Tax Sheltering Cost Among High-Income Taxpayers: Evidence from an Australian Tax Policy Change*

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February 9, 2024

Abstract

We present empirical evidence on the cost of tax sheltering among high-income taxpayers within progressive income tax systems. Exploring a unique personal income tax policy change in Australia, we use the "bunching" around the top tax kink to estimate costs of tax sheltering and the Elasticity of Taxable Income (ETI). Our findings reveal substantial behavioural responses to tax changes among high-income taxpayers, particularly those with greater flexibility in income adjustment, suggesting that tax sheltering behaviours play a pivotal role in their responses. When accounting for these costs, the estimated ETI significantly increases, emphasizing the necessity of considering tax sheltering in tax policy analysis. We contribute to the ongoing discourse on optimal tax policy design and its impact on economic behaviour. Our findings has important implications for the policy debates on whether high-income individuals should be taxed at higher rates.

JEL classification: H21; H24; H26; D31.

Keywords: taxation and incentives; progressive income tax; high-income taxpayers; tax sheltering; elasticity of taxable Income (ETI); bunching; kink.

*We appreciate the valuable insights and suggestions provided by Ashley Craig, Xiaodong Fan, Brendan Fugate, Christian Gillitzer, Nicolas Marceau, and Dylan Moore, which have significantly improved this paper. We also acknowledge the contributions of seminar participants at various conferences, including Asia and Australasian Society of Labour Economics (AASLE 2022), Australian Workshop on Public Finance (AWPF 2023), Labour Econometrics Workshop (LEW 2023), Canadian Public Economics Group (CPEG 2023), University of British Colombia, and Australian Public Economics Exchange (APEX 2024). We thank Trevor Rose for his excellent research assistance, and to Andrew Carter from the Australian Taxation Office and the Sax Institute for their assistance with data access. This research received support from the Canadian Social Sciences and Humanities Research Council's Insight Development Grant (SSHRC-IDG). All views expressed in this paper are those of the authors and do not necessarily represent the views of the Australian Government or its agencies.

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1 Introduction

Progressive income tax systems, in which marginal tax rates increase with taxable income, are a crucial policy tool for redistributing income from high-income to low-income individuals. However, the effectiveness of these tax systems relies on understanding how high-income individuals respond to changes in tax rates. Elasticity of Taxable Income (ETI) measures the sensitivity of taxable income to tax rate, where higher ETI suggest that individuals are highly responsive to tax rate changes. The observed sensitivity of taxable income may be driven not only by labour supply responses but also by *tax sheltering* behaviours (Slemrod, 1992, 1995). That is using legal strategies to minimize tax liabilities by taking advantage of loopholes and deductions in tax laws.[1] Distinguishing between these two factors –labour supply and tax sheltering– is crucial for assessing the efficiency costs of income taxation and informing policy decisions regarding higher tax rates for high-income individuals. While ETI estimates using tax return data are widely available (see Saez et al., 2012 for a review of recent literature), empirical estimates of the cost of tax sheltering among high-income individuals remain scarce. The ETI and the tax sheltering costs are essential parameters for designing optimal progressive income tax systems and assessing their efficiency costs.

In this paper, we provide the first empirical estimate of the tax sheltering cost for high-income taxpayers. Our study leverages a unique policy change in the Australian personal income tax schedule, which raised the top tax kink threshold from AUD 150,000 to AUD 180,000 during the 2008-2009 financial year (see Figure 1).[2] Although the marginal tax rates below and above the threshold remained at 40 and 45 percent, this policy change created incentives for tax sheltering. Individuals faced incentives to locate their taxable income just below the threshold, and *"bunch"* at the kink where the marginal tax rate is lower. After the policy change, we observe that some individuals continuing to bunch at the former threshold, indicating that they incurred costs to adjust their taxable income.

[1] We use administrative tax return data which only captures taxpayers' legal tax minimization activities. Illegal tax evasions are beyond the scope of this study.

[2] The financial year in Australia spans July 1 to June 30. In 2008, AUD 150,000 corresponded to USD 127,500, and AUD 180,000 to USD 153,000.

We first show that the bunchers are those with more flexibility to adjust their taxable income, and therefore the response is driven by tax sheltering behaviours rather than labour supply responses. We then use the amount of bunching at the former and new kinks before ad after the policy change and employ an adoption of the bunching method of Gelber et al. (2020) to estimate the cost of tax sheltering and the ETI with respect to net of tax rates. We investigate the immediate responses suing a static model. We examine the transition of bunching from the former to the new threshold using a dynamic model to estimate the cumulative probability of drawing a non-zero tax sheltering cost in addition to the tax sheltering cost and ETI. Additionally, we explore the tax sheltering mechanisms employed by high-income individuals. Finally, we analyse the policy's impact on government revenue, breaking it down into mechanical and behavioural response to assess the fiscal externalities of the policy change.

Our selection of the Australian tax system for this study offers several notable advantages. The Australian tax system is characterized by its comprehensiveness and individual-centric approach, with tax collection exclusively overseen by the federal government. Additionally, it operates on a single tax base principle, encompassing all sources of worldwide income, including wage and salary earnings, self-employment income, trust income, transfer payments, dividends, interest income, capital gains, rental income, in-kind income and fringe benefits.[3] Furthermore, the Australian tax system permits a range of deductions and facilitates income distribution within families. This flexibility allows taxpayers to strategically shelter a portion of their income from taxation to target a specific income level.

We use administrative personal income tax data from the Australian Taxation Office (ATO) for our empirical analysis. The data comprises a panel of ten percent sample of all individual taxpayers who filed tax returns from 2005-2006 to 2010-2011 financial years (three years of pre- and three years of post-policy change).[4] This dataset provides

[3]In scenarios involving multiple tax bases with differing tax rates, the overall Elasticity of Taxable Income (ETI) is no longer a sufficient statistic for welfare analysis. For an examination of tax systems with multiple tax bases, see Kleven (2014) for his analysis of Denmark's tax system.

[4]The data covers 1999-2000 to 2019-2020. We use the full sample for plotting Figure 4, which tracks the bunchers at the top kink both before and after our study period.

detailed information on individuals' total income, taxable income, including wage and salary income, trust income, total tax withhold, net tax, and deductions along with basic demographic data such as sex, gender, age, occupation, location of residence, and some family related information.

Our empirical analysis yields several key findings. First, high-income taxpayers exhibit strong behavioural responses to higher taxes, characterized by large and sharp bunching at the top tax kink (see Figure 2 and Figure 3). We also find bunching for wage and salary earners, although the bunching is quite small. These are quite unique findings since most of the previous studies document bunching only at the lower kinks, and no bunching for wage and salary earners.[5]

Second, we find strong evidence that the responses to the policy change are driven by tax sheltering behaviours rather than labour supply responses: (i) most of those who bunch at the top kink have a pattern of chronological bunching, adjusting their taxable income each time the top kink increases. It is unlikely to increase taxable income by a substantial amounts in just one year by increasing labour supply (see Figure 4).[6] (ii) bunchers are those who have more flexibility to adjust their taxable, including self-employed individuals and those with trust income (see Figure 5 and Figure 6). Our findings indicate that high-income individuals tax shelter by channelling income through trusts, often incorporating businesses within these trusts. This allows for income distribution to individuals subject to lower marginal tax rates, which can include spouses, children, or elderly relatives with lower or zero marginal income tax rates.

Third, the estimated ETI from both static and dynamic models are larger than estimates that do not account for tax sheltering cost using Saez (2010) bunching model. This indicates that the presence of costs can moderate both immediate and longer-term responses to changes in income taxes, even for high-income individuals. In particular, the static model, which captures immediate responses and incorporates the cost of tax sheltering, yields an ETI estimate of 0.12, which is twenty percent higher compared to the

[5] Saez (2010) document bunching at the lower kinks in the US, and Mavrokonstantis and Seibold (2022) document bunching at the lower kinks, and for self employed individuals in Cyprus.

