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Do earned income tax credits for older workers prolong labor market participation and boost earned income? Evidence from Australia's mature age worker tax offset

TTPI - Working Paper 15/2018
July 2018

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Abstract

We examine Australia's Mature Age Worker Tax offset (MAWTO), a targeted earned income tax credit of up to $500 to incentivize participation of older workers that existed from 2004-05 to 2014-15. Using a difference-in-differences approach, we find that MAWTO increased labor market participation by around 0.5 percentage points. For women only, it had a small impact on earnings of about 1.5 per cent. We estimate that the average cost for each person induced to work longer is between $37,000 and $78,000.

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1 Introduction

The Mature Age Worker Tax Offset (MAWTO) was an Australian Government Earned Income Tax Credit (EITC) which intended to encourage older workers to prolong their time in the labor market. It was introduced on 1 July 2004 and was available for 10 years before it was repealed on 1 July 2014. Similar to EITCs in other countries, the MAWTO, described in detail in section 3, reduced the tax liability of workers who met certain eligibility requirements. Official government estimates indicate that the MAWTO cost the Australian Government just over $4.3 billion in forgone tax revenue over the 10 years it was available (Department of the Treasury (2015b)).

In this paper we test the effects on participation and income of the MAWTO using administrative data from the Australian Taxation Office (ATO). We use the universe of tax return data from tax-filers combined with population estimates from the Australian Bureau of Statistics to estimate the number of non-tax filers. We use a difference-in-differences (D-i-D) approach to compare the changes in participation and earnings for people aged 54 (who don't qualify) and 55 years (who did qualify when the policy was in place) by comparing periods before and after the introduction of the policy. Similarly, we repeat this analysis in the MAWTO's final year to examine the effect of repealing the MAWTO on participation and earnings.

We find small effects of the MAWTO. On average, across men and women and across both time periods, we find that the MAWTO increased participation by about 0.5 percentage points. These average results mask some heterogeneity. The effect is larger and statistically significant for men at the introduction of MAWTO; for women it is smaller and not statistically significant. Conversely, the effect is larger and statistically significant for women when measured at the cessation of the program; for men it is smaller and not statistically significant.

The findings are robust to different definitions of 'working' and, at program introduction, to extending the treatment and control groups to 24-months around the program thresholds rather than 12-months. Placebo tests in the years immediately surrounding those years where we find significant effects lend support to our conclusion that the MAWTO had small, but significant effects. Placebo tests in other years are not informative given policy volatility before and after MAWTO's establishment.

Interestingly, the labor market behaviour of individuals born in 1947 (the baby boom peak year) appears different than those born in adjacent years. In addition to being greater in number, their participation rates at ages above 50 are higher than those of other birth years. This group turned 55 two years before the introduction of the MAWTO and using them as a control group introduces violations of the common trends assumption. Our paper thus also highlights the danger of using D-i-D if common trends fail to hold.

This paper makes three contributions. First, we contribute to the international literature on the effect of tax system design on participation of older workers. This question is of global policy interest as countries in Europe and Asia, particularly, deal with ageing workforces, lengthening life expectancy, and relatively static retirement ages.

Precise estimates of the effect of EITCs on sub-groups of workers are of broad interest. EITCs are being suggested as instruments which could be useful to transition disabled workers off of income support towards the labor market. In the US, MDRC is trialing an expansion of EITCs to childless workers (see `http://paycheckplus.mdrc.org`).

The second contribution is that we provide a precise estimate of the effect of the MAWTO on participation and earnings using Australian administrative data. Third, we use our results to provide an average cost estimate for each worker the program induced to remain in the workforce for longer. We discuss the savings from the program's elimination and discuss how these might compare to the benefits of the program.

2 Background

Australia's ageing population poses a demographic challenge shared by many developed countries. The elderly dependency rate[1] is projected by the Australian government to increase from 23 percent in 2015 to 37 percent by 2055[2]. Responding to the increasing demand for services which older citizens typically rely upon brings fiscal challenges. Big ticket items, such as pensions, public health and aged care services, are expected to place additional stress on public sector budgets over a period when there is expected to be an increasingly smaller share of people working and paying income taxes.

Chapman and Leigh (2009) observe that the taxation system has increasingly been used for purposes traditionally administered by the transfer system. EITCs, education credits and child credits are examples of programs commonly administered through the taxation system. The tax system can be an efficient mechanism to administer targeted incentives. First, there are administrative efficiencies from leveraging off existing systems and, second, the reporting burden on individuals is lessened given much of the information required for means testing is already captured in the tax return. In cases where additional information is required, tax return documents can be amended or more detailed schedules added. It is important to note, however, that even well intentioned policy interventions can create economics distortions and unintended consequences[3].

A downside of using the tax system to administer such programs is that the benefits are typically transferred after the financial year in which the benefit was earned. This introduces a timing delay issue which may impede the intended effect of the program.

In other developed countries, EITCs are typically used to incentivize labor market partic-

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[1]The elderly dependency rate is defined as the proportion of the elderly population (65 and over) to the working population (15 to 64 years)

[2]Author calculations derived from Department of the Treasury (2015a) data, p.99

[3]Auerbach (2006) provides an overview on distortions. Eissa and Hoynes (2004), in an example of unintended consequences, find that the EITC in the United States results in reduced labor supply of married couples.

ipation for lower income cohorts, with no qualifying age restrictions (see Hotz and Scholz (2003) and Leigh (2007)). Public perceptions of these programs are usually favourable given they are designed to encourage labor market engagement, rather than simply to transfer payments to the needy (see Hotz and Scholz (2003)). The key difference with the MAWTO is the attempt to influence the labor supply of individuals approaching retirement. The decision to work for this cohort is relatively more complicated due to various stage-of-life factors that may not necessarily be financial. For example, an individual's health status and their desire for more leisure time may be important for some individuals. Older workers are also more likely to have accumulated wealth which may reduce the attractiveness of a modest tax credit.

Theory predicts that EITCs increase labor supply (extensive margin) because they provide a financial benefit that can only be accessed through work. Theory is ambiguous with respect to the intensive margin. Individuals may choose to work less if they have the flexibility to do so. In theory, a person could maintain the previous year's income by using the EITC to make up the lost income from the hours no longer worked.

3   The Mature Age Worker Tax Offset

A tax filer qualified for a non-refundable MAWTO credit of up to \$500[4] if she met three eligibility tests. First, an individual must be classified as an Australian resident for tax purposes. Second, the person had to be at least 55 years old by the end of the tax lodgement year (30 June in Australia). Third, only people with 'net income from working' (NIFW) between zero and \$58,000 were eligible for the tax credit. NIFW is defined in detail below.

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[4]We note that the MAWTO is actually worth more than this in cash equivalent terms. This is because an additional \$500 of income attracts tax at a person's marginal rate. For example, in 2004-05 a person with taxable income of \$50,000 attracted a marginal rate of 30 cents per additional dollar earned. This meant the cash equivalent of a \$500 rebate was just over \$714 (\$500 \div (1 - 0.3)).

When introduced, MAWTO had a phase-in range below $10,000 and phase-out range above $48,000; see Table 1. The income threshold was increased to $63,000 from the second year in order to match the cut-off between the third and fourth tax brackets in the personal income tax system (see Figure 1). Over the next 8 years, there were no further changes to the MAWTO thresholds. There were however numerous changes to the income tax schedule, in the form of tax cuts, during this period. Appendix Table A.1 contains a list of the major tax policy changes during this period.

The Australian government began phasing out the MAWTO from 1 July 2012, as a savings measure, by preventing access to taxpayers who were 55 or older on or before 30 June 2012 (who would have otherwise qualified for the first time).[5] Importantly for our study, the minimum age consequently increased to 56 in 2012-13 and 57 in 2013-14 (see Table 2) during the MAWTO phase-out period. The MAWTO was repealed effective from 1 July 2014, following recommendations from an Australian Government review of the tax and transfer system.[6]

Table 1: MAWTO schedule, 2004-05

Net income from working[1]	MAWTO ($)
$0 or less	Nil
$0 to less than $10,000	5% of 'net income from working'
$10,000 to less than $48,000	$500
$48,000 to less than $58,000	$500 − [5% · ('net income from working' − $48,000)]
$58,000 and above	Nil

[1] From the 2005-06 financial year the $500 upper NIFW threshold was extended from $48,000 to $53,000. The $10,000 phase-out range then started from $53,000 and ended at $63,000.

Conceptually, NIFW included all income that is a reward for personal effort or skills (as opposed to passive income flows), less any related deductions. The ATO automatically calculated NIFW on an individual's behalf from information entered on the tax return.

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[5]The Government's Budget Papers estimated a saving of $40 million and $85 million in the respective financial years before the MAWTO was repealed on 1 July 2014 as a result of the age change.

[6]Department of the Treasury (2009) – *Australia's Future Tax System, Report to the Treasurer, Part Two – Detailed analysis*, Canberra, Australia. The review recommended that MAWTO be removed because it was unclear whether it was achieving its intended goal, and that the public money saved from its abolition should be directed towards more effective ways of encouraging labor market participation. In this instance, the review recommended lower tax rates and a higher tax-free threshold.
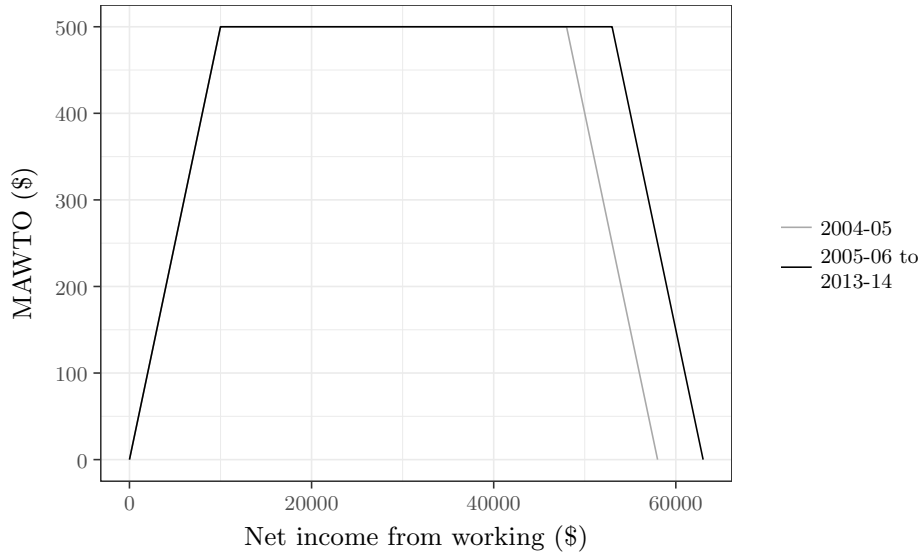
Figure 1: The Mature Age Worker Tax Offset

The specific NIFW components in the first and final year of the MAWTO are shown in Tables 3 and 4, respectively. Taxpayers who were self-employed or had partnership income from their business were required to complete a supplementary schedule to declare the share of this income that related to personal effort or skill (noting that this was reported elsewhere on the return but in aggregate form). This component of income is captured under item (11) in Table 3.

