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

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SEDAP Research Paper No. 295

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

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Abstract
Identifying the effect of the financial incentives created by social security systems on the retirement behaviour of individuals requires 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 the social security benefit. We find economically significant responses to the increase in the Age Pension eligibility age. An increase in the eligibility age of 1 year induced a decline in retirement probability by approximately 10 percent. In addition, we find that the social security 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 functioned as an alternative source for funding retirement.

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Résumé

Identifier l'effet des incitations financières créées par les systèmes de sécurité sociale sur le comportement de départ à la retraite exige un choc exogène de certains paramètres du programme. Dans cet article, nous étudions la réforme des retraites publiques de 1993 en Australie. Cette dernière introduisit une augmentation de l'âge d'éligibilité aux prestations des retraites publiques des femmes. Nous trouvons un effet statistiquement significatif de l'augmentation de l'âge d'éligibilité des retraites publiques. En particulier, chaque année additionnelle entraîne une baisse d'environ 10 pourcent de la probabilité de départ à la retraite. En outre, nous observons de même que la réforme de la sécurité sociale induit d'importants effets de substitution. La hausse de l'âge d'admissibilité de la retraite publique a eu pour conséquence involontaire, d'entrainer une augmentation des inscriptions à d'autres programmes d'assurance sociale, en particulier la pension de soutien d'un handicap, qui devint une source alternative du financement de la retraite.

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 of the programs, 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 evaluated 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 first tier Age Pension payments. The change to the Age Pension eligibility age represents a reduction in the social security wealth of later cohorts of women and provides an ideal natural experiment to study the incentives of the Age Pension program on retirement behavior. We use this policy experiment to study 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 worker's retirement decision is 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 exists if social security benefit payments increase with prior contributory earnings. In this case, an extra year of work also increases the future stream of expected social security benefits. Workers considering the optimal timing of retirement will take account of the effect of an extra year of work on the level of retirement income when s/he eventually retires. This effect is referred to as the "accrual effect" and works in the opposite direction of the "wealth effect."

A distinctive feature of the Australian Age Pension program is that is a non-contributory scheme, as 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 systems to quantify the behavioural effects 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[1]. These studies, summarised 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 over time.

One potential solution is to use natural experiments 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 Normal Retirement Age (NRA) in the United States, on the retirement behaviour of individuals. He compares the labour force behaviour of "treated cohorts" with

[1]This includes studies that use the Stock and Wise (1990) "option value" framework in which researchers estimate the effect of social security programs on retirement by estimating reduced form models that incorporate both "incentives for continuing work" and measures of income security. The common element of these reduced form studies is that they include a key explanatory variable which captures the incentive effects of income security programs (one year accrual, peak value, option value). These studies face the common criticism that they may capture cross-sectional variation in preferences rather than the variation in retirement incentives or budget constraint parameters.

earlier cohorts that were not affected by the increase in NRA. Mastrobuoni (2009) finds a substantial impact of the reform on retirement behaviour. He also underlines another advantage of the natural experiments 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).

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) look at the same US 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 unique 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 10 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, such as 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 tiers or "pillars". First is a means-tested public Age Pension; the second pillar is a mandatory employer contribution to 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 "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, constituting 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 the introduction of good and service tax. 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[2].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 above these amounts. The asset test depends on the home ownership status of the recipient. 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). Assets over these amounts reduce pension benefits by $1.50 per fortnight for every $1,000 above the disregard level. In 2008, two-thirds of all Age Pension recipients received the maximum pension payment.[3]

Eligibility for the Age Pension is subject to residency and age requirements. Individuals need to have been resident in Australia for 10 years prior to application. There

[2]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.

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

are different age requirements for male and female applicants. Since inception, the Age Pension qualifying age for men has remained at 65 years of age. 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 years (and will be 65 years in 2013).

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 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 the 1st July 2013. As seen from Table 1, the eligibility age for women increased by six months every 2 years since mid-1995.

[Table 1 here]

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.[4]

This reform to the Australian social security system represents an unambiguous decline in the social security wealth of women, which is expected to lead to an adjustment in the timing of their retirement. We show the effect of the pension age reform using a simple life-cycle model, expanding on that presented in Burbidge and Robb (1980). Assume that the life-time utility of an individual is given by:

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

[4]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.

where V is the value of lifetime utility discounted with the rate of time preference δ. We assume 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 $U^w = U(C_t, 0)$ 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:

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

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:

$$U_C^W = U_C^R = U_C = \mu \qquad (3)$$

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

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

[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

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.

[Figure 1: Maximisation 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 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 $\frac{\partial R^*}{\partial t_q} = \frac{\partial R^*}{\partial SSW} . \frac{\partial ASSW}{\partial t_q} > 0$, so that the optimal retirement age increases with an increase in the pension qualifying age (a decrease in the public Age Pension wealth). 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 the program rules.

In addition to a direct impact on the labour force participation of affected cohorts of women, the Age Pension reform may have other, 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.

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

3 DATA AND EMPIRICAL METHODS

3.1 Data and Sample Construction

Our empirical analysis is based on ten cross sections (1994/95 to 2007/08) 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 every fiscal year (for example from July 1994 to June 1995). As a result, our ten cross sections overlap 15 calender years from 1994 to 2008.[7] The IHCS are a rich data source that contains detailed information on individual demographic characteristics, 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 analysing the effects of Age Pension age on retirement decisions.

A limitation of the IHCS data for our purpose is the lack of an exact birth date variable. The data contain information about the quarter of the interview (September, December, March, June) and the individual's age at the time of the interview, but not the 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 a possible 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 report no post-school qualification in our sample. 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 IHSC data sets, there is a variable that indicates the 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 categorises including Age Pension, Disability Support Pension, and a range of additional income support programs.

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

This information is used in the analysis of program substitution effects.

The main sample analysed is composed of individuals who are aged 60 to 64 years old.[8] This restricts the sample to individuals born between 1929 and 1948. This sample represents the set of individuals at risk of retirement and most likely impacted by the Age Pension reform;[9] this sample also contains six birth cohorts that were not affected by the Age Pension reform (by virtue of being born before July 1935). The main sample for the analysis contains observations on 4487 women and 4442 men. Table 1 presents summary statistics for the sample by birth-cohort year. 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.

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 from the IHCS data. It is clear that our pooled data sample replicates the macro trends observed in aggregate data.

[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 the cohort differences. In order to investigate this in detail, we divide the data from the IHCS into birth cohorts. Figure 2 shows the participation rates by age for each birth cohort of males and females.