[6] The increase in the taxable income by AUD 30,000 is substantial given that the average taxable income in Australia during our study period is less than AUD 50,000. See Table A.1 in Appendix A.

estimate without cost at 0.10. The dynamic model, which captures longer-term responses and accounts for the cost of tax sheltering, yields an ETI estimate of 0.17, seventy percent higher compared to the estimate without cost. Furthermore, the dynamic model estimate is forty percent higher than that of the static model, suggesting that individuals might need more time to adjust to the new tax system.

Fourth, our estimates reveal that the fixed cost associated with tax sheltering is negligible, and not statistically significant. The estimated marginal cost of sheltering one dollar of taxable income from an additional five percent marginal tax is approximately two cents in both static and dynamic models. The cumulative probability of incurring tax sheltering cost decreases over time, aligning with the emergence of bunching from the former to the new threshold. Ultimately, it reaches zero within a three-year post-policy change period.

Fifth, we find a significant heterogeneity in estimated ETI from both static and dynamic models, depending on demographic and economic factors such as individuals' sex, age, marital status, having children, location of residence, employment type (self-employed versus wage and salary earners), occupation, and trust income. The estimated ETI range from 0.039 for wage and salary earners (for both static and dynamic models) to 0.500 for self-employed taxpayers with trust income (for both static and dynamic models). The estimated marginal cost of tax sheltering displays greater homogeneity in the dynamic model compared to the static model.

Lastly, although the policy change led to a decrease in government tax revenue of approximately AUD 13.2 million per annum due to lower marginal tax rates on higher incomes, the fiscal externalities of the policy change is quite high at about 35 cents. That is, for each dollar lost through the mechanical effects of the policy change due to lower marginal tax rates on higher taxable incomes, 35 cents is gained due to behavioural effects through bunching at the top kinks. The fiscal externalities are particularly larger for individuals with greater flexibility in adjusting their taxable income, such as self-employed individuals with trust income, with fiscal externalities exceeding the dollar-to-dollar equivalence by about 20 percent.

Income taxes, low or high, alter relative prices, distort decisions and create inefficiencies, which have important implications for optimal progressiveness of income taxes and the efficiency cost of tax policies. The efficiency cost of progressive income taxes depends on whether the income sensitivity is driven by tax sheltering rather than labour supply. If the marginal cost and benefit of sheltering income are equal to the marginal tax rate, then the source of inefficiency should not matter (Feldstein, 1999; Saez, 2004; Slemrod and Yitzhaki, 2002), and the estimated ETI is a sufficient statistic for estimating the inefficiency costs of taxation (Feldstein, 1995, 1999). These studies argue that an optimizing agent equates the marginal cost of sheltering one dollar of income from tax with the net marginal cost of reducing taxable income by one dollar. Therefore, the reason reported taxable income falls does not matter for inefficiency calculations. A large body of literature has focused on estimating the ETI as a sufficient statistic (see Saez et al., 2012 for a critical review of the recent literature).

However, Chetty (2009) provides two reasons why the marginal cost and benefit of sheltering one dollar of income might not necessarily be equal to the marginal tax rate, and therefore the ETI is not a sufficient statistic for measuring the efficiency cost of taxes.[7] First, some of the costs of sheltering income are not real costs and are instead in the form of transfers to other agents in the economy. For instance, individuals seeking to avoid taxation by making charitable contributions or setting up trusts for their descendants may not fully internalize the benefits of their contributions, effectively incurring a transfer cost for sheltering income. Second, individuals overestimate the cost of tax sheltering. For instance, individuals overestimate the detection probability and fines for tax evasion (Andreoni et al., 1998). These optimization errors create a difference between the true cost of tax sheltering and the tax rate.

While estimates of ETI using tax return data are widely available, estimates tax sheltering cost are relatively scarce. It requires developing a mapping between primitive parameters and observable behaviour (Chetty, 2009). There are studies suggesting that individuals face costs when adjusting their income in response to changes in taxes (Chetty,

[7] Doerrenberg et al. (2017) shows that the ETI is not a sufficient statistics for welfare analysis if the deductions generate externalities and if deductions are responsive to tax-rate changes.

2012, 2009; Kleven and Waseem, 2013; Alinaghi et al., 2020; Adam et al., 2020; Zaresani, 2020). However, none of these studies provides an estimate of the tax sheltering cost. We contribute to this literature by providing the first estimate tax sheltering cost for high-income taxpayers.

We also contribute to the literature examining the effects of tax polices on high income or wealth individuals. A number of recent studies examine taxable income responses to lower marginal tax rates at the top of the income distribution including the US (Feldstein, 1995; Auten and Carroll, 1999; Goolsbee, 2000; Gruber and Saez, 2002; Kopczuk, 2005; Giertz, 2007), UK (Brewer et al., 2010), Canada (Sillamaa and Veall, 2001; Saez and Veall, 2005), Norway (Aarbu and Thoresen, 2001), Sweden (Hansson, 2007; Blomquist and Selin, 2010; Gelber, 2014), Denmark (Kleven and Schultz, 2014), Poland (Kopczuk, 2012), and Australia (Johnson et al., 2023). Brülhart et al. (2022) investigate responses to the wealth taxes in Switzerland. Findings suggest that high-income individuals are sensitive to tax policies and adjust their behaviour accordingly. We contribute to this literature by providing evidence from Australia, accounting for the cost of tax sheltering.[8]

Gelber et al. (2020) build on Saez (2010) and develop a novel framework to jointly estimate the average cost and earnings elasticity using bunching at a kink.[9] They explore a policy change in the Social Security Annual Earnings Test in the US, which decreased the marginal tax rate above a kink. They use bunching at the kink before and after the policy change to estimate earnings elasticity and average adjustment cost. Zaresani (2020) adopts the model to estimate average adjustment costs and earning elasticity in the context of a disability insurance program, exploring a similar policy change to ours in which the kink threshold was increased, with no changes in the marginal tax rates. We contribute to this literature by adopting the approach of Gelber et al. (2020) for estimating fixed and marginal costs.

For the remainder of the paper, we proceed as follows. We describe the institutional background of the Australian income tax system and the data we use for our analysis in

[8] Johnson et al. (2023) explore several policy changes in Australia, and estimates ETI using a bunching model without accounting for the tax sheltering cost.

[9] See Kleven (2016) for a review of the recent bunching literature.

Section 2. We present our bunching model for estimating cost of tax sheltering and ETI and our findings in Section 4. We conclude in Section 5.

2 Institutional background and data

2.1 Personal income taxes in Australia

Personal income taxes constitute the primary form of taxation in Australia and are administered by the federal government through the Australian Taxation Office (ATO).[10] It operates on a progressive scale, meaning that higher income levels are subject to higher tax rates. The tax system is divided into various income tax brackets, each corresponding to specific tax rates (see Figure 1).[11]

Taxable income is determined by calculating the difference between assessable income and allowable deductions. For individual taxpayers, assessable income falls into three primary categories: personal earnings, business income, and capital gains.[12] The tax base encompasses all sources of income, spanning wage and salary earnings, self-employment income, trust income,[13] transfer payments, dividends, interest income, capital gains, rental income, and in-kind income.[14] The tax system also offers a range of tax deductions, offsets, and rebates designed to support lower-income individuals and families.[15]

Taxpayers are obligated to file an annual income tax return with the ATO at the conclusion of each financial year, typically on June 30. This return reports all sources of income, deductions, and other other relevant financial details. To facilitate the fulfilment

[10]In addition to personal income taxes, Australia also imposes a flat rate corporate tax on corporate profits and assets, and a payroll tax at the state and territory level.