The official definition of NIFW broadened over time. In 2009-10 the definition was expanded to include reportable employer superannuation contributions and the total assessable discount amount from employee share schemes. Later years saw some further, minor refinements to superannuation income to account for concessionally taxed contributions. The analysis in this paper uses the initial NIFW definition, presented in Table 3, for the years 2001 through 2009. We use the final definition of 2013-14, shown in Table 4, for years 2010 and later.

In summary, it is important to highlight two things. First, taxpayers were unlikely to be able to precisely estimate the value of their MAWTO credit due to the complexity

Table 2: MAWTO qualifying age threshold

Financial year	Born before (birth date)	Minimum age (year of age)
2004-05	1 July 1950	55
2005-06	1 July 1951	55
2006-07	1 July 1952	55
2007-08	1 July 1953	55
2008-09	1 July 1954	55
2009-10	1 July 1955	55
2010-11	1 July 1956	55
2011-12	1 July 1957	55
2012-13	*1 July 1957*	*56*
2013-14	*1 July 1957*	*57*
2014-15	MAWTO was abolished	

of the NIFW definition and the fact that this value did not appear anywhere on an individual's tax return but was calculated in the background by the ATO. Secondly, the MAWTO was a non-refundable tax credit. Some qualifying individuals may thus not have been able to use all of their tax credit. Both of these aspects could be expected to dampen the behavioural effects of the policy.

4 Related Literature

Hotz and Scholz (2003) review the evidence from studies of the EITC in the United States. This review was later updated by Nichols and Rothstein (2015). Eissa and Hoynes (2006) provided a review of the major lessons from EITCs over the previous two decades. There is strong consensus that EITCs have a positive impact on labor supply (the extensive margin). Eissa and Liebman (1996) and Meyer and Rosenbaum (2001) find strong responses for single mothers in the United States, following an expansion of the EITC in 1986. Similarly, Leigh (2007) finds that the 1999 expansion to the United Kingdom's EITC raised labor participation rates, hours and earnings. Labor supply responses can, however, go in the opposite direction for some cohorts. Eissa and Hoynes (2004) detect a negative impact of the EITC in the US on married couples. The

Table 3: 'Net income from working', 2004-05 to 2008-09 ATO definition

	Net income from working	
=	Total gross salary and wage payments	(1)
+	Income from allowances, earnings, tips, director's fees etc.	(2)
+	Attributed personal services income	(3)
+	Total reportable fringe benefits (RFB) amounts (if RFB >= RFB threshold)	(4)
−	Work related car expenses	(5)
−	Work related travel expenses	(6)
−	Work related clothing expenses	(7)
−	Work related self education expenses	(8)
−	Other work related expenses	(9)
−	Low value pool deduction[1]	(10)
+	Net income from working (supplementary section)[2]	(11)

[1] Low value pool deductions refer to 'low-cost' and 'low-value' assets used in the course of generating income. These are assets the cost less than \$1,000 which can be depreciated over multiple tax lodgement years.

[2] NIFW (supplementary section) refers to business and partnership income that is derived from working.

authors find that, while participation increased slightly for married men, the response from married women resulted in a net reduction in labor supply of married couples. The EITC worked as a subsidy for married mothers to stay at home.

There is mixed evidence of an impact of EITCs on individuals who are already in the labor market. Most studies find little or no evidence of intensive margin effects on labor supply. Nichols and Rothstein (2015) identify more recent studies that found small intensive margin effects when using a structural approach, as opposed to the more commonly used D-i-D approach. They argue that the D-i-D approach confounds the true intensive margin responses because the mean hours of those who were influenced by the policy are overwhelmed by the hours worked of the larger share of individuals who did not change working behaviour. Chetty et al. (2013) develop a framework for estimating the intensive margin by accounting for EITC knowledge across neighbourhoods. They find intensive margin effects similar in size to those found for the extensive margin.

Eissa and Hoynes (2006) review several explanations offered for why a change in hours is not observed in practice. First, it may be that the elasticity of hours worked is too small

Table 4: 'Net income from working' components, 2013-14 definition

	Net income from working	
=	Total gross salary and wage payments	(1)
+	Income from allowances, earnings, tips, director's fees etc.	(2)
+	Attributed personal services income	(3)
+	Total reportable fringe benefits (RFB) amounts (if RFB >= RFB threshold)	(4)
+	Total assessable discount amount[1]	(5)
+	Excess concessional contributions amount for income	(6)
+	(Reportable employer superannuation contributions – Excess concessional contributions amount for income) (if result < 0 then set to 0)	(7)
–	Work related car expenses	(8)
–	Work related travel expenses	(9)
–	Work related clothing expenses	(10)
–	Work related self-education expenses	(11)
–	Other work related expenses	(12)
–	Low value pool deduction[2]	(13)
+	Net income from working (supplementary section)[3]	(14)

[1] This item relates to the discount amount for Employee Share Schemes.
[2] Low value pool deductions refer to 'low-cost' and 'low-value' assets used in the course of generating income. These are assets the cost less than $1,000 which can be depreciated over multiple tax lodgement years.
[3] NIFW (supplementary section) refers to business and partnership income that is derived from working.

to be precisely estimated using quasi-experimental approaches. Second, workers may find it difficult to manipulate hours worked as these are often determined by work-place norms or salaried hours. Third, the authors acknowledge possible survey measurement error for hours worked, which is much less likely to be a problem for the extensive margin. Finally, there may be a lack of taxpayer understanding of the structure of the EITC schedule to optimize behaviour. Wishing to test this hypothesis, Chetty et al. (2009) ran a randomized control trial to test the knowledge of EITC recipients in the United States. The authors noted that people are often aware of the EITC, but find they do not take the schedule into consideration when making marginal earnings decisions.

Finally, **?**, using survey data from Australia, investigate the factors that influence older workers to retire. They show that there is a large degree of heterogeneity and many different factors that can influence the pathway to retirement. These tend to differ between men and women. Factors that relate to financial security rank highly (particularly

whether an individual has reached the eligibility age for a pension or the preservation age to access retirement savings) but non-financial factors also play a role. This is consistent the the Australian Bureau of Statistics (2016) *Retirement and Retirement Intentions* survey which shows physical health or the simple desire for more leisure time are important factors. This suggests that small, targeted tax incentives, like the MAWTO, may have only limited appeal.

5 Data

The data for this analysis draws upon de-identified administrative data from the ATO and official population estimates (Australian Bureau of Statistics (2017)). We exclude non-residents from the sample because they are not eligible for the MAWTO. In addition, we exclude tax filers who passed away before the beginning of a given financial year and had a tax return lodged on their behalf.[7]

We use the ATO's Income Tax Return (ITR) database to capture the share of the population who filed a tax return. Using these data we can classify those who worked and those who did not according to the specific sources of their income (discussed in section 6.2). We account for the small share of individuals who worked but did not file an ITR by adding those whose employers paid Pay-As-You-Go (PAYG) withholding tax instalments that correspond to salary or wage payments. All individuals with this income are assumed to have worked in the given financial year. We then account for the residual non-working population by topping up our sample to match the aggregate population counts, as published by the Australian Bureau of Statistics (ABS). Table 5 illustrates how the different data sources are combined to account for the entire population of workers and non-workers under examination for this analysis. The data was extracted

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[7]This only affects a very small share of tax filers. Filing can occur beyond death as estates continue to accrue tax liabilities on passive income flows until the estate is dissolved.

from ATO's systems on 30 November 2017.

A trade-off with the augmented data approach is that, apart from sex, we have no control variables for the non-working individuals accounted for by the residual population estimates. For the 'earned income' regression analysis, however, we can draw upon limited demographic data available in the income tax return.

Table 5: Data sources – accounting for the entire population

	Worked	Did not work
Lodged	Income tax return data	Income tax return data
Did not lodge	PAYG payment summary data (for salary or wage payments only)	Residual population calculated from ABS estimates

Using this approach, we compile a database for a period that spans 15 financial years, from 2000-01 to 2014-15, for people aged 53 to 58 years by the end of a given financial year[8]. The period captures the fours years before the MAWTO was implemented, along with a single year after it was abolished. This enables us to examine high-level trends in labor supply rates and earned income before focussing on the specific years and age cohorts used for the main analysis.

A limitation of the ATO data is that a measure for hours worked (intensive margin) is not available. We do, however, examine the impact of the MAWTO on 'earned income'. The effect of the MAWTO on 'earned income' is of interest as any possible changes in earnings are likely to influence people's welfare.

Compared with survey data, administrative data are better suited for this study because they provide (i) a more accurate and detailed picture of income sources; (ii) a precise amount of MAWTO actually received; and (iii) a much larger sample than is typically available in survey data, enabling precise estimation. A trade-off of using administrative data is the extremely limited number of demographic control variables.

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[8]There are 23.7 million observations over the period which matches, by construction, the ABS population estimates.

6 Identification strategy

6.1 A quasi-experiment: difference-in-differences

We use a D-i-D approach to detect the labor supply and earned income effects of the MAWTO. We compare the difference in outcomes for 55 and 54 year olds under the MAWTO to the same difference for years before the MAWTO existed. We also employ this strategy at the point where MAWTO was discontinued by comparing people aged 56 (control) and 57 years (treatment) in the final year of the MAWTO (2013-14) to the following year when the MAWTO was no longer in force.

In all of our analysis, we present separate estimation for males and females. Details of the analysis where we pool all individuals are available from the authors. The labor force participation rates of males and females are quite different during this time period. Also because of the increase in women's labor force participation over time for this cohort of women, male and female participation rates are evolving differently at the time of the MAWTO. It thus makes sense to consider the two groups separately.

As we have a very crisp age cut-off, it may at first appear that a regression discontinuity design (RDD) would be preferable in this situation. Individuals born on 1 July 1950 (who do not qualify for MAWTO in 2004-2005) are probably a good control group for those born on 30 June 1950 (who do quality) and we do know exact birth dates of individuals. However, we only measure income and labor supply over the 12 month window and when comparing 54 to 55 year olds, for any year, we see a rapid drop-off in labor force participation and a more gradual drop-off in earnings around these ages.[9] This drop-off begins around age 50 and continues through the seventies.

The key identifying assumption is common trends–that the evolution of labor force par-

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[9]Figures 8 and 9 show the gap between participation rates for 54 and 55 year-olds as measured in the tax data.

ticipation rates as individuals age from 54 to 55 which we observe in the pre-MAWTO period provides a valid counter-factual for what this trend would have been once MAWTO was in place. We similarly require common trends for 56 to 57 year-olds when MAWTO is discontinued. We present graphical evidence for common trends in section 8.2.

Once we take into account year-on-year wage inflation, the control and treatment groups are very similar.[10] Tables 6 and 7 show descriptive statistics separately by gender for the year before MAWTO's introduction (control period) and the year of its introduction (treatment period). Tables 8 and 9 show descriptive statistics in the years around MAWTO's cessation. This also gives us considerable confidence in our identification strategy as there do not appear to be any large compositional changes in the population which coincide with the introduction and cessation of MAWTO. This is not surprising given that we are using the entire universe of administrative tax records.