[8] We excluded immigrants that arrive to Australia less than 10 years from the time of interview. Those people are not eligible to receive age pension benefits because of the residency requirements. 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 analyse the wider age range (55 to 64) as a part of the robustness test.

[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, contrary 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 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.

In Figures 4 and 5 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 program. As expected, participation rates are decreasing across younger cohorts (because of 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. The second category excludes the Age Pension from the set of government programs; in contrast to the first graph, this graph shows that participation rates in other income support programs combined by more recent cohorts of women to be substantially greater than that for previous cohorts, specifically for at ages of 60 years and higher. Figure 4c 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. From examining male participation we see no cohort differences, neither for all government programs collectively[11] nor specifically for the Disability Support Pension. Thus these enrolment trends for women aged 60 and above strongly suggest that Age Pension reform has an effect on program substitution.

[Insert Figures 4 and 5. Government Program Participation]

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

[11] For men this also provides the counterpart to Graph 4b, 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

As explained in Section 2.1, the reform increased the Age Pension eligibility age (APA) from 60 years for women born prior to 1st July1935, by 6 months for each subsequent 18-month birth cohort, up to 65 years for women born after 1st January 1949. This increase in APA effectively represents a decline in the social security wealth of women. 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 this natural experiment by using 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 the 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.

[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.

Finally, the main concern is whether our control group – male cohorts – constitute a 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, it is more restrictive in terms of separating general time effects from the impact of the APA reform.

We estimate a probit model for an individual's binary choice of whether or not to participate in the labour force. It is specified as follow:

$$\Pr(LFP_i = 1) = \Phi\left(\beta x_i + \alpha_0 Female_i + \alpha_1 CohortA_i + \delta\left[Female_i \times CohortA_i\right] \times age_i\right) \tag{5}$$

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.[13] We substitute this indicator variable with a set of 5 variables in the section on robustness checks: one for individuals whose eligibility age is 60.5-61 (who were born between 01/07/1935 and 30/6/1938), one for individuals whose eligibility age is 61.5-62 (who were born between 01/07/1938 and 30/06/1941), one for individuals whose eligibility age is 62.5-63 (who were born between 01/07/1941 and 30/06/1944), one for individuals whose eligibility age is 63.5-64 (who were born after 01/07/1944 prior to 30/06/1947) and one for individuals whose

[13] 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.

eligibility age is 64.5 (those born after 01/07/1947).[14] We expect this variable (as well as each of the differential treatment indicators) to have a positive coefficient since recent cohorts have higher participation profiles. 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. In addition, we interact the treatment effect with the age dummy variable; this specification allows the treatment effect to vary the propensity to participate in the labour market differently at each age. Since the younger cohorts face higher APAs than older cohorts, 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).

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" are uniformly distributed 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:[15]

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

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

We also estimate equation 6 separately for men and women, in the following form

$$\Pr(LFP_i = 1) = \Phi\left(\beta x_i + \sum_{i=60}^{64} age_i(\alpha_0 + \sum_{t=1}^{5} \delta_{Age_i Cohort_t} \Pr(CohortA_t^* = 1)\right) \tag{7}$$

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 $\delta_{Age_i Cohort_t}$in this equation measures the change in the likelihood of being in the labour force between the treated cohorts and non-treated cohort at a specific age. The identification assumption in this specification is that, after controlling for observable characteristics, the cohort differences in the participation rates should be driven by Age Pension reform. Thus we

[14] In the appendix we also present the results where we use variables for each 18 months treatment group to test the internal validity of our results.

[15] 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.

test for a "placebo effect" with the male cohorts, and expect to find no effect, while finding significant effects for the treated cohorts of women.[16]

We also use this specification to investigate potential program substitution impacts. The fact that men and women exhibit quite different trends in participation in government programs (figures 4 and 5) implies that the difference-in-difference strategy that uses males as a control group may be misleading in this context. Therefore we utilize equation (3) and substitute the dependent variable in this equation with indicator variables that represents the individuals' participation in 'any government program', 'any government program except Age Pension' and 'Disability Support Pension program.' The identification assumption in this specification is that after controlling the observable characteristics, the 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. Further, if the 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 in all ages rather than only at the ages affected by the reform. In the next section we present the estimation results.

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. There are five specifications in the table; all of the specifications control for age, education, marital status, state of residence and household size.[17] The first column is the basic specification and compares the difference in the labour force participation of elderly women and elderly men, across the cohorts that are affected and unaffected by the reform. The coefficient on the treatment dummy variables (female) is significantly negative, and the coefficient on the

[16] 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.

[17] The results for covariates are not reported for the brevity of the tables and available upon request from authors. In summary as expected, being less educated, and being older, reduce the probability of labour force participation.

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. To help interpret the magnitude of the impact, we calculate the average treatment effect on the treated which corresponds to the marginal effect averaged over the treatment group. Our results show that the difference-in-difference estimate of the APA reform on the cohorts of affected women led to an economically significant increase in labour force participation of 10 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, thus we allow for differential macroeconomic shocks for women and men, with the estimation results presented in column (2). The difference-in-difference estimate is 3 percentage points smaller than our base specifications but remains statistically significant. Since most of our treatment groups are included from surveys prior to 1998, this decline is not surprising. In the third column, we introduce a constructed variable which measures the labour force participation of each birth cohorts at the age of 40.[18] We introduce this variable as a way to control for cohort heterogeneity, and to test whether an APA reform effect is evident after conditioning on mean differences in prior labour force experience for male and female birth cohorts. As presented in the column (3), this difference-in-difference estimate is smaller to our base specifications but still remains economically and statistically significant. The inclusion of this cohort and gender specific labour force history variable leads to a reduction in the coefficient on the treatment (female) dummy variable. Model specifications in columns (4) and (5) of table 3 report estimates based on different subsamples of observations. Column (4) is for the restricted sample of single men and women. The results for this subsample are stronger compared to the base specification; this is not surprising because although there is no difference in participation rates between single and married women, married men had higher participation rates than married women during the observation. Column (5) 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. Overall, the results from the robustness checks indicate the analysis is not sensitive to modelling of time trends for men and women nor to the sample composition by marital status or age range. The set of treatment impacts based on specifications allowing for a

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

uniform treatment effect indicate a statistically significant increase on the labour force participation of approximately 10 percentage points.