[11]The majority of Australian residents are also required to pay the Medicare Levy, which contributes to funding the country's public healthcare system, known as Medicare. Typically, the Medicare Levy is set at two percent of taxable income. However, individuals whose income exceeds a certain threshold and who do not purchase private health insurance are subject to an additional levy known as the Medicare Levy Surcharge (MLS), which range from one to 1.5 percent of their total income.

[12]Capital gains are subjected to taxation at the time the gain is realized, and receive a 50 percent reduction if the capital asset sold was held for more than one year.

[13]The partnerships and trust income is not directly taxed but is instead taxed upon distribution to the partners or beneficiaries.

[14]Some types of in-kind income are non-reportable and, as a result, are effectively exempt from taxation. Typically, these benefits correspond to expenses that would otherwise be deductible.

[15]Examples of these include the Low and Middle Income Tax Offset (LMITO) and the Family Tax Benefit.

of tax obligations throughout the year, many Australian employers withhold income tax from their employees' paychecks through a system known as Pay As You Go (PAYG) withholding.

2.2 Policy changes in personal income taxes

Figure 1 plots the personal income tax schedule and the corresponding marginal tax rates in Australia between 2000-2001 an 2020-2021. It shows four income brackets with marginal tax rates ranging between zero and 47 percent, and it has become more progressive over the last two decades.

Our focus is on the top income bracket of the tax schedule. It has gradually increased from AUD 60,000 in 2000-2001 financial year to AUD 180,000 in 2008-2009. The marginal tax rate above the top kink was 47 percent in 2000-2001 and it has been 45 percent since after 2006-2007. The marginal tax rate below the top kink in 2000-2001 was 42 percent and it has been 40 percent since after 2006-2007. These gradual changes have created two major changes to the kink at the top threshold. First, the top kink was shifted to AUD 150,000 (marginal tax rates of 40 percent and 45 percent respectively below and above the kink) from AUD 95,000 (47 and 42 percent marginal tax rates) in 2006-2007. Second, the top kink was shifted to AUD 180,000 (40 and 45 percent marginal tax rates) from AUD 150,000 (40 and 45 percent marginal tax rates) in 2008-2009. These kinks create incentives for individuals to locate their taxable income below the threshold and bunch at kink to shelter their income from higher marginal tax rate above the threshold. In this paper, we focus on the second major change, which is comparable to other tax reforms simply changed the tax kink threshold.

The features of the Australian personal income tax system combined with the changes in the top kink threshold provide an excellent opportunity to empirically estimate the tax sheltering costs. Firstly, income taxes are exclusively levied by the federal government, in contrast to the US, which imposes separate federal, state, and municipal taxes. Secondly, personal income tax is assessed on individuals, not on household units, as is the case in the US.[16] Thirdly, Australia's tax system boasts a single tax base, including worldwide income, and is comprehensive, unlike the dual tax system in the US. This comprehensiveness covers both labour and capital income, thereby reducing incentives to convert income from one form to another to evade higher marginal tax rates. Fourthly, Australia allows for a wide range of deductions to reduce taxable income.[17] Common deductions include work-related expenses, charitable donations, some in-kind income, specific investment-related costs such as interest expenses and capital depreciations, and salary sacrifices for various cases including the contributions to the retirement savings.[18]

2.3 Data and study sample

We use data from the Administrative Longitudinal Information File (ALife) from ATO. The ALife data represents a ten percent panel sample of individual annual tax return files, enabling longitudinal tracking of individual tax records from the financial year 2005-2006 through the financial year 2010-2011.[19] This dataset offers comprehensive insights into individuals' total income, taxable income, including wage and salary income, trust income, total tax withhold, net tax, and deductions along with basic demographic data such as sex, gender, age, occupation, location of residence, and some family related information, including having spouse, children, and being the main earner.

[16] Although Australia employs an individual-based personal income tax system, a few elements, including the Medicare Levy Surcharge (MLS), are based on household income. Individuals also have the capacity to contribute to the retirement savings of other family members or distribute trust income to other family members.

[17] The Australian taxation system has limited restrictions on expenses. For example, interest expenses on borrowings can offset labour or other income types, while capital losses resulting from the sale of an asset can be quarantined but used only against capital gains.

[18] Salary sacrificing allows employees to exchange a portion of their pre-tax income for various benefits, such as contributions to retirement savings (Superannuation), health insurance, or even a company car. This approach offers tax advantages, as the income sacrificed is not subject to regular income tax rates. For instance, superannuation contributions made from pre-tax income are taxed at a much lower flat rate of 15 percent, up to an age-specific contribution cap.

[19] A random sample is drawn from the initial client register of tax filers, regularly updated since 1980, including temporary visa holders and people who died prior to 2016. Each client is given a unique permanent random number between zero and one and clients with a number less than 0.1 are included in the sample. This means that the selection of each individual is an independent Bernoulli trial with a ten percent chance of selection. In each release following the initial sample, the sample is updated by a ten percent random sample of people added to the client register since the previous annual release. In years where a tax return was not lodged, the individual's information for that year is missing in ALife. A small number of individuals who face relatively high risk of re-identification (such as those aged 95 or more) are excluded from the sample. For more information see Bond and Wright (2018) and Polidano et al. (2020).

Our study sample comprises individual taxpayers aged 18 years and older, who are Australian residents for tax purposes, and whose taxable income falls within the range of AUD 130,000 to AUD 200,000 (spanning the former and new top kinks) for the years 2006-2007 to 2010-2011, encompassing three years before and three years after the policy change. Our study sample includes about 45 thousands and 65 thousands individuals before and after the policy change, with a total observation of about 170 thousands over a six years period.

Table 1 presents a summary of statistics for our study sample for economics outcomes and demographics.[20] This table describes statistics for the three years of pre- and the three years of post-policy change. The first block of the table presents the economics outcome statistics. The average total income and taxable income amount to approximately AUD 165,000 and AUD 156,000, respectively. Meanwhile, the average figures for total tax withheld is much lower than the net tax at AUD 36,000, AUD 45,000, respectively. The average deductions stands at about AUD 9,000. About one in three individuals in our study sample has trust income. About 45 percent of the sample are self employed, where more than 70 percent of them have trust income. Occupational information is primarily available for wage and salary earners, with about half of the sample comprising managerial and professional occupations. The average wage and salary income in our study sample is about AUD 107,000, which falls below both the former and new top tax thresholds.

The cost of tax affairs is tax-deductible in the Australian tax code and is reported in tax return files. About four in five tax filers within the sample utilized a tax agent for their tax filings. The average tax affair fee (for hiring a tax accountant) is AUD 420. Individuals spent on average eleven and eight hours for filling their taxes, respectively before and after the policy change.

Table 1 also presents demographic summary statistics. The average age within our study sample is 46 years. Three-quarters of the sample consist of males who have partners and at least one child and reside in major cities. Approximately nine out of ten taxpayers

[20]Table A.1 in Appendix A presents the summary statistics for taxpayers with all levels of taxable income during our study period.

are the primary earners in their households, where more than 80 percent of them are male.

3 Cost of tax sheltering

3.1 Documenting the cost

Figure 2 plots the distribution of taxable income over the period spanning from 2005-2006 to 2010-2011. In the first panel, which corresponds to the year 2005-2006, the top tax threshold stands at AUD 95,000 (as shown in Figure 1). Although it is not displayed in the figure, there is bunching at AUD 95,000 kink; however, there is no observable bunching within the taxable income range of AUD 130,000 to AUD 200,000.