Key to identification is that no other factors affected the two groups over the periods examined. For the initial introduction of MAWTO, we are confident that this assumption is plausible upon reviewing other Government policy announcements and macroeconomic factors in the periods we are examining. There is, however, a complication in detecting the impact of the MAWTO in its final year as the government announced the 'Restart' program which came into effect from 2014-15; the financial year immediately after the MAWTO was abolished. This program paid qualifying employers $10,000 if they hired a job seeker aged 50 or over who had been on income support for at least six months. The effect on our estimates is likely to be very small since the majority of workers getting the MAWTO are not exiting long income support spells.

The age threshold provides a suitably sharp boundary to assign treatment that is almost impossible for an individual to manipulate. In order to manipulate one's age, a person would have to dishonestly notify the ATO that their age has been recorded incorrectly

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[10]The NIFW 1 indicator of 'net income from working' is dissimilar due to its construction as explained in section 6.2.

and provide official supporting evidence.[11] There is no evidence that individuals lied about their age to access MAWTO.

Given the lack of policy change and the similarity in our two groups, we have considerable confidence in our identification strategy. We further test its validity by examining different measures of labor supply and earned income; by extending the control and treatment groups to people aged up to 24 months either side of the qualifying age threshold; and by running placebo-like tests in periods where there was no treatment. We discuss these in section 8.1.

6.2 Measures of labor supply and earned income

The ATO data does not directly classify individuals as working or not. We derive indicators for working based upon the 'earned income' fields on the tax return. We derive four different measures of 'working'. Having multiple measures will provide some insight on the relative sensitivity of our results to alternative definitions of working.

Under each measure, an individual is classified as working if she or he had any income derived from personal effort or skills. We can not observe anything about hours worked and the definitions of working apply equally to someone who worked one hour as to someone who worked full-time during the entire year.

We can observe dollar values of income for the reporting period and assign these, at least to some degree, to income from working. The data include a very small number of individuals who report negative income according to our definition of income derived from personal effort or skills.[12] We include these individuals as 'working' and note that our ability to perfectly identify income from 'working' is limited.

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[11] The ATO requires at least one of the following supporting documents: an Australian birth certificate, an Australian passport, an Australian visa or an Australian drivers licence or permit.

[12] As described below these individuals have business and partnership income from the supplementary section of the tax return and have negative income if business expenses were greater than income.

Table 6: Summary statistics before and after the MAWTO's introduction, males

	Control period 2003–04		Treatment period 2004–05	
	Mean	Std. dev	Mean	Std. dev
ITR, PAYG *plus* ABS estimates				
Income year	2003-04	0.00	2004-05	0.00
Age at 30 June	54.49	0.50	54.50	0.50
Employment rates				
NIFW indicator 1	0.69	0.46	0.75	0.43
NIFW indicator 2	0.82	0.38	0.83	0.38
NIFW indicator 3	0.69	0.46	0.70	0.46
Salary & wage indicator	0.66	0.47	0.68	0.47
Earned income				
NIFW 1 ($)	50,136	57,444	52,788	63,767
NIFW 2 ($)	48,318	69,208	51,856	68,930
NIFW 3 ($)	50,136	57,444	53,149	60,964
Salary & wage ($)	507,17	54,358	53,503	57,546
Observations (number)	252,364	na	254,926	na
Income tax return observations only				
Income year	2003-04	0.00	2004-05	0.00
Age at 30 June	54.49	0.50	54.50	0.50
Employment rates				
NIFW indicator 1	0.77	0.42	0.85	0.36
NIFW indicator 2	0.94	0.24	0.94	0.25
NIFW indicator 3	0.77	0.42	0.78	0.42
Salary & wage indicator	0.75	0.44	0.76	0.43
Earned income				
NIFW 1 ($)	51,150	57,976	53,731	64,432
NIFW 2 ($)	49,007	69,912	52,627	69,650
NIFW 3 ($)	51,150	57,976	54,240	61,611
Salary & wage ($)	51,821	54,795	54,671	58,096
Controls				
Reported spouse	0.56	0.50	0.59	0.49
Self-prepared tax return	0.19	0.39	0.20	0.40
Remoteness				
Major cities	0.68	0.47	0.68	0.47
Inner regional	0.20	0.40	0.21	0.40
Outer regional	0.09	0.29	0.09	0.29
Remote & very remote	0.02	0.13	0.02	0.13
Not available	0.01	0.09	0.01	0.09
Observations (number)	215,279	na	218,756	na

Note: The *Earned income measures* show the mean and standard deviation for working individuals only. The number of observations can be calculated by multiplying the relevant 'Participation measure' by the number of observations in a given year.

Table 7: Summary statistics before and after the MAWTO's introduction, females

	Control period 2003–04		Treatment period 2004–05	
	Mean	Std. dev	Mean	Std. dev
ITR, PAYG *plus* ABS estimates				
Income year	2003-04	0.00	2004-05	0.00
Age at 30 June	54.49	0.50	54.50	0.50
Employment rates				
NIFW indicator 1	0.62	0.49	0.67	0.47
NIFW indicator 2	0.70	0.46	0.71	0.45
NIFW indicator 3	0.62	0.49	0.64	0.48
Salary & wage indicator	0.61	0.49	0.62	0.48
Earned income				
NIFW 1 ($)	31,114	22,716	33,044	25,527
NIFW 2 ($)	30,317	25,697	32,538	27,497
NIFW 3 ($)	31,114	22,716	32,985	24,022
Salary & wage ($)	31,158	21,919	32,627	22,989
Observations (number)	252,618	na	257,015	na
Income tax return observations only				
Income year	2003-04	0.00	2004-05	0.00
Age at 30 June	54.49	0.50	54.49	0.50
Employment rates				
NIFW indicator 1	0.78	0.41	0.83	0.37
NIFW indicator 2	0.89	0.32	0.89	0.31
NIFW indicator 3	0.78	0.41	0.79	0.41
Salary & wage indicator	0.76	0.43	0.78	0.42
Earned income				
NIFW 1 ($)	31,796	22,422	33,700	25,436
NIFW 2 ($)	30,842	25,599	33,102	27,505
NIFW 3 ($)	31,796	22,422	33,694	23,853
Salary & wage ($)	31,879	21,534	33,357	22,768
Controls				
Reported spouse	0.49	0.50	0.51	0.50
Self-prepared tax return	0.22	0.42	0.23	0.42
Remoteness				
Major cities	0.70	0.46	0.70	0.46
Inner regional	0.20	0.40	0.20	0.40
Outer regional	0.08	0.28	0.08	0.28
Remote & very remote	0.01	0.12	0.01	0.12
Not available	0.01	0.08	0.01	0.08
Observations (number)	191,846	na	197,949	na

Note: The *Earned income measures* show the mean and standard deviation for working individuals only. The number of observations can be calculated by multiplying the relevant 'Participation measure' by the number of observations in a given year.

Table 8: Summary statistics before and after the MAWTO was abolished, males

	Treatment period 2013–14		Control period 2014–15	
	Mean	Std. dev	Mean	Std. dev
ITR, PAYG *plus* ABS estimates				
Income year	2013-14	0.00	2014-15	0.00
Age at 30 June	56.49	0.50	56.49	0.50
Employment rates				
NIFW indicator 1	0.75	0.43	0.70	0.46
NIFW indicator 2	0.82	0.39	0.82	0.39
NIFW indicator 3	0.70	0.46	0.70	0.46
Salary & wage indicator	0.68	0.47	0.68	0.47
Earned income measures				
NIFW 1 ($)	80,145	164,850	83,354	127,526
NIFW 2 ($)	78,579	164,124	80,168	132,095
NIFW 3 ($)	81,819	164,351	83,354	127,526
Salary & wage ($)	79,159	138,887	79,951	87,874
Observations (number)	282,119	na	287,305	na
Income tax return (ITR) observations only				
Income year	2013-14	0.00	2014-15	0.00
Age at 30 June	56.49	0.50	56.49	0.50
Employment rates				
NIFW indicator 1	0.85	0.35	0.79	0.41
NIFW indicator 2	0.93	0.25	0.93	0.25
NIFW indicator 3	0.79	0.41	0.79	0.41
Salary & wage indicator	0.76	0.42	0.77	0.42
Earned income				
NIFW 1 ($)	81,687	168,250	85,157	130,249
NIFW 2 ($)	79,897	167,213	81,499	134,565
NIFW 3 ($)	83,599	168,019	85,157	130,249
Salary & wage ($)	80,872	141,914	81,627	89,100
Controls				
Reported spouse	0.72	0.45	0.72	0.45
Self-prepared tax return	0.19	0.39	0.17	0.38
Remoteness				
Major cities	0.69	0.46	0.64	0.48
Inner regional	0.20	0.40	0.19	0.39
Outer regional	0.09	0.29	0.09	0.28
Remote & very remote	0.02	0.13	0.02	0.13
Not available	0.01	0.07	0.07	0.26
Observations (number)	237,486	na	240,680	na

Note: The *Earned income measures* show the mean and standard deviation for working individuals only. The number of observations can be calculated by multiplying the relevant 'Participation measure' by the number of observations in a given year.

Table 9: Summary statistics before and after the MAWTO was abolished, females

	Treatment period 2013–14		Control period 2014–15	
	Mean	Std. dev	Mean	Std. dev
ITR, PAYG *plus* ABS estimates				
Income year	2013-14	0.00	2014-15	0.00
Age at 30 June	56.49	0.50	56.50	0.50
Employment rates				
NIFW indicator 1	0.69	0.46	0.67	0.47
NIFW indicator 2	0.73	0.44	0.74	0.44
NIFW indicator 3	0.66	0.47	0.67	0.47
Salary & wage indicator	0.65	0.48	0.66	0.47
Earned income measures				
NIFW 1 ($)	50,144	43,522	52,370	43,894
NIFW 2 ($)	49,078	46,723	51,103	59,888
NIFW 3 ($)	50,599	41,316	52,370	43,894
Salary & wage ($)	47,490	37,961	48,709	39,758
Observations (number)	291,808	na	298,048	na
Income tax return (ITR) observations only				
Income year	2013-14	0.00	2014-15	0.00
Age at 30 June	56.49	0.50	56.49	0.50
Employment rates				
NIFW indicator 1	0.85	0.36	0.82	0.39
NIFW indicator 2	0.91	0.29	0.91	0.29
NIFW indicator 3	0.82	0.39	0.82	0.39
Salary & wage indicator	0.80	0.40	0.80	0.40
Earned income				
NIFW 1 ($)	51,110	43,612	53,432	43,940
NIFW 2 ($)	49,931	46,964	51,983	60,639
NIFW 3 ($)	51,638	41,288	53,432	43,940
Salary & wage ($)	48,408	37,833	49,595	39,657
Controls				
Reported spouse	0.67	0.47	0.67	0.47
Self-prepared tax return	0.21	0.40	0.20	0.40
Remoteness				
Major cities	0.69	0.46	0.63	0.48
Inner regional	0.20	0.40	0.18	0.39
Outer regional	0.09	0.28	0.08	0.27
Remote & very remote	0.02	0.12	0.01	0.12
Not available	0.00	0.07	0.10	0.29
Observations (number)	225,565	na	230,193	na

Note: The *Earned income measures* show the mean and standard deviation for working individuals only. The number of observations can be calculated by multiplying the relevant 'Participation measure' by the number of observations in a given year.

