]
x (Age 63)	0.164 [0.105]	0.204*** [0.080]
x (Age 64)	0.033 [0.054]	0.081* [0.045]
AC8 (eligibility age 64)		

AC8x TG x (Age 60)	0.107 [0.110]	0.154* [0.091]
x (Age 61)	0.023 [0.063]	0.188*** [0.051]
x (Age 62)	0.156 [0.083]	0.297*** [0.073]
x (Age 63)	0.068 [0.045]	0.114*** [0.039]
x (Age 64)	0.053 [0.163]	0.072 [0.128]
AC9 (eligibility age 64.5)		
AC9x TG x (Age 60)	0.085 [0.098]	0.328*** [0.086]
x (Age 61)	0.036 [0.059]	0.161*** [0.049]
x (Age 62)	-0.210** [0.013]	0.144** [0.068]
AC10 (eligibility age 65)		
AC10x TG x (Age 60)	-0.054 [0.063]	0.207*** [0.056]
x (Age 61)	0.078 [0.161]	0.184 [0.126]
Observations	5600	5838
Adjusted R^2	0.548	0.345
Total Estimated Cohort Impact[3]		
AC1 (eligibility age 60.5)	-0.356* [0.187]	0.263* [0.154]
AC2 (eligibility age 61)	0.304 [0.195]	-0.001 [0.173]
AC3 (eligibility age 61.5)	-0.303* [0.176]	0.455*** [0.152]
AC4 (eligibility age 62)	0.306 [0.187]	0.473*** [0.159]
AC5 (eligibility age 62.5)	-0.064 [0.186]	0.422 [0.153]
AC1 (eligibility age 63)	0.184 [0.187]	0.395** [0.164]
AC2 (eligibility age 63.5)	0.418** [0.183]	0.977*** [0.154]
AC3 (eligibility age 64)	0.407* [0.228]	0.825*** [0.187]
AC4 (eligibility age 64.5)	-0.084 [0.141]	0.633 [0.121]
AC5 (eligibility age 65)	-0.018 [0.087]	0.369*** [0.075]
Estimated Average Response to Homogenous Treatment[4]		
Treatment (AC1-AC5)	-0.022 [0.062]	0.206*** [0.054]

Notes:

1. All regressions include controls for age, educational attainment, state of residence, household size and marital status.

2. Bootstraped standard errors, based on 999 replications, are in square brackets [].

significant at 10%

4. The total cohort impact is the sum of the treatment effects across the age categories for a cohort.

5. Estimate of Mean Impact Across Cohorts in Response to 1 Year Increase in APA.