Subsequently, the top tax threshold increases to AUD 150,000 in 2006-2007. In the second panel, there is a sharp bunching at this new top kink, with the bunching increasing in the following year. Further changes in tax policy raise the top tax threshold to AUD 180,000 in 2008-2009. The fourth panel shows that the bunching shifts to this new top threshold at AUD 180,000, although some bunching at the former kink persists. For a closer examination of the taxable income distribution surrounding the policy change, see Figure 3.[21]

The final two panels of Figure 2 show the gradual increase in bunching at the new threshold, concurrent with a decrease in bunching at the former threshold. This gradual shift of bunching from the former to the new top threshold implies that individuals face costs when attempting to adjust their taxable income, tax shelter to minimize their tax liabilities.

It's important to note that the cost of hiring an accountant for tax filing in Australia is tax-deductible, and these costs are recorded in our dataset. During our study period, approximately seventy percent of all tax filers used a tax accountant (see Table A.1 in Appendix A). Moreover, the usage rates are even higher within our study sample including those with higher taxable incomes (see Table 1) and sharp bunchers at the top kinks (see Table 2), with a usage rate exceeding eighty percent. This high rate of tax accountant

[21] Figure B.1 to Figure B.8 in Appendix B plot the distribution of taxable income around the top kink for different sub-samples before and after the policy change.

usage implies that tax filers have a strong understanding of the tax system and related policy changes. Therefore, it is unlikely that the residual bunching can be attributed to a lack of information about the policy changes.

3.2 Tax sheltering versus labour supply responses

Figure 4 provides a comprehensive overview of top kink bunchers over various time periods, including during and both preceding and following our study period. It plots the distribution of taxable income for sharp bunching individuals, those who bunched within a AUD 5,000 window of the new kink at AUD 180,000 during the post-policy change period of our study (2008-2009 to 2010-11). The grey and red lines represent the former and new top kinks over the years. Panel (a) tracks the sharp bunchers before our study period, spanning from 1999-2000 to 2004-2005. Panel (b) illustrates the distribution during our study period, from 2005-2006 to 2010-2011. Notably, it displays significant bunching at the kink due to the sample's structure. Panel (c) tracks the bunching patterns after our study period, spanning from 2011-2012 to 2019-2020.

The figure shows that individuals who bunched at the top kink of AUD 180,000 during our study period also bunched at other former top kinks, including AUD 50,000, AUD 60,000, AUD 62,500, AUD 70,000, AUD 95,000, and AUD 150,000 (see Figure 1 for changes in the tax schedule). Remarkably, these individuals continued to bunch at the AUD 180,0000 top kink for the subsequent nine years, extending beyond our study period. This suggests that top kink bunchers have a pattern of chronological bunching, adjusting their taxable income each time the top kink increases. This finding indicates that the observed responses are unlikely to be driven solely by changes in labour supply.

Table 2 presents summary statistics for sharp bunchers at both the former top kink (AUD 150,000) and the new top kink (AUD 180,000). The study sample includes about 11 thousands individuals whose taxable income fell within a AUD 5,000 window around these kinks three years before and three years after the policy change. While the demographic characteristics of sharp bunchers do not significantly differ from those of our study sample presented in Table 1, there are notable differences in economic outcomes, notably total tax withhold, wage and salary earnings, trust income, and self employed status.

Sharp bunchers have about ten percent lower total tax withhold compared to our study sample. The average wage and salary earnings for sharp bunchers at both kinks are more than ten percent lower than those in Table 1, and it comprises a smaller share of total and taxable income. A larger portion of sharp bunchesr, more than half, are self employed.

The average tax affairs fee (for hiring an accountant) for sharp bunchers increased by about 30 percent after the policy change, an increase from AUD 370 to AUD 490. The average time spend for filing taxes also increased by four folds after policy change, an increase from six hours to 24 hours. This findings suggest that sharp bunchers had to make an extra financial and time efforts to minimize their tax liabilities following the policy change.

The most striking difference between sharp bunchers and our study sample is their trust income. The portion of sharp bunchers with trust income at the new kink is 25 percent higher compared to the former kink (35 versus 44 percent). The average trust income for sharp bunchers at the former and new kinks stands at AUD 21,500 and AUD 43,000, respectively. In contrast, the corresponding figures for our study sample are considerably lower, at AUD 290 before the policy change and AUD 420 after the policy change, which is more than 70 times lower.

Figure 5, Figure 6 and Figure 7 illustrate the distribution of taxable income before and after the policy change, by employment type (self employed versus wage and salary earners), trust income (with and without trust income), and self employed individuals with trust income, respectively. The figure suggests that self employed individuals and those with trust income bunch more, and have stronger responses to the policy change. The flexibility to adjust taxable income for these individuals can be attributed to three primary factors. Firstly, they have the capacity to easily modify their labour supply since they are not bound by fixed-hour contracts. Secondly, a substantial portion of their income is not third-party reported, providing them with increased opportunities for tax sheltering. Thirdly, they have the ability to transfer a portion of their income to other family members who may face lower marginal tax rates, such as spouses, children, or elderly parents, thereby reducing the overall tax burden (Chetty et al., 2011; Kleven et al., 2011).

These findings suggest that the responses to the policy change are primarily driven by tax sheltering behaviours rather than labour supply responses. Firstly, most individuals who bunched at the new kink also did so at the former kinks. Increasing taxable income by a substantial amount, such as AUD 30,000 in just one year, through labour supply adjustments is unlikely. Secondly, bunchers are typically those with greater flexibility to adjust their taxable income, including self-employed individuals and those with trust income.

3.2.1 Tax sheltering instrument among high income individuals

Among high-income individuals in Australia, a common approach to reduce tax burden is channelling income through a trust, often by incorporating a business within the trust. This allows for income distribution to individuals in lower tax brackets, such as spouses, children, or elderly relatives with lower or zero marginal tax rates.[22]

We first provide evidence that trust income is used as the main tax sheltering instrument. In Figure 8, we present the distribution of taxable income, gross taxable income, total deductions, and trust income for individuals with trust income.[23] The study sample comprises individuals with taxable income ranging from AUD 130,000 to AUD 200,000 who reported trust income. Gross taxable income is calculated by excluding trust income while including total deductions in taxable income.

In Panel (a), we observe a sharp bunching at the top income threshold of AUD 150,000 before the policy change. This bunching subsequently shifts to the new threshold of AUD

[22]A recent article in the Australian Financial Review on February 1, 2023, highlights that "The AUD 2.2 trillion trust sector is under growing scrutiny from the Australian Taxation Office amid concerns that as trusts become increasingly popular, they are being more blatantly used for tax manipulation by individuals and companies" (for more detail see https://www.afr.com/wealth/personal-finance/ato-turns-screws-on-popular-trusts-amid-tax-evasion-claims-20230130-p5cghb). In a related study, Sainsbury and Breunig (2020) discuss some of the easier methods through which trusts can be utilized to shift income to individuals with lower marginal tax rates or to defer taxation to future periods.

[23]Figure B.9 in Appendix B provides similar distributions for self-employed individuals with trust income.

180,000 after the policy alteration. Panel (b) illustrates the distribution of gross taxable income, where the bunching has disappeared.

The distribution of deductions in Panel (c) appears relatively flat, while Panel (d) shows significant bunching of trust income at the top income kinks. This observation suggest that trust income has more prominent role in tax sheltering than deductions.

While gross taxable income alone cannot provide a comprehensive counter-factual for assessing how individuals' income would appear in the absence of deductions or trusts, these figures collectively suggest that trust income plays a crucial role in tax minimization, contributing to the observed bunching in the distribution of taxable income.

Due to the absence of family link information in our data, we offer suggestive evidence on how high-income individuals use trust income as an instrument for income distribution to family members with lower marginal tax rates including women, younger children or older grandparents. To do this, we plot the distribution of trust income by gender and age.