We derive the following four indicators of 'working':

1. NIFW indicator 1 – This is the official measure that includes the income components presented in Table 3 at the MAWTO's introduction and Table 4 for the 12 months before the MAWTO was discontinued. For administrative reasons, the ATO database does not have 'business & partnership income' related to working for people under MAWTO's qualifying age threshold. This is because only those who meet the minimum age to qualify for MAWTO, and have income from business & partnership activity, are obliged to complete the 'net income from working – supplementary section' schedule. Accordingly, this measure provides an artificially high level of derived employment for the treatment group when compared with the control group. Despite this issue, we present results for this measure simply as a reference point given it captures the ATO's official NIFW measure as it applied to the MAWTO tax credit.

2. NIFW indicator 2 – This measure attempts to overcome the problem with NIFW indicator 1 by recalculating the 'net income from working – supplementary section' component for all individuals, regardless of whether they completed this schedule. This can be achieved given 'business & partnership' income is available elsewhere on the return. However, there is no way to separate out the share of this income that is derived from personal effort or skills. As some of this 'business & partnership' income will be derived from passive income, this measure is likely to overstate the true degree of participation and the actual amount of income that comes from working. However, the over-statement should be equal across treatment and control groups.

3. NIFW indicator 3 – This measure removes the 'net income from working – supplementary section' to create a comparable series for control and treatment groups. In this measure, the small number of individuals who only report business or part-

nership income (i.e. no salary & wages or other 'earned income' components) will be classified as not working. We feel that this measure closely matches the intended MAWTO recipients, namely workers.

4. Salary & wages indicator – This measure defines only those with salary or wage income (component 1 from the NIFW definitions) as working. This simple definition provides an indicator for the most common component of the official NIFW definition and, akin to the rationale for NIFW indicator 3, closely matches the intended MAWTO recipients. It is also the only measure where negative income is not possible.

Our preferred measure is NIFW indicator 3 as it applies an identical definition of working for both treatment and control groups and matches the income sources of intended MAWTO recipients.

Figures 2 and 3 show the evolution of our participation (employment) measure based upon the four different measures of income from working. We look at workers age 55 at each year from 2001 to 2015. A few insights emerge from these graphs. First, NIFW indicators 1 and 3 are identical for non-MAWTO years because the information on working from the supplementary section of the tax return is not available in the administrative system outside of the years when MAWTO was in force. This highlights why NIFW indicator 1 is going to be a very poor measure of the impact of the program and why we prefer NIFW indicator 3. A second thing to highlight is that the evolution of NIFW indicator 3 and the Salary & wage indicator are roughly identical so these two measures will give very similar impacts of MAWTO. As we indicate above, these measures are both preferred because they are consistent across control and treatment periods and they are focused on the population that MAWTO is designed to incentivize.
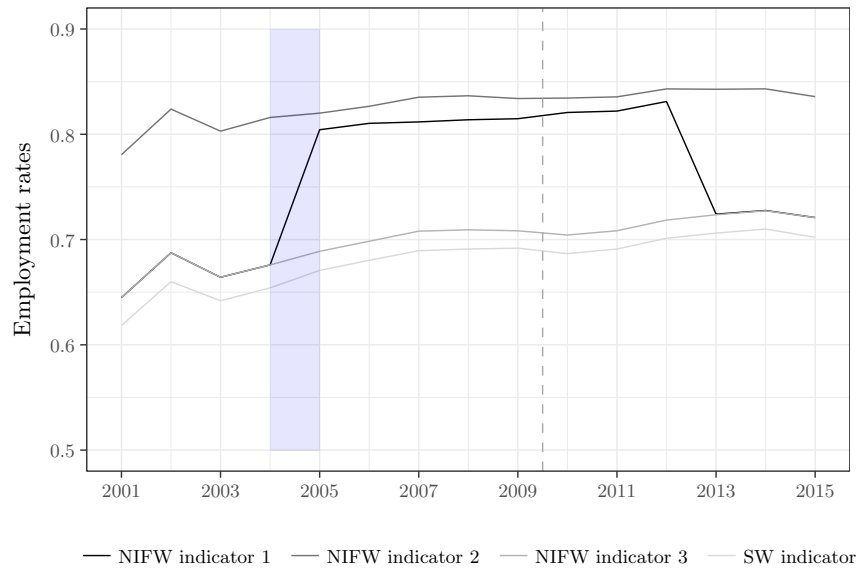
Figure 2: Derived employment rates for individuals aged 55 years, males
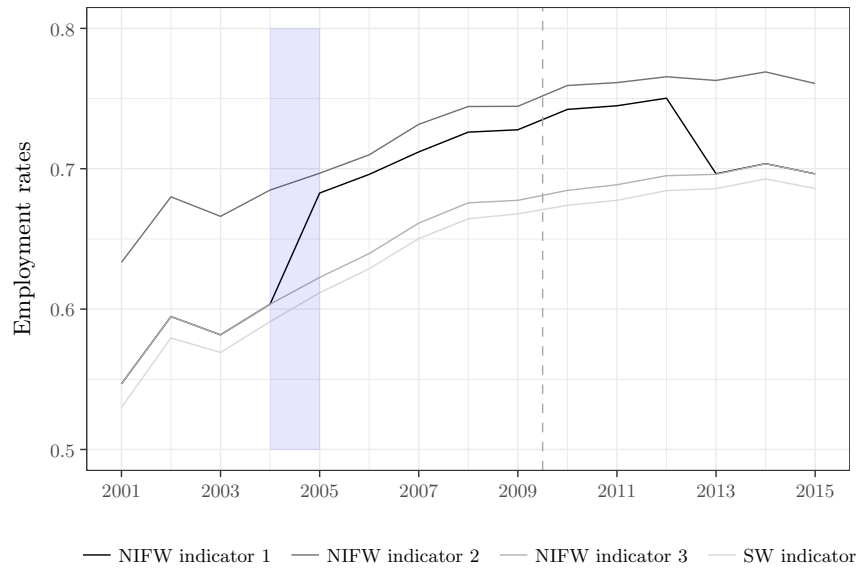

Figure 3: Derived employment rates for individuals aged 55 years, females

Thirdly, participation rates for the baby boomers born in 1947 (they are 55 in 2002) are quite different than the other birth cohorts. We discuss this in more detail in section 8.2 below. Lastly, while our measured labor force participation rates are relatively flat for males during this period, they are increasing quite rapidly for females. This provides additional justification for our separate consideration of these two groups.

6.3 Model specification

6.3.1 Participation

We estimate a linear probability model to detect the MAWTO's effect on labor supply. For all individuals in the tax data, $participation_{it}$ equals one if an individual is working (per each of the four definitions above) and zero if an individual is not working. We create an observation for each individual who is identified as being in the ABS population data but absent from the ATO data (by age and sex) and assign $participation_{it}$ equal to zero for each of these individuals. The explanatory variables are all binary indicators that represent whether the MAWTO's minimum qualifying age was met ($D_{it} = 1$ if age 55 or older) and whether the MAWTO existed in the given year ($T_{it} = 1$ if MAWTO is in force). The D-i-D estimator will be the estimate of β_3 from the interaction of T_{it} and D_{it} in equation (1). We estimate separately by sex. As discussed above, there are no other control variables available.

$$participation_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 D_{it} + \beta_3 (T_{it} \cdot D_{it}) + \epsilon_{it} \qquad (1)$$

6.3.2 Earned income

To detect the impact on 'earned income' we consider a model similar to that of equation (1) by substituting participation with the log of the corresponding income measure

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($\ln(income_{it})$) for individuals who worked. For the small share of individuals with negative earned income, we convert these values to 0.01 prior to the log transformation. We then include a binary indicator variable equal to one for those observations ($negative_{it}$) in the regression.

$$\ln(income_{it}) = \beta_0 + \beta_1 T_{it} + \beta_2 D_{it} + \beta_3 (T_{it} \cdot D_{it}) + \beta_4 negative_{it} + \boldsymbol{\beta}_5 \mathbf{Z}_{it} + \epsilon_{it} \qquad (2)$$

We estimate a model with no control variables where we combine the ITR and PAYG income data. We also estimate the model on the ITR data only; that is, dropping those individuals for whom we have data from PAYG statements but who did not file a tax return. This provides a sense of the impact the non-filers have on the estimates, and enables us to extend this model to control for additional characteristics ($\mathbf{Z}_{it}$) that are available in the income tax return data. These include whether the individual reported a spouse on their tax return; whether they prepared their own return (as opposed to an agent), and indicators of geographic remoteness from major cities, according to the *Australian Statistical Geographic Standard* (Australian Bureau of Statistics (2011)).

7   Empirical results

7.1   Participation

Table 10 presents average employment rates for control and treatment groups in the 12 month periods before and after the introduction of the MAWTO.

The labor supply rates in columns 1 and 2 show that a higher share of people aged 54 years (control group) work, compared with people aged 55 years (treatment group). Columns 3 shows the difference between the two periods, and Column 4 shows the D-i-D estimates. Labor supply rates range from 59 percent of women pre-MAWTO under

the 'Salary & wage indicator', to 82 percent under the 'NIFW indicator 2' measure for males post-MAWTO. Recall that this latter measure overstates participation because it includes all income components from the supplementary section including income not derived from working.

As expected, NIFW indicator 1 shows a very strong (and misleading) D-i-D response of 12.8 per cent for men and 7.9 per cent for women. Recall that the final component of the NIFW (item 11 in Table 3) is not reported by those tax filers who (i) do not meet the minimum age threshold by the end of a given financial year and (ii) have income derived from business or partnership activity. As explained earlier this will result in an under-counting of the control group who do not meet the MAWTO age threshold. Looking at the other three measures in rows B through D, it appears that the undercounting in the control group drives almost all of this large difference in measured participation.

When we look at NIFW indicator 3 and the Salary & wages indicator, we find a small positive impact of the MAWTO for both men and women. For men, this difference is statistically significant. The estimates suggest that the MAWTO induced an increase in participation rates of men of 0.6 or 0.7 percentage points. For women, the effect is smaller (0.25 percentage points) and not statistically significant.

For NIFW indicator 2, we find a very small negative and statistically insignificant effect of MAWTO for both men and women. NIFW indicator 2, unlike NIFW indicator 1, is consistent across treatment and control groups. However, it includes income from other sources besides work, namely business & partnership income. MAWTO was intended to influence the workforce behaviour of those who receive income from working. NIFW indicator 2 is a noisier measure of working than NIFW indicator 3 or Salary & wages and we may thus be unable to detect the effect of MAWTO using this measure. These indi-viduals are more likely to earn above the MAWTO income threshold and, accordingly, the MAWTO will not have a large importance in their motivation to work.

In what follows we will focus on NIFW indicator 3 and the Salary & wages indicator which provide comparable labor supply rates in both periods and for both control and treatment groups and which best capture the idea of 'working'.

Table 11 presents the same information for the period around the repeal of the MAWTO. We again calculate a D-i-D estimate by comparing the participation rates in the MAWTO's final year with the following year after the policy was repealed. A difference is that we compare labor supply rates for individuals aged 56 (control) and 57 years (treatment) by the end of the lodgement year.