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. Alternatively, 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 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 to decide when to retire. According to this notion, the APA reform causes a change in a 'social norm,' 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 this expanded specification. The interaction terms of the different cohort dummy variables with gender capture the APA treatment impact on specific cohorts of women. In specification (2) we further interact the APA treatment effect with age variables; these additional terms capture age-cohort specific difference-in-difference effects. There are two important patterns revealed by the results shown in this table. First, the treatment effect is much more pronounced in the younger cohorts, consistent with the magnitude of the wealth effects of the APA changes and contrary to the effect hypothesised by Mastrobuoni (2009). Second, the increase in labour forces participation is common to all ages and it does not peak at the APA threshold. For example, the group of women faced with a new eligibility age 61.5-62 years, the difference-in-difference estimates show that the Age Pension reform causes statistically significant increase of 14 percentage points participation of labor force at age 64 in this group.[19] In

[19]In the appendix table 1, we test the robustness of our results first by introducing 9 treatment groups and secondly by estimating equation 7, for men and women separately. The results are consistent with

conclusion we find a significant effect of Age Pension reform on the women's participation to labor force, our estimates show that there is an increase at each ages and cohorts. In the next subsection we investigate the effect of the reform on the individual's decision to participation in other 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 this model for men and women separately. Table 5 presents the coefficient estimates for the indicator variables that represent the individuals' participation 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 the graphs and Appendix Table 1). 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 last column, which presents the results for participation in any government program apart from the Age Pension, shows 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 12 percentage points. For the cohort with eligibility age 61.5 to 62 years, the participation in other programs increased by 24 percentage point at age 60 and 12 percentage points at age 61. Furthermore, there is no 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 all cohort.

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our findings in Table 4, the signs and magnitudes stays the same as our base specification when we introduce 9 treatment groups, though some coefficients lose their significance due to the reduction in the number of observation in several age - cohort cells. When we estimate the Mastrabouni specification, we see significant effects on the female group and not in the male group. For the male group the coefficients for the young ages are negative and close to zero, for the old ages the coefficient becomes positive (and sometimes significant). This validates our difference-in-difference strategy and implies that our results are a lower bound for the treatment effect at older ages.

The variation in participation rates by age across cohorts is aligned with the Age Pension reform.

In Table 6, we present the results on the participation specifically 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 some 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 model. First, there is no placebo effect for men; the coefficient estimates are small, very close to zero and generally statistically insignificant.[20] For women, there is a significant increase in participation at the ages directly impacted affected by reform, and no effect at the other ages. The average treatment effect of the APA reform on disability support participation is approximately 10 percentage points on average, and is significantly larger for younger cohorts over the affected ages.

4.3 Further Sensitivity Tests

As we outlined, the Age Pension reform raised the qualifying age by six months for each subsequent 18 month birth cohort. This implies that we have actually 9 treatment groups in our data sample. In our main results we used 5 treatment groups rather than 9 because of cell sample sizes; for some birth cohort-age cells we have low numbers of observations, with some less than 50. In the appendix table 1, we present estimates of the labour force participation equations with 9 treatment groups. The estimations results fully accord with our main findings. The sign and magnitude of the treatment impacts stay the same as our base specifications, though the estimates are not as precise as evident by the larger standard errors.

There may be a remaining concern with common trend assumption in our difference-in-difference empirical strategy. As illustrated in the figures, throughout our observation

[20] For two cohort there was a negative effect at a specific age - which coincided with a higher incidence of labour force participation at those ages.

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 (3) for male and female groups separately. As seen in appendix table 2, the male group coefficients are generally insignificant, for the more recent cohorts the coefficients tend to be positive while or prior cohorts they are negative and close to zero. When we investigate the female group, the results are actually larger than our difference-in- difference results, especially for more recent cohorts and at older ages. These validate our base specifications, and suggest that if anything, our identification strategy is conservative and that our difference-in-difference results may represent the lower bound of the policy impact.[21]

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 10 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 30 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 analyse 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 cohort. 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 an ideal natural experiment for assessing the impact of the change in this key program

[21]We re-estimated the program participation equations by using the difference-in-difference estimator. As expected this also resulted in larger estimates of the treatment impact than reported for our base specification. This is not surprising as can be seen from figure 4 and 5, the male and female program participation trends are moving in opposite directions.

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 approximately 10 percent 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 insurance, that may have unintentionally functioned as a alternative source of income support for retirement.

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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 - 1/07/2015

Table 2 : Summary Statistics

Birth Cohort	All		1929-35		1936-40		1941-45		1946-48	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Age (years)	61.9	61.9	62.4	62.4	62.1	62.1	61.6	61.6	60.5	60.5
Bachelor Degree +	0.18	0.15	0.17	0.12	0.13	0.1	0.23	0.21	0.24	0.24
Single	0.18	0.29	0.19	0.3	0.19	0.29	0.17	0.29	0.22	0.27
Household Size	1.90	1.73	1.87	1.71	1.89	1.73	1.93	1.78	1.92	1.76
Observations	4,442	4,487	1,256	1,269	1,420	1,392	1,504	1,540	249	299

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

	Full Sample			Singles	Aged 55-64 Sample
	(1)	(2)	(3)	(4)	(5)
After Cohort	0.08*	-0.11	-0.08	-0.01	0.06
(Born After July 1935)	[0.05]	[0.10]	[0.10]	[0.11]	[0.04]
Treatment Group	-0.95***	-1.02***	-0.13	-0.76***	-0.93***
(Females)	[0.06]	[0.16]	[0.62]	[0.13]	[0.06]
Treatment Effect	0.31***	0.24**	0.21*	0.52***	0.33***
(Treatment - After Cohort Interaction)	[0.07]	[0.11]	[0.12]	[0.15]	[0.07]
Average Treatment Effect on Treated	0.10	0.07	0.06	0.16	0.09
Constructed Variable (Average Cohort Participation Rates betwen age 40 to 45 years)			✓		
Year Effects		✓	✓		
Observations	8929	8929	8929	2129	19859

Notes:

1. All regressions include controls for age, educational attainment, marital status, state of residence and household size.
2. Constructed Variable is calculated by using the information from the Australian Bureau of Statistics' Labour Force Survey, Australia (Cat. No. 6202.0)
3. Bootstraped Standard Errors (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)			(2)	
AC1 (eligibility age 60.5 to 61)	-0.02			-0.02	
	[0.06]			[0.07]	
AC2 (eligibility age 61.5 to 62)	0.04			0.04	
	[0.06]			[0.06]	
AC3(eligibility age 62.5 to 63)	0.10*			0.10*	
	[0.06]			[0.06]	
AC4(eligibility age 63.5 to 64)	0.26***			0.25***	
	[0.08]			[0.08]	
AC5 (eligibility age 64.5)	0.48**			0.47**	
	[0.21]			[0.22]	
Female (TG)	-0.93***			-0.93***	
	[0.06]			[0.07]	
APA Treatment Effect		***ATET***			***ATET***
AC1 x TG	0.20**	0.06	AC1 x TG x (Age 60)	0.22	0.07
	[0.1]			[0.14]	
			AC1 x TG x (Age 61)	0.04	0.01
				[0.16]	
			AC1 x TG x (Age 62)	0.30*	0.09
				[0.17]	
			AC1 x TG x (Age 63)	0.13	0.04
				[0.16]	
			AC1 x TG x (Age 64)	0.3	0.09
				[0.19]	
AC2 x TG	0.31***	0.09	AC2 x TG x (Age 60)	0.30**	0.09
	[0.09]			[0.14]	
			AC2 x TG x (Age 61)	0.39***	0.11
				[0.15]	
			AC2 x TG x (Age 62)	0.39***	0.11
				[0.14]	
			AC2 x TG x (Age 63)	0.05	0.02
				[0.13]	
			AC2 x TG x (Age 64)	0.47***	0.14

				[0.14]	
AC3 x TG	0.23**	0.07	AC3 x TG x (Age 60)	0.19	0.05
	[0.09]			[0.12]	
			AC3 x TG x (Age 61)	0.26**	0.08
				[0.13]	
			AC3 x TG x (Age 62)	0.18	0.05
				[0.15]	
			AC3 x TG x (Age 63)	0.11	0.03
				[0.15]	
			AC3 x TG x (Age 64)	0.42***	0.12
				[0.15]	
AC4 x TG	0.45***	0.13	AC4 x TG x (Age 60)	0.46***	0.13
	[0.11]			[0.14]	
			AC4 x TG x (Age 61)	0.38***	0.11
				[0.13]	
			AC4 x TG x (Age 62)	0.58***	0.17
				[0.17]	
			AC4 x TG x (Age 63)	0.41*	0.12
				[0.24]	
AC5 x TG	0.25	0.07	AC5x TG x (Age 60)	0.25	0.07
	[0.29]			[0.29]	
Observations	8929			8929	

Notes:

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

2. Bootstraped Standard Errors (999 replications) are in Square Brackets

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

Table 5. Program Subsitution Impacts of APA Change

	Males		Females			
	Benficiary of Any Government Program		Benficiary of Any Government Program		Beneficiary of Any Government Programs Excluding Age Pension	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
AC1 (eligibility age 60.5 to 61)						
AC1 x (Age 60)	0.0423	0.015	-0.0294	-0.01	0.440**	0.122
	[0.180]		[0.190]		[0.202]	
AC1 x (Age 61)	0.127	0.044	0.138	0.046	-0.0855	-0.024
	[0.168]		[0.166]		[0.196]	
AC1 x (Age 62)	-0.0249	-0.009	-0.232	-0.077	-0.352*	-0.098
	[0.155]		[0.169]		[0.203]	
AC1 x (Age 63)	-0.264**	-0.092	-0.117	-0.39	0.159	0.044
	[0.133]		[0.147]		[0.164]	
AC1 x (Age 64)	-0.342**	-0.119	-0.191	-0.063	-0.382*	-0.106
	[0.153]		[0.172]		[0.201]	
AC2 (eligibility age 61.5 to 62)						
AC2 x (Age 60)	-0.129	-0.045	-0.332*	-0.11	0.898***	0.248
	[0.175]		[0.184]		[0.194]	
AC2 x (Age 61)	-0.0972	-0.034	-0.494***	-0.165	0.438**	0.121
	[0.161]		[0.154]		[0.172]	
AC2 x (Age 62)	0.0477	0.0167	-0.323**	-0.107	-0.146	-0.041
	[0.134]		[0.141]		[0.161]	
AC2 x (Age 63)	-0.210*	-0.073	-0.102	-0.034	0.0609	0.017
	[0.111]		[0.127]		[0.150]	
AC2 x (Age 64)	-0.0865	-0.03	-0.145	-0.048	-0.0362	-0.01
	[0.122]		[0.132]		[0.143]	
AC3 (eligibility age 62.5 to 63)						
AC3 x (Age 60)	-0.0745	-0.026	-0.293*	-0.098	0.950***	0.263
	[0.160]		[0.167]		[0.178]	
AC3 x (Age 61)	-0.0376	-0.013	-0.261*	-0.087	1.280***	0.354
	[0.145]		[0.141]		[0.156]	
AC3 x (Age 62)	-0.123	-0.043	-0.574***	-0.191	0.775***	0.215
	[0.139]		[0.147]		[0.152]	
AC3 x (Age 63)	-0.502***	-0.175	-0.256*	-0.085	0.0308	0.009
	[0.150]		[0.146]		[0.177]	

AC3 x (Age 64)	-0.311**	-0.108	-0.356**	-0.119	-0.0650	-0.018
	[0.141]		[0.147]		[0.165]	
AC4 (eligibility age 63.5 to 64)						
AC4 x (Age 60)	-0.134	-0.047	-0.515***	-0.172	0.732***	0.203
	[0.177]		[0.181]		[0.191]	
AC4 x (Age 61)	-0.545***	-0.189	-0.785***	-0.261	0.656***	0.182
	[0.157]		[0.142]		[0.156]	
AC4 x (Age 62)	-0.223	-0.077	-0.845***	-0.281	0.831***	0.23
	[0.157]		[0.168]		[0.172]	
AC4 x (Age 63)	-0.715***	-0.249	-1.093***	-0.364	0.809***	0.224
	[0.272]		[0.232]		[0.252]	
AC5 (eligibility age 64.5)						
AC5 x (Age 60)	-0.364	-0.127	-1.174***	-0.391	0.0628	0.017
	[0.264]		[0.263]		[0.268]	
Age 60	-0.548***	-0.19	0.255	0.085	-1.258***	-0.349
	[0.184]		[0.272]		[0.279]	
Age 61	-0.444***	-0.154	0.356	0.119	-1.400***	-0.388
	[0.158]		[0.249]		[0.257]	
Age 62	-0.359**	-0.124	0.636***	0.212	-1.305***	-0.362
	[0.146]		[0.246]		[0.250]	
Age 63	-0.0533	-0.019	0.705***	0.235	-1.540***	-0.427
	[0.138]		[0.245]		[0.252]	
Age 64	-0.0499	-0.017	0.835***	0.278	-1.319***	-0.365
	[0.140]		[0.241]		[0.241]	
Bachelor +	-0.719***	-0.25	-0.751***	-0.25	-0.466***	-0.129
	[0.0593]		[0.0576]		[0.0667]	
Other Post-School Qualification	-0.227***	-0.079	-0.289***	-0.096	-0.00979	-0.003
	[0.0446]		[0.0582]		[0.0630]	
Single	0.518***	0.18	0.417***	0.139	0.326***	0.09
	[0.0766]		[0.120]		[0.120]	
Household Size	0.0954*	0.033	-0.0136	-0.005	0.0767	0.021
	[0.0534]		[0.111]		[0.111]	
Observations	4442		4487		4487	