Figure 9 presents trust income distributions for males and females, revealing more pronounced bunching at the top tax thresholds for females, in which the bunching shifts from the former top kink to the new one after the policy change. Figure 10 presents the distribution of trust income among individuals aged 18-24 years, 24-44 years, 45-59 years, and those over 60 years old. Younger individuals exhibit a stronger bunching effect for trust income at the top tax thresholds. Figure 11 shows the distribution of trust income for individuals who are not the main earners, indicating sharp bunching at the top tax threshold, which shifts to the new threshold after the policy change. These findings suggest that reported trust income may originate from higher-income family members.[24]

Figure 12 presents the distribution of tax affairs fee for our study sample, broken down to sharp bunchers, and those with trust income. The figure also presents average costs for each group. Two notable findings emerge from Figure 12. Firstly, the average cost is higher for those with trust income. Secondly, costs for all, bunchers, and those with trust income show an increase in 2008-2009 when the top kink is changed, reflecting

[24] About 60 percent of taxpayers with taxable income between AUD 130,000-200,000 who are not main earner in their family are females, of which more than 60 percent have trust income.

re-optimization costs.

Figure 13 plots the distribution of annual personal contributions of individuals in our study sample to tax-favored retirement savings accounts, known as ”Superannuation” in Australia. These accounts have age-based caps, and there are sharp bunching at the contribution caps. The grey lines on the figure show the contribution caps over the years. The figure shows that the bunching moves immediately with the cap changes, and it does not seem to be affected with the changes to the top kinks of the income tax schedule, since the saving incentives are much higher in tax favoured retirement savings accounts.[25] There are quite sharp bunching at the contribution caps, and the bunching moves immediately with the cap changes, and it does not seem to be affected with the changes to the top kinks of the income tax schedule, since the saving incentives are much higher in tax favoured retirement savings accounts. This figure suggest that retirement savings does not play an prominent role in tax sheltering.

In conclusion, our findings provide compelling evidence that high-income individuals strategically use trust income to minimize their tax liabilities within the bounds of tax regulations. Furthermore, variations in trust income by gender and age suggest potential intergenerational income redistribution strategies within families. This evidence sheds light on the complex tax optimization strategies employed by high-income individuals.

4 Empirical analysis

In this section, we first present our bunching models for estimating tax sheltering costs and the ETI, which is an adoption of Gelber et al. (2020) model. We then show the empirical implementation of our model. We explore the policy change that raised the top kink threshold and use the amount of bunching at the top kink before and after the policy change, and the residual bunching at the former kink following the policy change,

[25]The superannuation retirement savings accounts have age based caps where the tax rate below the cap is 15 percent and the tax rate for contributions above the cap jumps up to individuals' marginal income tax. The caps have changed multiple times since the introduction in 2006-2007 where it was 100,000 AUD for all ages. Then the caps for those below 50 years was decreased to 50,000 AUD in 2007-2008. The caps were further decreased to 25,000 AUD for those below 50 years and to 50,000 AUD for those above 50 years. Individuals can make contributions to other family members' accounts.

to estimated the models. Finally, we will present our estimation results.

The bunching model developed by Gelber et al. (2020) serves as the foundation for estimating adjustment costs and earning elasticity. They examined a policy change in the Social Security Annual Earnings Test in the US, which reduced the marginal tax rate above a kink. This change allowed them to estimate average adjustment costs and earnings elasticity. Building upon their work, Zaresani (2020) adopted the model to analyze a policy change in a disability insurance program. In this case, the policy increased the threshold of a kink, enabling the estimation of average adjustment costs and earnings elasticity. We further extend the model proposed by Gelber et al. (2020) to estimate both fixed and marginal costs associated with tax sheltering and the ETI. Our analysis explores a policy change akin to that studied by Zaresani (2020), which involved raising the kink threshold rather than changing marginal tax rates as in Gelber et al. (2020).

4.1 Model

We present both static and dynamic bunching models. The static model investigates immediate responses to the policy change, while the dynamic model examines the gradual transition of bunching from the former to the new threshold over a three-year post-change period. Bunching at a threshold is conceptually linked to the ETI but inversely related to the magnitude of the tax sheltering cost.

The utility function, denoted as $u(c, z; \alpha)$, depends on the ETI represented by e. Here, z and c denote the taxable income and consumption, defined as after-tax income. α represents individuals' time-invariant ability, which is the only source of heterogeneity in the model. When individuals seek to shelter their income from taxes, they face a cost denoted as $\phi > 0$ in the form of utility loss.

A marginal buncher at the kink z^* with ability α faces marginal tax rates of $\tau_0 < \tau_1$ below and above z^*. Their initial taxable income is z where $z > z^*$. These individuals are indifferent between taxable income z, subject to the higher marginal tax rate of τ_1, or incurring tax sheltering cost ϕ to reduce their taxable income to z_1^*, where the marginal tax rate is lower at τ_0. The initial taxable income of such a marginal buncher corresponds to their taxable income with a flat tax rate of τ_0.

In our models, z_1^* and z_2^* represent the former and new top kinks, respectively, set at AUD 150,000 and AUD 180,000. The marginal tax rates below and above each kink are 40 percent and 45 percent, as shown in Figure 1.

4.1.1 Static Model

Panel (a) of Figure 14 illustrates a marginal buncher at z_1^* before the policy change whose ability is denoted by $\alpha^{m_{10}}$ and their initial taxable income is $\underline{z}_{10}$ where $\underline{z}_{10} > z_1^*$. Faced with a choice, they must decide between maintaining their taxable income at $\underline{z}_{10}$, subject to the higher marginal tax rate of τ_1, or enduring a utility loss ϕ as tax sheltering cost to reduce their taxable income to z_1^*, where the marginal tax is lower at τ_0. The *marginal buncher* equation at z_1^* before the policy change is:

$$u\left((1-\tau_0)z_1^* + R_1, z_1^*; \alpha^{m_{10}}\right) = u\left((1-\tau_0)z_1^* + (1-\tau_1)(\underline{z}_{10} - z_1^*) + R_1, \underline{z}_{10}; \alpha^{m_{10}}\right) + \phi \quad (1)$$

where R_1 represents virtual income. Without tax sheltering costs, individuals with initial taxable income in the range of $(z_1^*, z_1^* + \Delta z_1^*]$ would choose to bunch at z_1^*. Assuming mild conditions regarding the underlying utility function, applicable to all quasi-linear utility functions, the gain from relocating to a kink increases as the distance from the kink grows.[26] Tax sheltering costs result in only those individuals bunching at the kink whose utility gain surpasses the tax sheltering costs. Consequently, the bunching range contracts to $(\underline{z}_{10}, z_1^* + \Delta z_1^*]$ from $(z_1^*, z_1^* + \Delta z_1^*]$ where $\underline{z}_{10} > z_1^*$.