We again observe that younger workers (age 56, control group) have higher participation rates than older workers (age 57, treatment group) for all measures except NIFW indicator 1 while MAWTO is in force. Again, NIFW indicator 1 is very misleading here because it is using information available under MAWTO that is not available after MAWTO is cancelled.

Focusing on NIFW indicator 3 and the Salary & wages indicator, we find no statistically significant effect of MAWTO for men. The estimated effect is about 0.2 percentage points but the standard errors are larger than that.

For women, we find a positive and statistically significant effect of MAWTO. We find a participation response of 0.70 to 0.76 percentage points.

Overall, these results are suggestive of a small, positive effect of MAWTO. The confidence intervals for the effect on participation for men and women overlap for both the introduction and cessation of MAWTO. On average, across men and women and averaging over the two sets of estimates, the results suggest an effect of MAWTO of around 0.5 percentage points–roughly the estimate if we pool males and females.

In section 8.1 below we examine the robustness of these results in a variety of ways. Before that, we briefly discuss the effect of MAWTO on earnings.

Table 10: Labor market participation rates before and during the MAWTO's first year

	Pre-MAWTO 2003-04 (1)	MAWTO 2004-05 (2)	Difference (2 − 1) (3)	Difference-in-differences (4)
Males				
A *NIFW indicator 1*				
Treatment (age 55)	0.6759	0.8043	0.1284***	
[251,596]	(0.0013)	(0.0011)	(0.0017)	
Control (age 54)	0.6948	0.7027	0.0079***	0.1205***
[255,694]	(0.0013)	(0.0013)	(0.0018)	(0.0025)
B *NIFW indicator 2*				
Treatment (age 55)	0.8160	0.8201	0.0041***	
[251,596]	(0.0011)	(0.0011)	(0.0015)	
Control (age 54)	0.8317	0.8367	0.0050***	-0.0009
[255,694]	(0.0010)	(0.0010)	(0.0015)	(0.0021)
C *NIFW indicator 3*				
Treatment (age 55)	0.6759	0.6888	0.0129***	
[251,596]	(0.0013)	(0.0013)	(0.0019)	
Control (age 54)	0.6948	0.7018	0.0070***	0.0059**
[255,694]	(0.0013)	(0.0013)	(0.0018)	(0.0026)
D *Salary & wage indicator*				
Treatment (age 55)	0.6541	0.6707	0.0166***	
[251,596]	(0.0013)	(0.0013)	(0.0019)	
Control (age 54)	0.6741	0.6838	0.0098***	0.0068***
[255,694]	(0.0013)	(0.0013)	(0.0018)	(0.0026)
Females				
E *NIFW indicator 1*				
Treatment (age 55)	0.6035	0.6827	0.0792***	
[252,029]	(0.0014)	(0.0013)	(0.0019)	
Control (age 54)	0.6310	0.6483	0.0173***	0.0619***
[257,604]	(0.0013)	(0.0013)	(0.0019)	(0.0027)
F *NIFW indicator 2*				
Treatment (age 55)	0.6848	0.6968	0.0120***	
[252,029]	(0.0013)	(0.0013)	(0.0018)	
Control (age 54)	0.7103	0.7240	0.0138***	-0.0018
[257,604]	(0.0013)	(0.0012)	(0.0018)	(0.0026)
G *NIFW indicator 3*				
Treatment (age 55)	0.6035	0.6226	0.0191***	
[252,029]	(0.0014)	(0.0014)	(0.0019)	
Control (age 54)	0.6310	0.6477	0.0168***	0.0023
[257,604]	(0.0013)	(0.0013)	(0.0019)	(0.0027)
H *Salary & wage indicator*				
Treatment (age 55)	0.5911	0.6116	0.0206***	
[252,029]	(0.0014)	(0.0014)	(0.0020)	
Control (age 54)	0.6195	0.6376	0.0180***	0.0025
[257,604]	(0.0014)	(0.0013)	(0.0019)	(0.0027)

Notes: Labor supply equals one if the specific NIFW measure has a dollar value that does not equal zero. Sample size is presented in the square brackets and robust standard errors in parentheses. ***, ** and * denote statistical significance at the 0.01, 0.05 and 0.1 levels.

Table 11: Labor market participation rates during and after the MAWTO's final year

		MAWTO 2013-14 (1)	Post-MAWTO 2014-15 (2)	Difference $(1-2)$ (3)	Difference-in-differences (4)
Males					
A	NIFW indicator 1				
	Treatment (age 57)	0.8004	0.6903	0.1101***	
	[281,257]	(0.0011)	(0.0012)	(0.0016)	
	Control (age 56)	0.7080	0.7101	-0.0020	0.1121***
	[288,167]	(0.0012)	(0.0012)	(0.0017)	(0.0023)
B	NIFW indicator 2				
	Treatment (age 57)	0.8115	0.8095	0.0020	
	[281,257]	(0.0010)	(0.0010)	(0.0014)	
	Control (age 56)	0.8257	0.8267	-0.0010	0.0030
	[288,167]	(0.0010)	(0.0010)	(0.0014)	(0.0020)
C	NIFW indicator 3				
	Treatment (age 57)	0.6894	0.6903	-0.0008	
	[281,257]	(0.0012)	(0.0012)	(0.0017)	
	Control (age 56)	0.7075	0.7101	-0.0025	0.0017
	[288,167]	(0.0012)	(0.0012)	(0.0017)	(0.0024)
D	*Salary & wage indicator*				
	Treatment (age 57)	0.6702	0.6712	-0.0010	
	[281,257]	(0.0013)	(0.0012)	(0.0018)	
	Control (age 56)	0.6888	0.6916	-0.0028	0.0018
	[288,167]	(0.0012)	(0.0012)	(0.0017)	(0.0025)
Females					
E	NIFW indicator 1				
	Treatment (age 57)	0.7065	0.6529	0.0537***	
	[291,776]	(0.0012)	(0.0012)	(0.0017)	
	Control (age 56)	0.6751	0.6825	-0.0074***	0.0611***
	[298,080]	(0.0012)	(0.0012)	(0.0017)	(0.0024)
F	NIFW indicator 2				
	Treatment (age 57)	0.7229	0.7208	0.0021	
	[291,776]	(0.0012)	(0.0012)	(0.0017)	
	Control (age 56)	0.7420	0.7492	-0.0072***	0.0093***
	[298,080]	(0.0011)	(0.0011)	(0.0016)	(0.0023)
G	NIFW indicator 3				
	Treatment (age 57)	0.6528	0.6529	-0.0001	
	[291,776]	(0.0013)	(0.0012)	(0.0018)	
	Control (age 56)	0.6748	0.6825	-0.0077***	0.0076***
	[298,080]	(0.0012)	(0.0012)	(0.0017)	(0.0025)
H	*Salary & wage indicator*				
	Treatment (age 57)	0.6407	0.6413	-0.0006	
	[291,776]	(0.0013)	(0.0012)	(0.0018)	
	Control (age 56)	0.6634	0.6710	-0.0076***	0.0070***
	[298,080]	(0.0012)	(0.0012)	(0.0017)	(0.0025)

Notes: Labor market participation equals one if the specific NIFW measure has a dollar value that does not equal zero. Sample size is presented in the square brackets and robust standard errors in parentheses. ***, ** and * denote statistical significance at the 0.01, 0.05 and 0.1 levels.

7.2 Earned income

We estimate the model of equation (2) to assess the effect of the MAWTO on earned income. In Table 12, we present the D-i-D coefficients from the simple regressions with no controls. For males, we find no evidence of the MAWTO having an effect on earned income. We do find a positive impact on earnings for women at the cessation of MAWTO–the group for whom we found a positive participation effect of MAWTO. Using NIFW indicator 3 and Salary & wages, we find that MAWTO led to an increase in earnings of 1.36 and 1.54 per cent, respectively.

Table 12: MAWTO 'earned income' effect, D-i-D coefficients: without controls

	2003-04 vs 2004-05 54 vs 55 (1)		2003-04 vs 2004-05 53-54 vs 55-56 (2)	
ITR _and_ PAYG data				
Males				
NIFW 3 D-i-D (MAWTO · Age)	0.0065	[0.0071]	0.0027	[0.0051]
Salary & wages D-i-D (MAWTO · Age)	0.0064	[0.0071]	0.0005	[0.0051]
Females				
NIFW 3 D-i-D (MAWTO · Age)	-0.0032	[0.0079]	-0.0027	[0.0057]
Salary & wages D-i-D(MAWTO · Age)	-0.0017	[0.0079]	-0.0034	[0.0056]
	2013-14 vs 2014-15 56 vs 57 (1)		2013-14 vs 2014-15 55-56 vs 57-58 (2)	
ITR _and_ PAYG data				
Males				
NIFW 3 D-i-D (MAWTO · Age)	-0.0026	[0.0067]	-0.0093**	[0.0047]
Salary & wages D-i-D (MAWTO · Age)	0.0040	[0.0067]	-0.0035	[0.0047]
Females				
NIFW 3 D-i-D (MAWTO · Age)	0.0136**	[0.0068]	-0.0004	[0.0048]
Salary & wages D-i-D (MAWTO · Age)	0.0154**	[0.0067]	0.0027	[0.0048]

Notes: Coefficients are marginal probabilities from a linear OLS model. Robust standard errors are presented in brackets. ***, ** and * denote statistical significance at the 0.01, 0.05 and 0.1 levels.

These models are estimated using data for all individuals who file a tax return plus those who do not file a tax return but for whom we have data available from the pay-as-you-go system. These individuals did not file a tax return but received a salary that

was reported by an employer. Using only the income tax return data and the controls discussed in section 6.3.2 does not produce any substantive change in the results reported above.[13]

8 Discussion

In this section we undertake some simple robustness checks to assess the sensitivity and validity of our findings. We discuss the common trends assumption and some demographic issues that arise in our analysis of common trends. Many studies which use difference-in-difference techniques assert common trends without being able to check whether or not they hold. We have the advantage of long-term administrative data that both pre-dates and post-dates the program we are evaluating which allows us to assess common trends.

We then assess the size of the MAWTO response and discuss possible reasons for our findings. Finally, we provide some simple back-of-the-envelope calculations of the costs of the MAWTO. The MAWTO was cancelled by the Australian government based upon a sense that the program was costly but no formal evaluation was conducted.

8.1 Robustness checks

First, we examine whether expanding the window to include two years either side of the threshold changes the results. These results are presented in Table 13. For the earlier period when MAWTO was introduced we now find statistically significant effects for both males and females in the range of a 0.4 to 0.5 percentage point increase in participation in response to the MAWTO. This provides additional evidence for an effect of MAWTO at its introduction.

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[13]Detailed regression results are available from the authors upon request.

For the latter period when MAWTO was withdrawn, we now find no statistically significant effect for women (point estimates are very close to zero) but a slight negative effect for men, but only for the Salary & wage indicator. This negative effect is only statistically significant at the 10 per cent level. This seems to suggest less of an effect for MAWTO when measured at its cessation.