Notes:

1. Regressions include controls for state of residence.
2. Bootstraped Standard Errors (999 replications) are in square brackets [].
3. *** significant at 1%, ** significant at 5%; * significant at 10%

Table 6. Disability Support Pension Program Partcipation

	Males		Females	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
AC1 (eligibility age 60.5 to 61)				
AC1 x (Age 60)	0.0002	0.0004	0.602*	*0.064*
	[0.196]		[0.335]	
AC1 x (Age 61)	0.0193	0.005	0.332	0.035
	[0.181]		[0.408]	
AC1 x (Age 62)	-0.0217	-0.006	16.11	1.71
	[0.167]		[862.7]	
AC1 x (Age 63)	-0.213	-0.061		
	[0.144]			
AC1 x (Age 64)	-0.117	-0.033		
	[0.161]			
AC2 (eligibility age 61.5 to 62)				
AC2 x (Age 60)	-0.235	-0.067	0.856***	*0.091*
	[0.194]		[0.318]	
AC2 x (Age 61)	-0.210	-0.06	1.015***	*0.108*
	[0.176]		[0.338]	
AC2 x (Age 62)	0.0228	0.007	16.32	1.736
	[0.145]		[862.7]	
AC2 x (Age 63)	-0.145	-0.041	-0.400	-0.042
	[0.119]		[0.430]	
AC2 x (Age 64)	0.0463	0.013	0.242	0.257
	[0.129]		[0.389]	
AC3 (eligibility age 62.5 to 63)				
AC3 x (Age 60)	-0.0124	-0.004	1.127***	*0.119*
	[0.173]		[0.296]	
AC3 x (Age 61)	-0.253	-0.072	1.583***	*0.168*
	[0.161]		[0.320]	
AC3 x (Age 62)	-0.109	-0.031	17.34	1.844
	[0.153]		[862.7]	
AC3 x (Age 63)	-0.341**	-0.097	0.398	0.042
	[0.165]		[0.314]	
AC3 x (Age 64)	-0.0880	-0.025	0.185	0.019
	[0.150]		[0.430]	
AC4 (eligibility age 63.5 to 64)				
AC4 x (Age 60)	0.00410	0.001	1.021***	*0.109*
	[0.190]		[0.310]	
AC4 x (Age 61)	-0.389**	-0.11	1.414***	*0.15*
	[0.170]		[0.320]	
AC4 x (Age 62)	-0.0398	-0.011	17.47	1.858
	[0.170]		[862.7]	
AC4 x (Age 63)	-0.143	-0.041	1.641***	*0.175*
	[0.290]		[0.349]	
AC5 (eligibility age 64.5)				
AC5 x (Age 60)	-0.177	-0.05	1.188***	*0.126*
	[0.282]		[0.376]	

Age 60	-0.617***	-0.176	-1.509***	-0.161
	[0.204]		[0.571]	
Age 61	-0.514***	-0.147	-1.821***	-0.194
	[0.175]		[0.578]	
Age 62	-0.531***	-0.151	-17.89	-0.185
	[0.163]		[862.7]	
Age 63	-0.380**	-0.108	-1.737***	-0.211
	[0.154]		[0.545]	
Age 64	-0.394**	-0.112	-1.982***	-0.055
	[0.155]		[0.562]	
Bachelor +	-0.891***	-0.254	-0.521***	-0.055
	[0.0725]		[0.108]	
Other Post-School	-0.264***	-0.075	-0.295***	-0.031
Qualifications	[0.0478]		[0.108]	
Single	0.339***	0.096	0.242	0.026
	[0.0840]		[0.254]	
Household Size	-0.00206	-0.0005	-0.371	-0.039
	[0.0612]		[0.246]	
Observations	4442		4487	

Notes:

1. Regressions include controls for state of residence.

2. Bootstraped Standard Errors (999 replications) are in Square Brackets

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

Appendix Table 1. Extended Specification for Multiple APA Treatment Effects

	Coefficient	*ATET*
Birth Cohorts		
AC1 (eligibility age 60.5)	-0.13	
	[0.09]	
AC2 (eligibility age 61)	0.12	
	[0.09]	
AC3 (eligibility age 61.5)	-0.08	
	[0.08]	
AC4 (eligibility age 62)	0.15*	
	[0.08]	
AC5 (eligibility age 62.5)	-0.03	
	[0.08]	
AC6 (eligibility age 63)	0.21***	
	[0.08]	
AC7 (eligibility age 63.5)	0.23**	
	[0.09]	
AC8 (eligibility age 64)	0.26**	
	[0.13]	
AC9 (eligibility age 64.5)	0.46**	
	[0.23]	
Treatment Group (Female)	-0.93***	
	[0.07]	
Treatment Group x Birth Cohort	**APA treatment effect**	**ATET**
AC1 x TG x (Age 60)	0.37**	0.11
	[0.19]	
x (Age 61)	0.50***	0.15
	[0.19]	
x (Age 62)	0.4	0.12
	[0.34]	
x (Age 63)	0.33	0.1
	[0.24]	
x (Age 64)	0.18	0.05
	[0.25]	
AC2 x TG x (Age 60)	0.05	0.01
	[0.20]	
x (Age 61)	-1.71	-0.49
	[1.62]	
x (Age 62)	0.25	0.07
	[0.21]	
x (Age 63)	-0.06	-0.02
	[0.23]	
x (Age 64)	0.54*	0.16
	[0.30]	
AC3x TG x (Age 60)	0.33	0.10
	[0.22]	
x (Age 61)	0.70***	0.20
	[0.19]	
x (Age 62)	0.31	0.09
	[0.30]	
x (Age 63)	0.25	0.07
	[0.20]	