Figure 15 illustrates the counterfactual distribution of taxable income with a flat tax rate of τ_0, denoted as $h_0(\cdot)$. In the absence of tax sheltering costs, the bunching range covers $i + ii + iii$, but with tax sheltering costs, it narrows to $ii + iii$. The area under the counterfactual distribution of taxable income in the bunching range at z_1^* represents the

[26]This assumption is based on the premise that the size of the adjustment in taxable income increases with α at a rate faster than the decrease in the marginal utility of consumption. For more details, refer to Gelber et al. (2013).

bunching at z_1^*. The bunching at z_1^* before the policy change can be approximated as:[27]

$$B_{10} = \int_{\underline{z}_{10}}^{z_1^* + \Delta z_1^*} h_0(\zeta) d(\zeta) \approx (z_1^* + \Delta z_{10}^* - \underline{z}_{10}) h_0(z_1^*) \tag{2}$$

The policy change increased the top kink threshold to z_2^* from z_1^*. Bunchers at z_1^* would increase their taxable income only if their utility gain from relocation exceeds the cost they face. Panel (b) of Figure 14 illustrates a marginal buncher at z_1^* after the policy change, with ability $\alpha^{m_{11}}$ and an initial taxable income of $\underline{z}_{11} \in (\underline{z}_{10}, z_1^* + \Delta z_1^*]$. They are indifferent between continuing to bunch at z_1^* or enduring a utility loss ϕ and relocating to their optimal taxable income $\underline{z}'_{11}$ with the new tax rates. The *marginal buncher* equation at z_1^* post-policy change is:

$$u\left((1-\tau_0)\underline{z}'_{11} + R_2, \underline{z}'_{11}; \alpha^{m_{11}}\right) = u\left((1-\tau_0) z_1^* + R_2, z_1^*; \alpha^{m_{11}}\right) + \phi \tag{3}$$

Individuals with initial taxable income in the range of $(\underline{z}_{10}, \underline{z}_{11}]$ continue bunching at z_1^* after the policy change. Figure 15 illustrates the residual bunching range at z_1^* after the policy change. The *bunching* at z_1^* after the policy change can be approximated as:

$$B_{11} = \int_{\underline{z}_{10}}^{\underline{z}_{11}} h_0(\zeta) d(\zeta) \simeq (\underline{z}_{11} - \underline{z}_{10}) h_0(z_1^*) \tag{4}$$

Panel (c) of Figure 14 illustrates a marginal buncher at z_2^* kink with ability α_2 and initial taxable income at $\underline{z}_2 > z_2^*$. Once a kink at z_1^* was introduced, a marginal buncher relocated to $\underline{z}'_2$, representing their optimal taxable income with a marginal tax rate of τ_1. Once the kink threshold is increased to z_2^*, they are indifferent between staying at $\underline{z}'_2$

[27]This approximation assumes that the distribution of $h_0(\cdot)$ on $(\underline{z}_{10}, z_1^* + \Delta z_{10}^*]$ is uniform. This is a common assumption in the bunching literature. Refer to, for instance, Chetty et al. (2011); Kleven and Waseem (2013), and Kleven (2016) for a review of recent bunching literature. Gelber et al. (2020) utilize the income distribution of a different group of individuals who do not face a kink as a counterfactual income distribution for their study sample. This approach allows them to estimate the bunching with no further distributional assumptions on their counterfactual distribution. However, this approach assumes similarity between distributions of income between two different groups. We are unable to use this approach as all individuals in our sample face the same income taxes. We could potentially use the distribution of taxable income from the previous years as a counterfactual distribution, but the numerous changes in the tax schedule over the years (see Figure 1) prevent us from using that approach (see Figure 2).

with a marginal tax rate of τ_1 or enduring a cost ϕ and decreasing their taxable income to bunch at z_2^*. The *marginal buncher* equation at z_2^* is given by:

$$u((1-\tau_0)z_2^* + R_2, z_2^*; \alpha^{m_2}) = u((1-\tau_0)z_1^* + (1-\tau_1)\underline{z}_2' + R_2, \underline{z}_2'; \alpha^{m_2}) + \phi \tag{5}$$

In the absence of tax sheltering costs, individuals with initial taxable income in the range of $(z_2^*, z_2^* + \Delta z_2^*]$ would choose to bunch at z_2^*. Tax sheltering costs attenuate the bunching at the kink, and the bunching range shrinks to v from $iv + v$. Figure 15 shows that those with initial taxable income in the range of $(\underline{z}_2, z_2^* + \Delta z_2^*]$ bunch at z_2^*. The *bunching* at z_2^* can be approximated as:

$$B_2 = \int_{\underline{z}_2}^{z_2^* + \Delta z_2^*} h_0(\zeta) d\zeta \approx (z_2^* + \Delta z_2^* - \underline{z}_2) h_0(z_2^*) \tag{6}$$

The marginal buncher and bunching equations at each kink, collectively define a system of equations that we solve numerically to determine the parameters. Further information and details can be found in Appendix D.

4.1.2 Dynamic Model

A dynamic model takes into account the gradual evolution of bunching over time, as depicted in Figure 2. In our dynamic model, we estimate parameters that indicate the cumulative probability of incurring zero tax sheltering costs in each period, in addition to tax sheltering costs and ETI. These parameters are estimated by aligning the bunching behavior at the former and new kinks in each period.

Two crucial aspects of the data are worth highlighting. First, there is a delayed response to the policy change. Second, there is a lack of anticipatory responses to the policy change, as there is no bunching at the new kink in the pre-policy change periods (see Figure 2). Following the approach of Gelber et al. (2020), we assume that the tax sheltering cost is drawn from a stochastic process where individuals do not anticipate the policy change. This assumption can capture both of these data features effectively.

A discrete distribution models the stochastic arrival of tax sheltering opportunities or information about the policy change. An individual may change their taxable income in a given period only if the utility gain from the change is sufficiently large to offset the drawn cost in that period. This results in a gradual response to the policy change, manifesting as a gradual decrease in bunching at the former kink and a gradual increase in bunching at the new kink during the post-policy change periods.

At time 0, individuals start with their initial taxable income, which represents their optimal taxable income under a linear tax rate of τ_0. At time 1, a kink at z_1^* is introduced. This kink is implemented for T periods before moving to z_2^*. At each time t, individuals draw a cost from a discrete distribution $\{0, \phi\}$. Following Gelber et al. (2020), we assume that the probability of drawing a positive cost at time t is a function of the time elapsed since the most recent policy change at time t^*, denoted as π_{t-t^*}. Consequently, the probability of drawing zero cost at time t is $1 - \pi_{t-t^*}$. Individuals adjust their taxable income only if the utility gain from doing so exceeds the drawn cost. The cumulative probability of drawing zero cost by period t is $1 - \prod_{j=1}^{t} \pi_j$.

Bunching at z_1^* in the pre-policy change period $t \in [1, T]$ can be expressed as follows:

$$
\begin{aligned}
B_{10}^t &= \int_{\underline{z}_{10}}^{z_1^*+\Delta z_1^*} h_0(\zeta) d\zeta + (1 - \prod_{j=1}^{t} \pi_j) \int_{z_1^*}^{\underline{z}_{10}} h_0(\zeta) d\zeta \\
&= \int_{z_1^*}^{z_1^*+\Delta z_1^*} h_0(\zeta) d\zeta - \prod_{j=1}^{t} \pi_j \int_{z_1^*}^{\underline{z}_{10}} h_0(\zeta) d\zeta \\
&= B_{10}^* - \prod_{j=1}^{t} \pi_j (B_{10}^* - B_{10}) \\
&= \prod_{j=1}^{t} \pi_j B_{10} + (1 - \prod_{j=1}^{t} \pi_j) B_{10}^*
\end{aligned}
\tag{7}
$$

In this equation, B_{10}^*, specified in (D.4) in the Appendix D, and B_{10}, specified in (2), represent the bunching with no tax sheltering cost and immediate bunching after introducing the kink at z_1^*. The first line of (7) shows that bunching at z_1^* consists of two components added together. First, those in areas *ii* and *iii* in Figure 15 immediately bunched once the kink was introduced, similar to the group in the static model. Second, those in area *i* would bunch only if they draw a zero cost. The probability that this occurs at period t is $1 - \prod_{j=1}^{t} \pi_j$.