Overall, we prefer the shorter window because there is less potential for confounding effects of other policies or macro-economic events. The smaller window also produces more similar control and treatment groups. Expanding the window, at either time period, to 36 months makes little sense as there were other policy and demographic changes that could influence the labor supply of the MAWTO target group; see below.

Typically, standard D-i-D robustness checks will include placebo tests in periods where there was no treatment. These should return D-i-D coefficients that are not significantly different from zero. For men, we found a statistically significant effect of MAWTO at the introduction of the program. If we run placebo tests in the years immediately before and after the introduction of MAWTO as if there were a treatment when in fact there was none, we find only insignificant coefficients. For women, we found a statistically significant effect of MAWTO at the cessation of the program. If we run placebo tests in the four years prior to the cessation (2010-11 through 2013-14) we again find only insignificant coefficients. These results would seem to provide some evidence that we are identifying the effect of the MAWTO.

If we consider other years, the results are not so unambiguous. Figures 4 through 7 present placebo tests for all the years of our data. The first two figures show the comparison between 54 and 55 year olds, relevant for the introduction of MAWTO. Figures 6 and 7 show the comparison between 56 and 57 year olds, relevant for the cessation of MAWTO.

In Figure 4, we plot the D-i-D coefficient for the impact on men and standard errors

for each year from 2001-02 to 2014-15, treating that year as the treatment year and the preceding year as the control year. Figure 5 does the same for women. Figures 6 and 7 are analogous but focusing on the 56 and 57 year olds.

The first thing to note is the very large positive and negative 'treatment effects' in 2001-02 and 2002-03 (and two years later for Figures 6 and 7). These are driven by the baby boomers born in 1947 whose workforce participation rates are substantially higher than those born either year before or after–see section 8.2 below.

The second thing to note is that we find significant 'treatment effects' in roughly half the years of our data. As shown in Appendix Table A.1, there were many policy changes during these years including changes to the LITO 2006-07 and 2009-10 that could have caused differential participation effects. The GFC negatively impacted participation in 2010-2011 and that seems to have had different effects on 54 and 55 year olds. The large positive participation effect for 55 year olds compared to 54 year olds in 2013-2014 does not seem to be related to any policy but could be related to strong post-GFC economic recovery. Across many of these years, it is difficult for us to disentangle policy effects from macro-economic effects from other demographic effects similar to the 1947 baby boomer effects.

The results from Figures 4 through 7 could be interpreted as saying that the MAWTO had little effect since the D-i-D estimates in the years of MAWTO's introduction and cessation are not that different from many of the placebo years. That the impact of MAWTO is small relative to changing the overall tax system for all tax payers (through LITO and other threshold changes) or relative to the GFC is perhaps not surprising. We return to this in the discussion of the size of the impact of MAWTO.

In the next section we examine the parallel trends assumption.

Table 13: MAWTO labor supply effect, extended two-year age window estimates

	2003-04 vs 2004-05 53-54 vs 55-56 (1)		2013-14 vs 2014-15 55-56 vs 57-58 (2)	
ITR, PAYG *and* ABS population estimates	**Males**			
NIFW indicator 3				
Intercept	0.6990***	[0.0009]	0.7155***	[0.0008]
MAWTO (2004-05/2013-14 equals 1)	0.0111***	[0.0013]	0.0020*	[0.0012]
Age (age>=55/57 equals 1)	-0.0371***	[0.0013]	-0.0345***	[0.0012]
D-i-D (MAWTO · Age)	0.0037**	[0.0018]	-0.0022	[0.0017]
Adjusted R²	0.0016		0.0015	
Observations	1,015,601		1,140,439	
Salary & wage indicator				
Intercept	0.6788***	[0.0009]	0.6969***	[0.0008]
MAWTO (2004-05/2013-14 equals 1)	0.0133***	[0.0013]	0.0026**	[0.0012]
Age (age>=55/57 equals 1)	-0.0398***	[0.0013]	-0.0353***	[0.0012]
D-i-D (MAWTO · Age)	0.0050***	[0.0019]	-0.0032*	[0.0017]
Adjusted R²	0.0018		0.0016	
Observations	1,015,601		1,140,439	
ITR, PAYG *and* ABS population estimates	**Females**			
NIFW indicator 3				
Intercept	0.6423***	[0.0009]	0.6895***	[0.0008]
MAWTO (2004-05/2013-14 equals 1)	0.0188***	[0.0013]	-0.0002	[0.0012]
Age (age>=55/57 equals 1)	-0.0597***	[0.0014]	-0.0477***	[0.0012]
D-i-D (MAWTO · Age)	0.0042**	[0.0019]	-0.0002	[0.0017]
Adjusted R²	0.0040		0.0026	
Observations	1,017,922		1,179,307	
Salary & wage indicator				
Intercept	0.6312***	[0.0009]	0.6786***	[0.0008]
MAWTO (2004-05/2013-14 equals 1)	0.0198***	[0.0013]	-0.0004	[0.0012]
Age (age>=55/57 equals 1)	-0.0613***	[0.0014]	-0.0488***	[0.0012]
D-i-D (MAWTO · Age)	0.0044**	[0.0019]	-0.0004	[0.0018]
Adjusted R²	0.0044		0.0026	
Observations	1,017,922		1,179,307	

Notes: Robust standard errors are presented in brackets. ***, ** and * denote statistical significance at the 0.01, 0.05 and 0.1 levels.
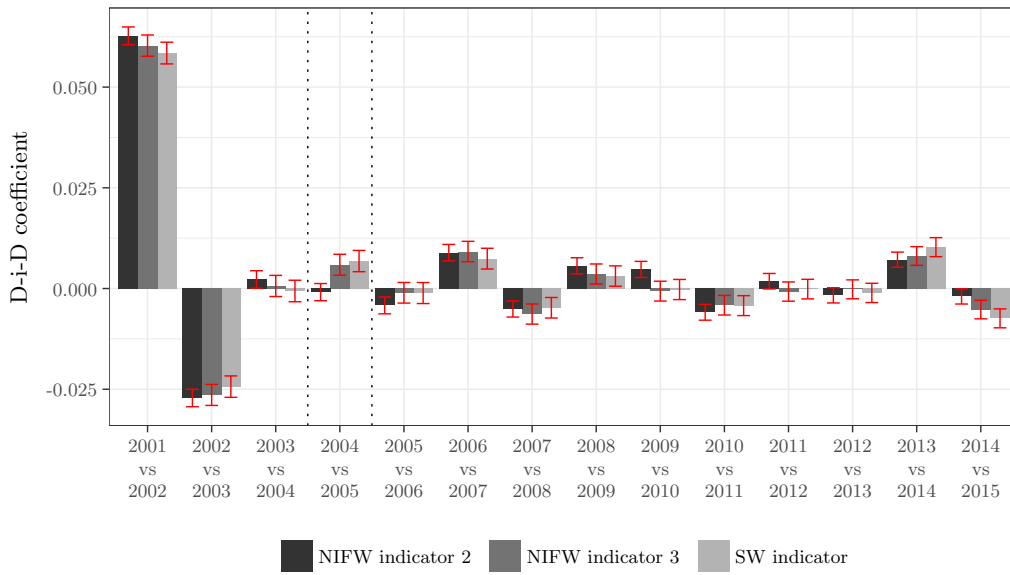
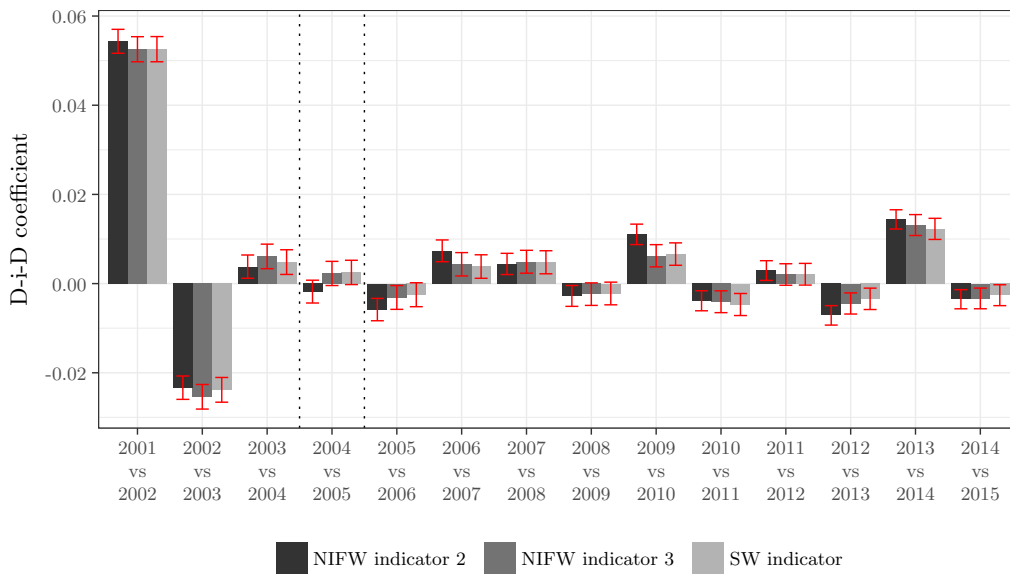Figure 4: Rolling D-i-D estimates - 54 vs 55 years of age, males

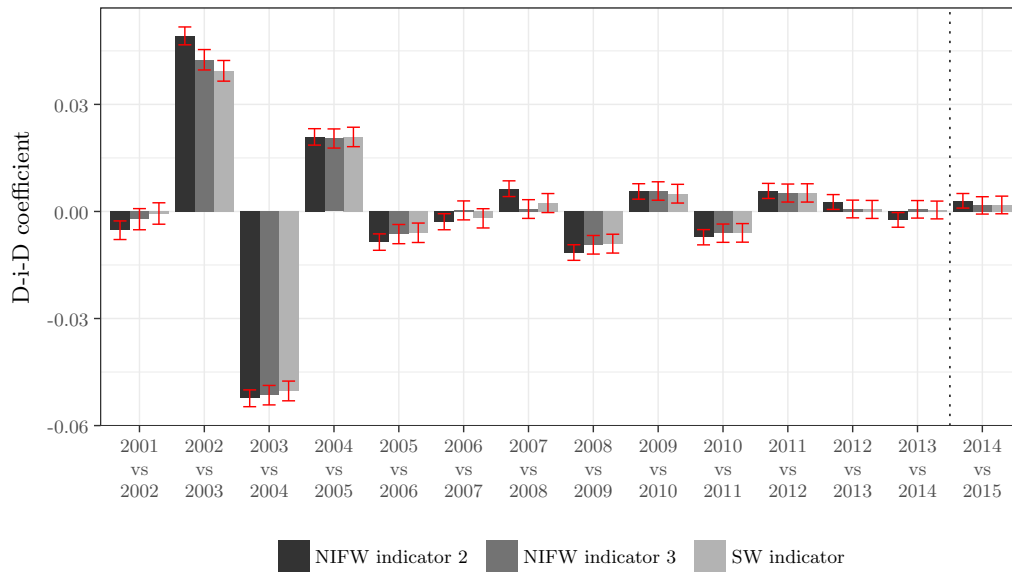Figure 5: Rolling D-i-D estimates - 54 vs 55 years of age, females