x (Age 64)	0.55**	0.16
	[0.22]	
AC4 x TG x (Age 60)	0.27	0.08
	[0.21]	
x (Age 61)	0.23	0.07
	[0.25]	
x (Age 62)	0.34**	0.1
	[0.18]	
x (Age 63)	-0.1	-0.03
	[0.18]	
x (Age 64)	0.27	0.08
	[0.32]	
AC5 x TG x (Age 60)	0.28*	0.08
	[0.17]	
x (Age 61)	0.39**	0.11
	[0.17]	
x (Age 62)	0.47**	0.14
	[0.24]	
x (Age 63)	0.22	0.07
	[0.18]	
x (Age 64)	0.67*	0.20
	[0.49]	
AC6 x TG x (Age 60)	0.11	0.03
	[0.16]	
x (Age 61)	0.16	0.05
	[0.26]	
x (Age 62)	-0.01	0.00
	[0.19]	
x (Age 63)	0.18	0.05
	[0.35]	
x (Age 64)	0.27	0.07
	[0.20]	
AC7x TG x (Age 60)	0.52***	0.15
	[0.16]	
x (Age 61)	0.42	0.12
	[0.27]	
x (Age 62)	0.73***	0.21
	[0.21]	
x (Age 63)	0.35	0.1
	[0.31]	
AC8x TG x (Age 60)	0.38	0.11
	[0.30]	
x (Age 61)	0.36**	0.10
	[0.22]	
x (Age 62)	0.01	0.00
	[0.77]	
AC9 TG x (Age 60)	0.33	0.10
	[0.34]	

Notes:

1. Regressions include controls for age, education , marital status, state of residence and

2. Bootstraped Standard Errors (999 replications) are in square brackets [].

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

Appendix Table 2. Separate Male-Female Specifications, Labor Force Participation

	MALE		FEMALE	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
AC1 (eligibility age 60.5 to 61)				
AC1 x (Age 60)	-0.06	-0.02	0.185	0.053
	[0.08]		[0.203]	
AC1 x (Age 61)	-0.02	-0.01	-0.0681	-0.019
	[0.02]		[0.182]	
AC1 x (Age 62)	-0.179	-0.07	0.293	0.084
	[0.152]		[0.185]	
AC1 x (Age 63)	0.310**	0.12	0.148	0.042
	[0.132]		[0.164]	
AC1 x (Age 64)	-0.01	0.00	0.309	0.089
	[0.153]		[0.195]	
AC2 (eligibility age 61.5 to 62)				
AC2 x (Age 60)	-0.0587	-0.02	0.330*	0.095
	[0.170]		[0.195]	
AC2 x (Age 61)	-0.0769	-0.03	0.348**	0.1
	[0.155]		[0.164]	
AC2 x (Age 62)	-0.025	-0.01	0.443***	0.127
	[0.131]		[0.153]	
AC2 x (Age 63)	0.361***	0.136	0.123	0.035
	[0.111]		[0.143]	
AC2 x (Age 64)	-0.023	-0.009	0.530***	0.152
	[0.122]		[0.145]	
AC3 (eligibility age 62.5 to 63)				
AC3 x (Age 60)	-0.121	-0.046	0.279	0.08
	[0.155]		[0.178]	
AC3 x (Age 61)	-0.0808	-0.03	0.287*	0.083
	[0.139]		[0.152]	
AC3 x (Age 62)	0.00900	0.003	0.272*	0.078
	[0.133]		[0.161]	
AC3 x (Age 63)	0.440***	0.166	0.218	0.062
	[0.144]		[0.161]	
AC3 x (Age 64)	0.257*	0.097	0.516***	0.148
	[0.138]		[0.162]	
AC4 (eligibility age 63.5 to 64)				
AC4 x (Age 60)	0.168	0.063	0.704***	0.202
	[0.172]		[0.189]	
AC4 x (Age 61)	0.265*	0.099	0.533***	0.153
	[0.145]		[0.148]	
AC4 x (Age 62)	-0.0637	-0.024	0.826***	0.237
	[0.149]		[0.175]	
AC4 x (Age 63)	0.375	0.141	0.682***	0.196
	[0.252]		[0.247]	
AC5 (eligibility age 64.5)				
AC5 x (Age 60)	0.365	0.138	0.694***	0.199
	[0.254]		[0.254]	
Age 60	0.0466	0.017	-1.155***	-0.332
	[0.180]		[0.279]	
Age 61	-0.104	-0.039	-1.190***	-0.342
	[0.153]		[0.253]	
Age 62	-0.202	-0.076	-1.445***	-0.416
	[0.142]		[0.251]	
Age 63	-0.594***	-0.223	-1.495***	-0.43
	[0.136]		[0.250]	
Age 64	-0.584***	-0.219	-1.692***	-0.487
	[0.138]		[0.247]	
Bachelor +	0.349***	0.132	0.589***	0.169
	[0.0535]		[0.0575]	
Other Non-School Qualifications	0.206***	0.078	0.309***	0.089
	[0.0439]		[0.0607]	

Single	-0.277***	-0.105	0.239**	0.068
	[0.0753]		[0.120]	
Household Size	0.0672	0.025	0.103	0.03
	[0.0521]		[0.111]	
Observations	4,442		4,487	

1. Regressions also include controls for the state of residence.
2.*** significant at 1%, ** significant at 5%; * significant at 10%