Bunching at z_1^* in the post-policy change period $t > T$ can be expressed as follows:

$$\begin{aligned} B_{11}^t &= (1 - \prod_{j=1}^{T} \pi_j)(\prod_{j=1}^{t-T} \pi_j) \int_{z_1^*}^{z_{10}} h_0(\zeta) d\zeta + \prod_{j=1}^{t-T} \pi_j \int_{\underline{z}_{10}}^{z_{11}} h_0(\zeta) d\zeta \\ &= (1 - \prod_{j=1}^{T} \pi_j)(\prod_{j=t-T}^{t} \pi_j)(B_{10}^* - B_{10}) + \prod_{j=1}^{t-T} \pi_j \int_{\underline{z}_{10}}^{z_{11}} h_0(\zeta) d\zeta \end{aligned} \tag{8}$$

The first line of (8) shows that bunching at z_1^* in the post-policy change period t consists of two components added together. First, individuals in area i in Figure 15, who bunched once they drew a zero cost, with a probability of $1 - \prod_{j=1}^{T} \pi_j$ and they will de-bunch only when they draw a zero cost. The probability of not drawing a zero cost by period t is $\prod_{j=1}^{t-T} \pi_j$. Second, individuals in area ii who bunched immediately after the kink was introduced and will de-bunch once they draw a zero cost.

Finally, bunching at the new kink at z_2^* in period $t > T$ can be expressed as follows:

$$\begin{aligned} B_2^t &= \int_{\underline{z}_2}^{z_2^* + \Delta z_2^*} h_0(\zeta) d\zeta + (1 - \prod_{j=1}^{t} \pi_j) \int_{z_2^*}^{z_2} h_0(\zeta) d\zeta \\ &= \prod_{j=1}^{t} \pi_j B_2 + (1 - \prod_{j=1}^{t} \pi_j) B_2^* \end{aligned} \tag{9}$$

Here, B_2^*, specified in (D.4) in the Appendix D, and B_2, specified in (6), represent the bunching with no cost sheltering cost and immediate bunching after introducing the kink at z_2^*. The first line of (9) shows that bunching at z_2^* consists of two components added together. First, those in area v in Figure 15 who immediately bunch once the kink at z_1^* is introduced, the same group of bunchers as in the static model. Second, those in area iv who would bunch only if they draw a zero cost. The probability of such a draw by period t is $1 - \prod_{j=1}^{t} \pi_j$.

The static model corresponds to the special case of the dynamic model when there is only one time period with $\pi = 1$. This is the case when individuals never draw a zero cost. The $\lim_{t \to \infty} B^T$ converges to B^*, suggesting that after a sufficiently long time, bunching at a kink returns to its level without costs.

The marginal buncher and bunching equations at each kink at each time period, collectively define a system of equations that we solve numerically to determine the model parameters including the cumulative probability of drawing zero tax sheltering cost at each time period, parameters of tax sheltering cost and the ETI. Further information and details can be found in Appendix D.

4.2 Empirical Implementation

In this section, we employ a widely-used approach in the bunching iterature and parameterize our model using an iso-elastic and quasi-linear utility function (Saez, 2010; Chetty et al., 2011; Kleven and Waseem, 2013; Bastani and Selin, 2014; Aghion et al., 2017; Gelber et al., 2020), which is expressed as follows:[28]

$$u(c, z; \alpha) = c - \frac{\alpha}{1+\frac{1}{e}} \left(\frac{z}{\alpha}\right)^{1+\frac{1}{e}} \tag{10}$$

Here, we define z as taxable income and c as consumption, which is equivalent to after-tax income ($z - T(z, \tau)$), where τ represents income taxes. The ETI with respect to net-of-tax rate is denoted as e, and α represents an ability parameter.

Each time period corresponds to one financial year. For the estimation of the static model, we use data from one year prior to the policy change (2007-2008) and one year after (2008-2009) (see Figure 3). To estimate the dynamic model, we incorporate data spanning two years of pre- and three years of post-policy change from 2006-2007 to 2010-2011(see Figure 2).

To estimate the amount of bunching at a kink, we follow the procedure outlined by Chetty et al. (2011) and Kleven and Waseem (2013). This involves setting the bin size to $\delta =$ AUD 500 and fitting a sixth-degree polynomial ($D = 6$) to the observed distribution of taxable income. We exclude six bins on each side of the kink ($l = u = 6$). The measure of bunching at a kink is computed as the difference between the fitted polynomial and the observed distribution of taxable income. A detailed explanation of the bunching estimation procedure can be found in Appendix C. We also assess the robustness of our

[28] Despite the limitations associated with the use of an iso-elastic and quasi-linear utility function, it remains popular in the bunching literature due to its convenience in estimation and expressing findings. A comprehensive review by Kleven (2016) highlights that almost all recent bunching papers adopt this quasi-linear utility function.

estimates with respect to these parameters in Table A.5 in Appendix A.

In our models, we assume that the cost of adjusting taxable income from an initial level z_0 to z to tax shelter $z - z_0$ is determined by the function $\phi(z, z_0) = \phi_f + \phi_m |z - z_0|$, where ϕ_f and ϕ_m represent fixed and marginal costs, respectively.

The marginal buncher and bunching equations at each kink for each time period collectively define a system of equations that we solve numerically to determine the model parameters. In the static model, we estimate e, ϕ_f, and ϕ_m by solving a system of equations encompassing (1) to (6). These equations jointly determine these parameters. In the dynamic model, we estimate not only the ETI and the tax sheltering cost parameters but also the cumulative probability of drawing zero tax sheltering costs in each time period. Additional details regarding the estimation procedure can be found in Appendix D.

4.2.1 Estimation Assumptions

A fundamental underlying assumption for using the amount of bunching at a kink to estimate structural parameters of a utility function is that the taxable income distribution would be smooth and continuous under a flat tax regime. Another critical parametric assumption is that the taxable income elasticity remains consistent across all individuals and does not change after the policy change. Furthermore, we assume that an individual's ability remains time-invariant and represents the sole source of heterogeneity in our models.

We also assume that the induced income effects of the policy change are negligible and employ a quasi-linear utility function specified in (10) to parametrize the models.

4.2.2 Inference

To make inferences about the estimated parameters, we employ bootstrapped standard errors, following the procedure described by Chetty et al. (2011). We perform 200 bootstrapped draws with replacement from the estimated error vector ϵ_i in (C.3) in Appendix C to generate new taxable income distributions. For each bootstrapped distribution, we estimate the parameters of interest. The standard error for a parameter θ is calculated as the standard deviation of its bootstrapped distribution $S_{\widehat{\theta}}$, which reflects the misspecification of the fitted polynomial to the observed taxable income distribution rather than sampling error.

To test whether an estimated parameter $\widehat{\theta}$ significantly deviates from zero ($H_0 : \theta \neq 0$), we compute a t-test statistic $T = \frac{\widehat{\theta}}{S_{\widehat{\theta}}}$ for each bootstrapped distribution. The bootstrapped critical values at level β are defined as the lower $\beta/2$ and upper $\beta/2$ quantiles of the ordered bootstrapped test statistics. We then assess whether an estimate falls significantly different from zero within a $100(1-\beta)$ confidence interval if the corresponding t-statistic falls within the critical values at level β.

4.3 Results

4.3.1 Results from static model

Figure 3 illustrates the distribution of taxable income and the estimated bunching at the top kink before and after the policy change, using the method outlined in Appendix C. In Panel (a), the estimated bunching at the top kink before the policy change is 2.59, representing a more than 2.5 times higher concentration of taxable income around the kink threshold compared to the counterfactual distribution depicted by the red line in the figure. Panel (b) displays that the estimated residual bunching at the former kink is 0.37, indicating a 37 percent higher concentration at the threshold compared to the counterfactual distribution. Additionally, the estimated bunching at the new kink is 4.05, reflecting a more than four times more concentration at the new top kink. We use these estimated bunchings in our static model estimation.

Table 3 presents the estimates from the static model. The first row provides the estimates for our study sample. The estimated fixed cost is negligible and not statistically significant. The estimated marginal cost of tax sheltering is 0.020 and is statistically significant, suggesting that it costs the bunching taxpayers about two cents to tax shelter one dollar of their taxable income from a five cents higher taxes. The estimated ETI with respect to the net-of-tax rate is 0.119, which is higher than the estimated ETI from a model with only a fixed cost and no cost, at 0.099 and 0.098 respectively, as presented in Tables A.2 and A.3 in Appendix A.