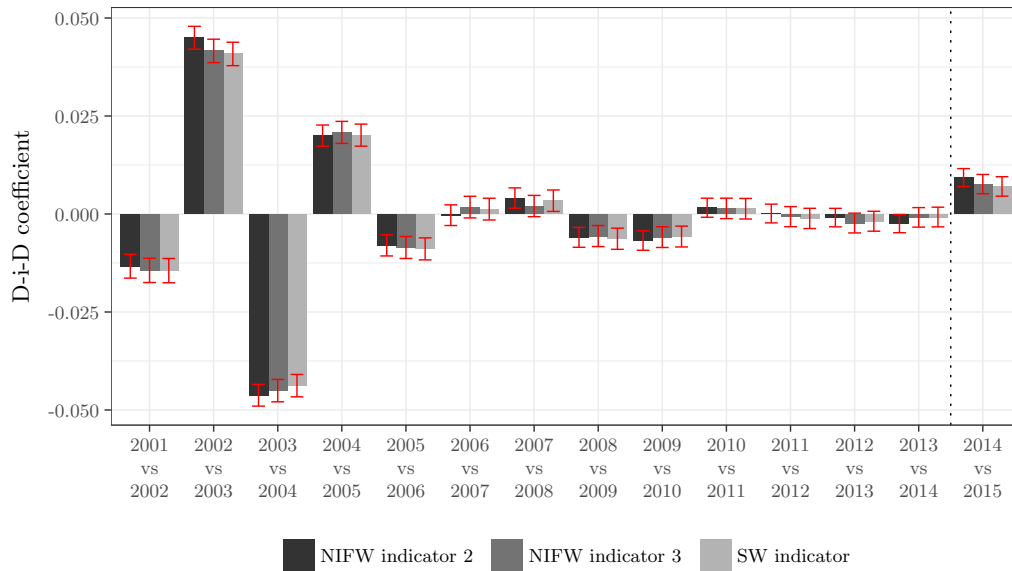Figure 6: Rolling D-i-D estimates - 56 vs 57 years of age, males

Figure 7: Rolling D-i-D estimates - 56 vs 57 years of age, females

8.2 Common trends assumption and demographic issues

We find that the share of individuals working, according to our derived NIFW definitions, remained stable over the period that the MAWTO was available. Figures 8 and 9 show the trends for NIFW indicator 3 and the Salary & wages indicator. The graph shows two different groups of individuals at the two different time periods separated by the vertical dashed line in the graph.

The period up to 2008-09 shows the labor market participation rates for individuals aged 54 and 55 by the end of the given financial year. The period from 2009-10 onwards show the participation rates for individuals age 56 and 57. The other difference in the two periods is that the second period uses the 2014 MAWTO income definition, presented in Table 4, which is slightly broader than the original definition that was effective in the period from 2003-04 to 2008-09.

The parallel trends assumption did not hold in 2000-01 and 2001-02. The Australian Bureau of Statistics (2004) identify that the fertility peak of the post-World War II baby boom occurred in 1947. This birth cohort reached their early to mid-50s by 2001-02 and seem to explain the violation of parallel trends. There were more people aged 55 years in 2001-02 than there were people aged 54 years, according to official statistics (Australian Bureau of Statistics (2017)). Furthermore, the baby boomers seem to behave differently than the cohorts either year before or after them, with higher earnings and higher labor force participation. This explains the violation of parallel trends for 2000-01 and 2001-02 in Figures 8 and 9. This does not affect our results provided we avoid using these years in forming the control group.

Overall, the graphs provide strong support for the hypothesis of parallel trends. In the pre-MAWTO the trends for 54 year-old men look quite similar to those of 55 year-old men. Similarly for women. In the lead-up to the end of MAWTO, trends again look similar for 56 and 57 year-olds for both men and women.
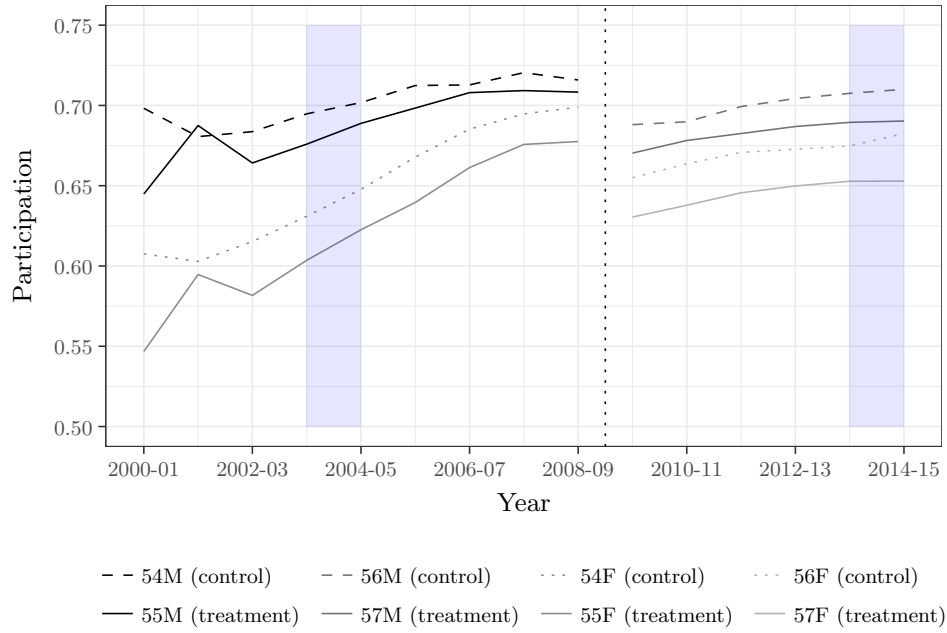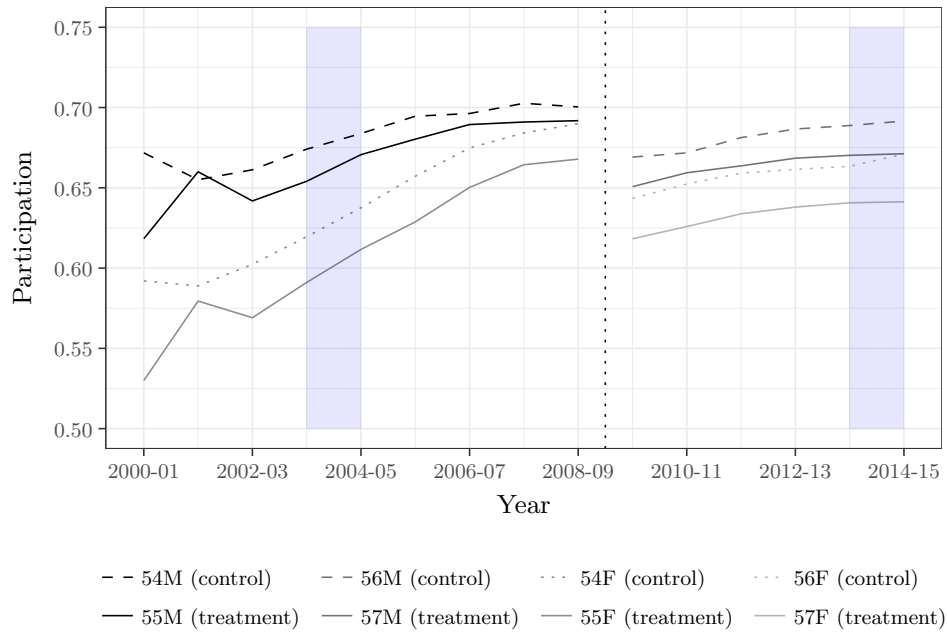
Figure 8: Parallel trends – NIFW indicator 3

Figure 9: Parallel trends – Salary & wages indicator

8.3 What explains the size of the response?

MAWTO offered a maximum $500 rebate on an individual's tax liability. This amount may be relatively unimportant when combined with other competing factors that may influence the decision to retire (e.g. health status, job satisfaction and desire for more leisure time).

The MAWTO was non-refundable which resulted in a share of individuals not being able to use some or all of their rebate because their did not have a large enough tax liability. The size of unused rebates grew from 2011-12 when the 'Low Income Tax Offset' was promoted to position 3 in the order that the offsets are applied, demoting the MAWTO to 4th position. We note that, before this demotion, the MAWTO was already being applied after the 'Senior Australian's tax offset' and the 'Pension and government allowance offset' which also target older tax filers. Similarly, the income tax schedule saw a large change in 2011-12 whereby the the tax-free income threshold was increased three-fold from $6,000 to $18,200. The design of this change resulted in lower tax liabilities for lower to middle income earners and would have affected the amount of the MAWTO credit that was used.

The definition of NIFW was complicated, and became slightly more complicated in the MAWTO's latter years when the definition of 'earned income' was broadened. This may have reduced the intensive margin effect as it may have been difficult for workers seeking to use the MAWTO as an income substitution strategy to optimize their behaviour. Also, given the MAWTO was automatically calculated by the ATO, some people may have been unaware that they received it.[14] Eissa and Liebman (1996) p.634 cite evidence that EITC recipients are often unaware of the program. On this point, it would be interesting to test whether a more visible method to boost wages would be more effective than administering the benefit automatically through the tax return system.

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[14]This is with the exception of qualifying individuals with business or partnership income who are made aware of the MAWTO by the requirement to fill out the NIFW supplementary schedule.

Figure 10 shows MAWTO recipients as a share of total tax filers over the 10 year period it was available. The light-grey line shows the share of tax filers who qualified for the MAWTO (who had a non-refundable credit to which they were entitled) and the darker line shows the share of tax filers who actually used some or all of their MAWTO because they had a tax liability. The difference between the two lines represents the share of individuals who did not receive the MAWTO, despite being eligible, because their tax liability had already reached zero dollars before the offset was applied.

The four vertical dashed lines mark points in time we wish to highlight. The first shows the effect of increasing the earned income threshold in 2005-06 from $58,000 to $68,000. This reduced the distance between the MAWTO 'used' and 'available' amounts given more workers, at the higher end of the MAWTO income threshold qualified and had a sufficiently large enough tax liability to offset. The second dashed line shows the combined effect of two changes to the tax system. One was the tripling of the tax-free threshold in 2011-12, and the other was the demotion of the MAWTO in the order that the non-refundable offsets were applied; from 3rd to 4th position. This resulted in the distance between the MAWTO 'used' and 'available' amounts to increase significantly. The following income years, 2012-13 and 2013-14, show the impact of freezing the MAWTO eligibility age to 1 July 1957. This change prevented new recipients, who would have otherwise qualified, from receiving the tax credit. This resulted in fewer taxpayers receiving the MAWTO in both years and produced a level shift of the 'used' and 'available' amounts in Figure 10.