Figure 1: Maximisation Problem and Shift in Wealth Constraint

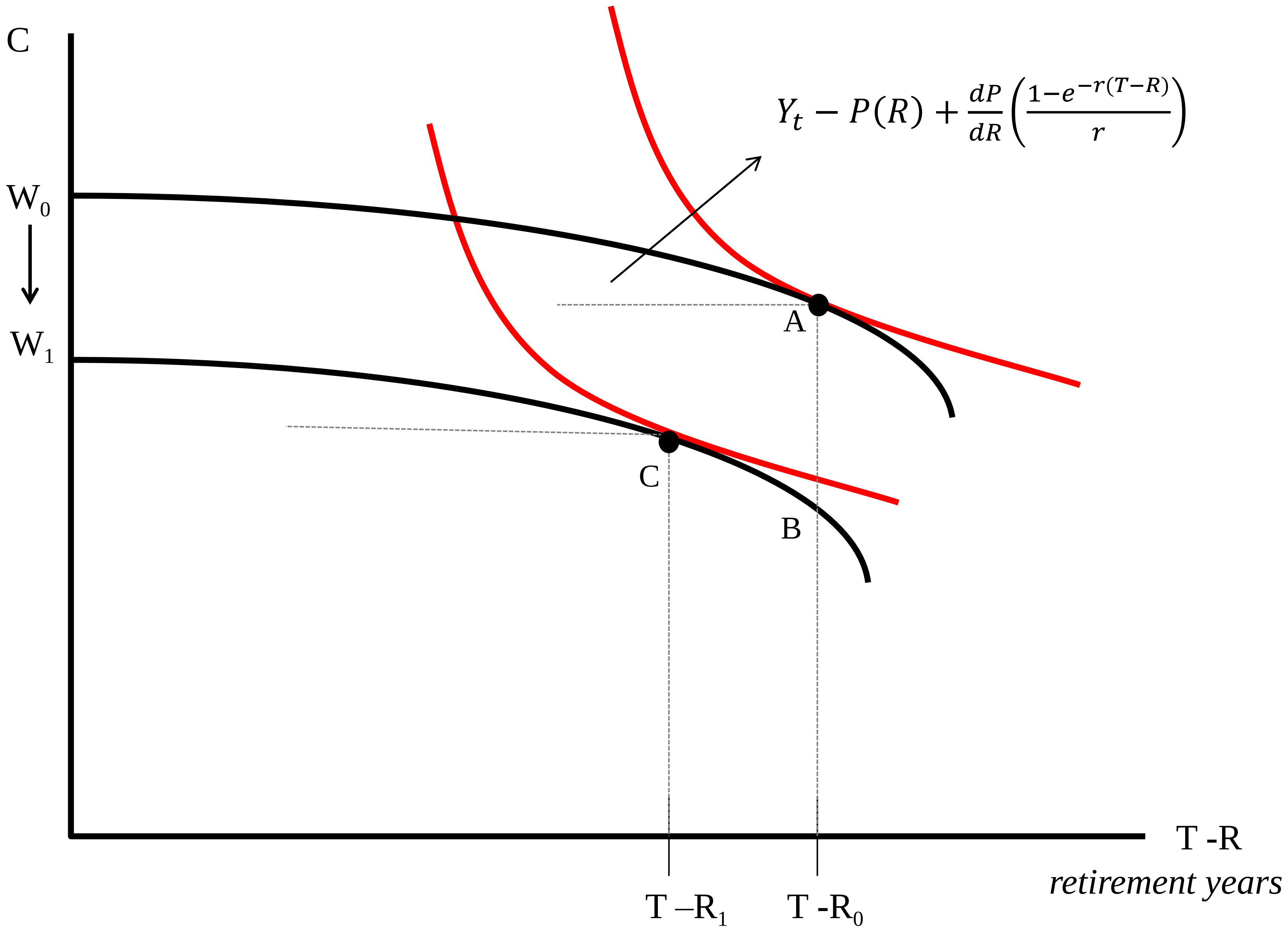


Figure 2 : Participation Rates by Year, Aggregate Time Series and Micro data

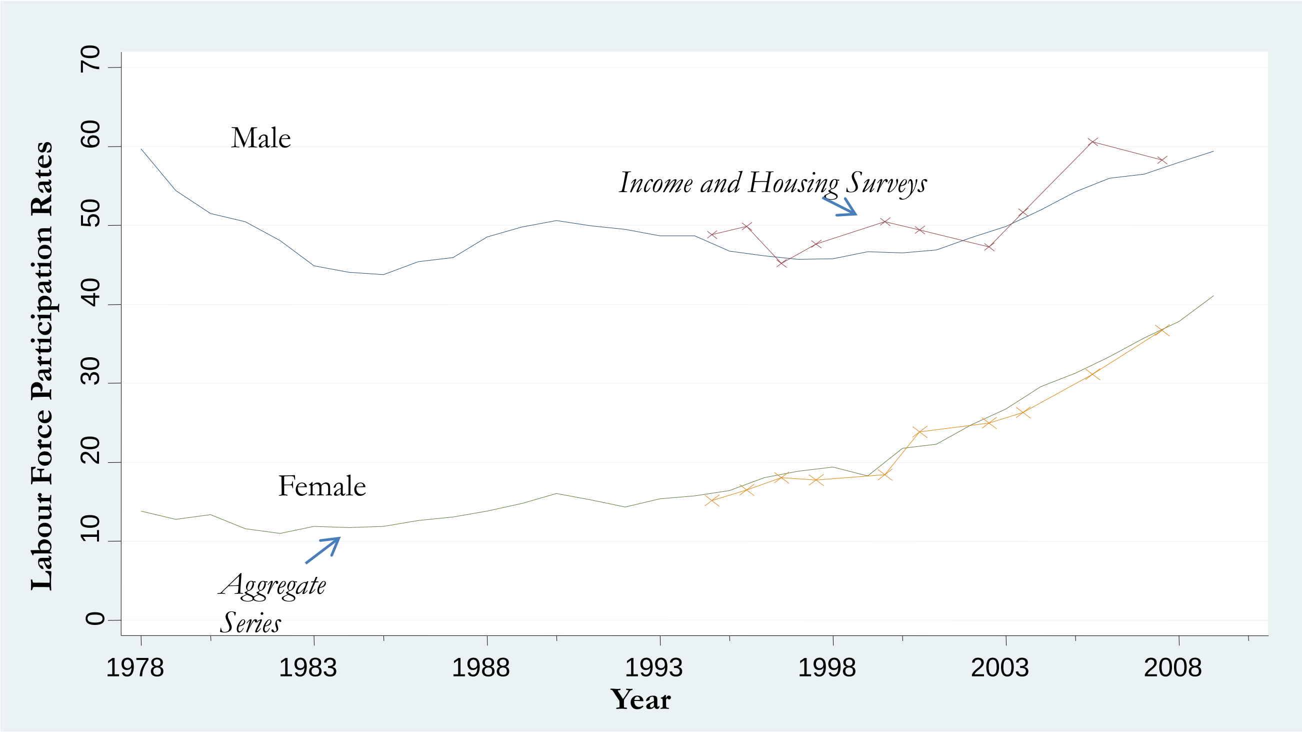


Figure 3: Cohort Participation Rates, for Male and Female