For all of these reasons, we would not expect a particularly large effect of MAWTO. In this regard, the results seem plausible. It is not clear why we find slightly different results for men and women at the beginning and end periods of MAWTO. Possible candidates include: the 'Restart' program (the wage subsidy program for income support recipients that replaced MAWTO); underlying demographic changes akin to those of the 1947 baby boomers that we can not detect in the data; growth in unused rebates; or macro-
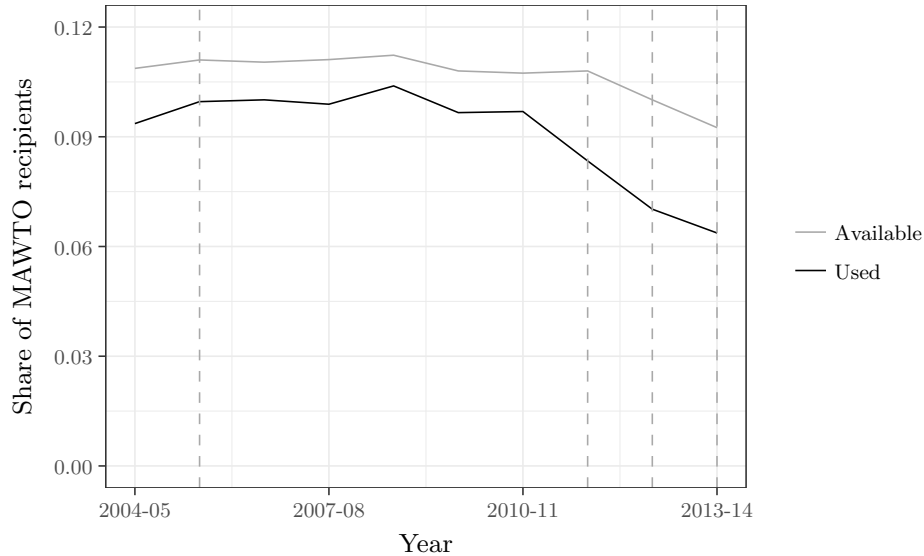
Figure 10: MAWTO recipients as a share of tax filers

economic shocks. Any of these may have affected men differently than women and potentially had differential impacts across age cohorts.

8.4 Cost and benefits of the MAWTO

A typical downside of EITCs is that it is not possible to provide the credit only to those individuals who were induced to work longer. This results in an inefficiency whereby a share of the qualifying cohort who received the credit would have remained in the workforce irrespective of receiving the credit. Hypothetically, if it were possible to target the credit to only the individuals who worked longer, the cost of the MAWTO in forgone public revenue terms could be significantly reduced. In this section we attempt to provide some fiscal context around the key results by providing back-of-the-envelope average cost calculations. The average inducement cost is calculated by allocating the total yearly cost of the program to the number of workers who prolonged their time in the workforce as a result of the MAWTO.

We start with the Australian Government's published estimates of the MAWTO's pecuniary benefit to taxpayers. The Department of the Treasury (2010) estimates that the tax credit cost $425 million in foregone revenue in the 2004-05 financial year. The estimated cost of the MAWTO grew and peaked at $465 million in 2011-12 (Department of the Treasury (2015b)), the final year before the phase-out period began. By 2013-14 the estimated cost fell to $350 million due to the increase in the qualifying age.

We use our D-i-D estimates to calculate the average cost of the MAWTO for people aged 55 in the policy's first year and, similarly, for people aged 57 in the MAWTO's final year. The summary cost estimates for each participation measure are presented in Table 14. Using pooled estimates for males and females, the table shows that the MAWTO induced around 700 workers aged 55 to remain in the workforce in 2004-05 and 900 57 year old workers to remain in the workforce in 2013-14. The fiscal cost per induced worker ranges between $37,000 to $78,000 depending on the period and participation measure. Table A.2 in the Appendix section steps through the calculations that were used to derive the cost estimates for the Salary & wages indicator. The detailed calculations for NIFW indicator 3 follow the same process. Table 14 also reports the estimates separately for men and women.

Table 14: MAWTO cost estimates based on detected labor supply effect

| | 2004-05 | | | 2013-14 | | |
	Number induced	Cost per worker ($)	D-i-D estimate	Number induced	Cost per worker ($)	D-i-D estimate
Males and females						
NIFW indicator 3	668	78,000	0.0040**	912	37,000	0.0048**
Salary & wage	751	69,000	0.0046**	854	39,000	0.0046**
Males only						
NIFW indicator 3	502	103,000	0.0059**	Not significant		0.0017
Salary & wage	579	90,000	0.0068***	Not significant		0.0018
Females only						
NIFW indicator 3	Not significant		0.0023	783	48,000	0.0076***
Salary & wage	Not significant		0.0025	751	52,000	0.0070***

Note: ***, ** and * denote statistical significance at the 0.01, 0.05 and 0.1 levels.

We note that there will be some fiscal claw-back for a share of the estimated average cost based on the additional income tax that would have otherwise been unpaid. We do not provide an estimate for this impact as it requires further analysis and assumptions which are outside the scope of this paper.

In addition to the small boost in participation, the MAWTO provided benefits to all recipients by reducing their tax liability. This would have had a welfare enhancing effect through increased disposable income. For the small share of induced workers, they would have had an additional year of 'earned income' from working and their employer would have been obliged to make retirement fund contributions which they would have not otherwise received. It may also mean that these workers delay drawing upon their retirement fund income which would have allowed additional time to accrue earnings. Further, keeping mature age individuals in the labor market may also delay or reduce reliance on public pensions.

9   Conclusion

We detect a small positive effect on labor supply of the MAWTO using Australian Government administrative data. Overall, the evidence suggests that labor market participation increased around 0.5 percentage points in response to the tax credit provided by MAWTO. This result adds to the literature around the effectiveness of EITCs that aim to prolong labor market engagement of mature age workers.

This overall result emerges from bringing together somewhat different results for men and women. For men, we detect a strong employment effect of MAWTO of around 0.65 percentage points at the introduction of MAWTO but an effect only about one-third the size, and statistically insignificant, at the cessation of MAWTO. For women, the story is inverted with an employment effect of about 0.7 percentage points detected at

the end of MAWTO but a smaller (around 0.2) and statistically insignificant effect at the cessation of MAWTO.

For women, at the cessation of MAWTO, we find that the program increased income by 1.4 or 1.5 per cent in response to the tax credit. We find no evidence for men of any effect on earned income.

The modest amount of the tax offset ($500) led to modest behavioural change. The effects should be considered in the context of other stage-of-life factors which contribute to the decision about whether or not to work, such as an individual's health status, job satisfaction, partner's retirement status or desire for more leisure time.

Official estimates of the MAWTO indicate the program cost $4.3 billion in forgone government revenue over its 10 years of applicability. We show that most MAWTO recipients would have remained in the workforce irrespective of receiving the offset. We estimate that it cost between $37,000 and $78,000 for each additional worker who was induced to remain in the labor force.

Our results are robust to different definitions of working and extended age groupings for the control and treatment periods. We test our identification strategy by assigning treatment in periods where there was no treatment. These placebo tests lend support to our identification strategy in the years adjacent to the policy change. For other years, they are affected by a large amount of policy volatility. We critically analyse the parallel trends assumption and it appears to hold for the periods of interest, but not in periods before the MAWTO was introduced. This is due to the very different behaviour of those born in 1947 at the peak of the post-World War II baby boom.

This research adds to the body of literature on EITCs but in a unique way as MAWTO was targeted at mature age workers only. How to retain mature age workers in the labor market is a question of policy interest around the world. Our results suggest that tax credits would be an expensive and relatively ineffective way to do this.

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Table A.1: Select policy changes

APPENDIX

Year	Tax schedule change[a]	Select policy changes that may affect labor supply decisions for the cohort examined in the MAWTO analysis
2000-01	✓	Substantial personal income tax cuts, increases to family benefits, pensions and allowances following the introduction of the Goods and Services Tax (GST) (a component of *The New Tax System*).
2001-02	✗	More services to support unemployed individuals to find work; further financial incentives to encourage people on income support into the labor market.
2002-03	✗	Self-employed individuals can claim a full tax deduction on superannuation contributions up to $5,000.
2003-04	✓	Low income tax offset increased; increase to Medicare levy threshold for senior Australians.
2004-05	✓	MAWTO introduced.
2005-06	✓	MAWTO upper 'earned income' threshold increases from $58,000 to $63,000, *Transition to Retirement Income Streams* policy introduced; superannuation surcharge abolished;
2006-07	✓	Low Income Tax Offset increased; *A Plan to Simplify Superannuation* announced various changes to simplify and streamline Australia's superannuation system.
2007-08	✓	Introduction of concessional contributions caps on superannuation; further increase to the Low Income Tax Offset.
2008-09	✓	Increase in the Low Income Tax Offset.
2009-10	✓	Concessional superannuation contributions caps reduced; Low Income Tax Offset increased.
2010-11	✓	Low Income Tax Offset increased.
2011-12	✗	Phase-out of MAWTO begins; Temporary Flood levy introduced.
2012-13	✓	Tripling of the tax-free threshold; phase-out of MAWTO continues; concessional superannuation contributions caps reduced for individuals over 50 years of age only; changes to the Low Income Tax Offset formula.
2013-14	✗	MAWTO discontinued; concessional superannuation contributions caps change.
2014-15	✗	Further changes to concessional superannuation contributions caps; Medicare levy rate increases from 1.5 percent to 2.0 percent; temporary budget repair levy introduced for individuals with taxable income over $180,000; *Restart* wage subsidy program introduced for individuals over 50 years of age who have been on income support for more than 6 months.

[a] This refers to changes to individuals income tax rates and thresholds for a given year.

✓ indicates change to income tax rates and thresholds

✗ indicates no change to income tax rates and thresholds

Table A.2: MAWTO average cost estimate – Salary & wages participation indicator

	MAWTO cost calculation, people aged 55 in 2004-05	**2004-05**	Note
A	Total people aged 55 (count)	254,539	A=B+C; matches ABS population estimate
B	- Working 55s (count)	163,173	Derived from 'Salary & wages' earned income definition
C	- Non-working 55s (count)	91,366	C=A-B
D	D-i-D (share induced to remain in workforce)	0.0046	D-i-D coefficient (Salary & wages)
E	Number induced	751	E=B·D
F	Total estimated MAWTO cost in 2004-05 ($)	425,000,000	Source: *Tax Expenditures Statement 2009*
G	Assumed share attributable to 55s	0.1221	No. MAWTO recipients aged 55 / total no. of MAWTO recipients
H	Assumed cost 55s	51,896,878	H=F·G
I	Cost per 55 year old worker induced	69,141	I=H/E
J	Cost rounded to nearest $1000	69,000	
	MAWTO cost calculation, people aged 57 in 2013-14	**2013-14**	Note
A	Total people aged 57 (count)	283,368	A=B+C; matches ABS population estimate
B	- Working 57s (count)	185,665	Derived from 'Salary & wages' earned income definition
C	- Non-working 57s (count)	97,703	C=A-B
D	D-i-D (share induced to remain in workforce)	0.0046	D-i-D coefficient (Salary & wages)
E	Number induced	854	E=B·D
F	Total estimated MAWTO cost in 2013-14	350,000,000	Source: *Tax Expenditures Statement 2014*
G	Assumed share attributable to 57s	0.0955	No. MAWTO recipients aged 57 / total no. of MAWTO recipients
H	Assumed cost 57s	33,438,965	H=F·G
I	Cost per 57 year old worker induced	39,153	I=H/E
J	Cost rounded to nearest $1000	39,000	