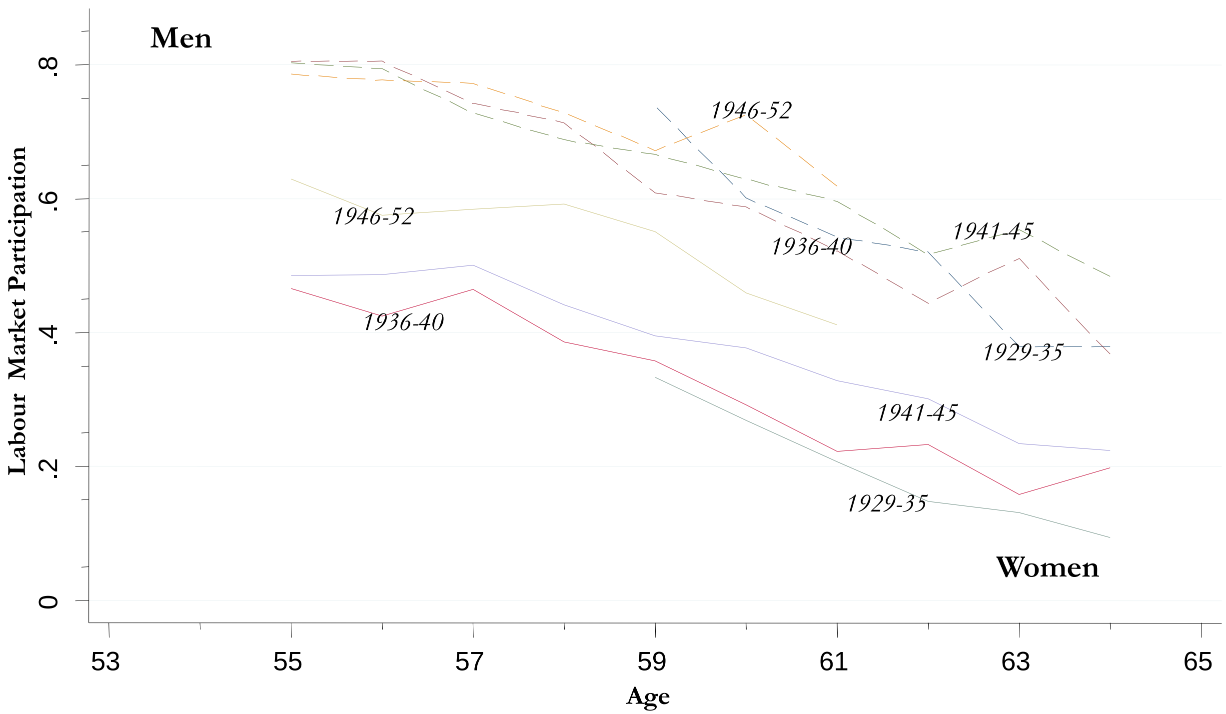
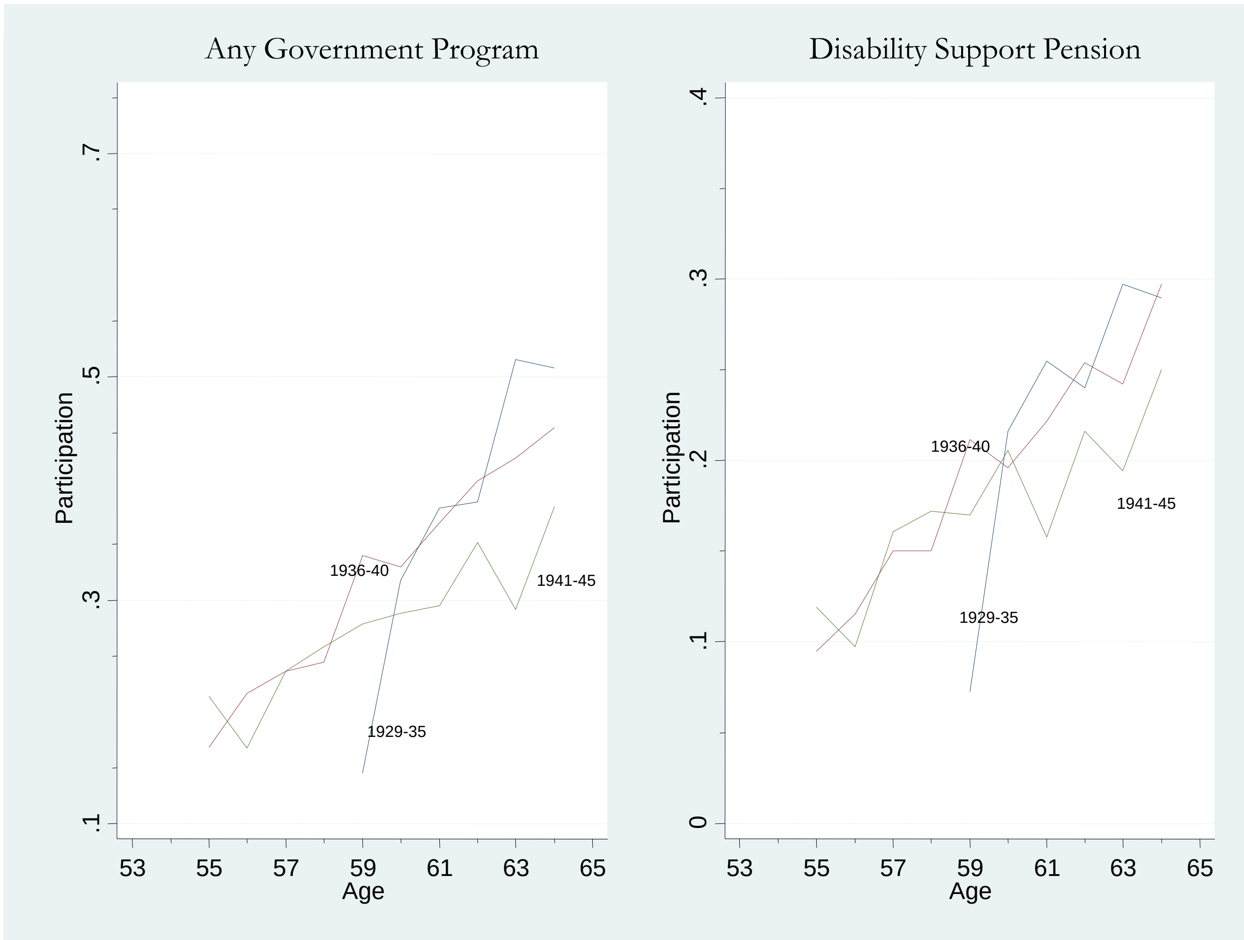


Figure 4: Female Government Program Participation

Figure 5: Male Government Program Participation



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