Table 3 also presents estimates broken down by gender, age, marital status, having a child, living in a major city, being the main earner in the household, employment type, professional and managerial occupations, individuals who used a tax agent, and those who spent more time filing their taxes. The estimated fixed cost for all sub-samples is negligible and not statistically significant. The estimated marginal cost varies from 0.006 for the self-employed to 0.05 for women and those in professional and managerial occupations, which primarily consist of wage and salary earners. The estimated ETI varies from 0.039 for wage and salary earners to 0.500 for women, all of which are larger than those estimated with only a fixed cost and no cost.

4.3.2 Results from dynamic model

Figure 2 depicts the evolution of bunching at the top kink, starting from its introduction at AUD 150,000 and then increasing to AUD 180,000. The figure also displays the estimated bunching at each kink, which is the difference between the fitted polynomial (shown in the red line) and the observed distribution of taxable income.

Once the kink at AUD 150,000 is introduced, the estimated bunching is 2.561, representing more than a 2.5 times higher concentration of taxable income around the kink compared to the counterfactual distribution. One year later, the bunching increases to 2.594. Following the policy change, the bunching shifts to the new kink at AUD 180,000, with estimated bunching at 4.047, indicating more than a four times higher concentration of taxable income around the new top kink, with residual bunching at the former kink at 0.369 (36.9 percent higher concentration).

Figure 2 shows that bunching at the new kink gradually increases to more than five times higher concentration compared to the counterfactal distribution over the two years post-policy (5.290 and 5.137, respectively), while the residual bunching at the former kink diminishes over the following two years post-policy change (bunching at 0.209 and 0.153, respectively).

Table 4 presents the estimates from the dynamic model, including the fixed and marginal costs of tax sheltering, the ETI, and the cumulative probabilities of drawing a positive tax sheltering cost at each time period. These estimates capture the responses to the policy change within two years before and three years after the policy change. The first row provides the estimates for our study sample. The estimated fixed cost is negligible, and not statistically significant. The estimated marginal cost of tax sheltering is 0.021 and statistically significant. The estimated cost parameters are similar to those from the static model. The estimated ETI is much higher at 0.17, which is 46 percent larger than the estimate from the static model (0.12). The cumulative probabilities of drawing positive tax sheltering costs to bunch at the former kink decrease from 0.44 to 0.15. The probability of drawing positive cost to bunch at the new kink is 0.24 and subsequently decreases to 0.04 and 0.00 in the following years.

Table 4 also presents estimates for the sub-samples. Similar to the static model, the estimated fixed cost for all sub-samples is negligible and not statistically significant. Unlike the static model, the estimated marginal costs are more consistent across the sub-samples, ranging from 0.021 for females, individuals aged 45-59, and those who spent more time preparing their tax files, to 0.028 for wage and salary earners. The estimated ETI, in general, is slightly larger than those from the static model, ranging from 0.039 for wage and salary earners to 0.323 for women.

4.3.3 Estimates for flexible bunchers

Table 5 presents the estimates from static and dynamic models for flexible bunchers including self employed individuals, those with trust income, and self employed individuals with trust income.[29] The following remarks emerges. First, The estimated fixed cost of tax sheltering is negligible, and not statistically significant. Second, the estimated ETI from static and dynamic models are quite similar. Third, those with trust income, and self employed individuals with trust income have the largest estimated ETI and highest marginal cost of tax sheltering at 0.50 and 0.029, respectively.

[29] See Figure 5, Figure 6 and 7 for the distribution of taxable income for flexible bunchers.

The estimated ETI for these flexible bunchers are larger than the estimates for other groups presented in Table 3 and Table 4. The self employed individuals have the lowest marginal cost of tax sheltering at 0.006 cents per dollar of taxable income. The estimated cumulative probabilities of incurring positive costs at each time period are relatively small, and the probabilities diminish to zero after the policy change. This finding suggests that adjusting taxable income is relatively easier for these individuals.

5 Policy implications and conclusions

5.1 Government Revenue and Pareto Improvement

The policy change increased the top tax threshold from AUD 150,000 to AUD 180,000 without altering the marginal tax rates below and above the kink (40 and 45 percent, respectively). This change extended the budget set for all individuals, regardless of their position in the income distribution. Therefore, when considering the government as an additional agent in society, a sufficient condition for the policy change to be Pareto improvement is its impact on government tax revenue (Moore, 2022).

The effects of this policy change on government tax revenue can be divided into two components: the *"mechanical effect"* and the *"behavioural effects."* The mechanical effect refers to the decrease in tax revenue from taxpayers with income within the range affected by the change in marginal tax rates. On the other hand, the behavioural effect captures changes in taxpayer behaviour resulting from the policy change.

The behavioural effect consists of three components. First, when keeping the bunching mass constant, there is an increase in tax revenue because the bunching shifts to a higher income level at the new threshold. However, it's important to note that this bunching group is not homogeneous; it includes individuals who previously bunched at the old kink but have now decided to either continue bunching at the old kink or increase their income while staying below the new, higher kink. Additionally, it includes those who bunched at the former kink and continue to bunch at the new higher kink. These two effects result in increased tax revenue. Finally, there are individuals whose income was above the new kink before the policy change, but they might decrease their income to bunch at the new kink, resulting in a decrease in tax revenue.

Moore (2022) shows that the bunching mass at a kink is a sufficient statistic for analyzing the behavioural effects on tax revenue resulting from changes to that kink's threshold, assuming marginal tax rates remain constant. Similarly, the probability of individuals falling above the kink is a sufficient statistic for understanding the mechanical revenue effects of the reform. Moore (2022) findings suggest that the change in tax revenue resulting from increasing the kink threshold z^* by ΔK can be approximated as follows:

$$\Delta R \approx \underbrace{\tau_0 \overbrace{\left(H_{\tau_1}(z^*) - H_{\tau_0}(z^*)\right)}^{\text{taxpayers bunching at } z^*} \Delta K}_{\text{behavioral effects}} \underbrace{-(\tau_1 - \tau_0) \overbrace{\left(1 - H_{\tau_1}(z^*)\right)}^{\substack{\text{taxpayers} \\ \text{located above } z^*}} \Delta K}_{\text{mechanical effects}} \tag{11}$$

where ΔR represents the change in the government's income tax revenue, and τ_0 and τ_1 denote the marginal tax rates below and above the kink at 0.40 and 0.45, respectively. $H_\tau(.)$ denotes the cumulative distribution of taxable income with linear tax rates of τ. The terms $H_{\tau_1}(z^*) - H_{\tau_0}(z^*)$ and $1 - H_{\tau_1}(z^*)$ represent the estimated bunching at the z^* kink and the mass of taxpayers with taxable income higher than z^*, respectively. If the estimated ΔR is non-negative, it implies that the new tax schedule represents a Pareto improvement over the previous one.

For our analysis, we consider z^* as the location of the initial kink (AUD 150,000) and ΔK as the increase in the kink threshold to the new kink (AUD 180,000) at AUD 30,000. We use data from one year before the policy change in 2007-2008 to estimate bunching at the kink.

Table 6 presents the estimated behavioural effects, mechanical effects, total changes in government revenue resulting from the policy change, and the fiscal externalities, defined as the ratio of behavioural effects to mechanical effects. The first row shows the estimates for our study sample. The estimated effects of the policy change indicate a decrease in annual tax revenue of approximately AUD 13.2 million This consists of a AUD 7.1 million increase in revenue due to behavioural effects and a AUD 20.3 million decrease due to mechanical effects. The fiscal externalities of the policy change is quite high at approximately 35 cents, indicating that for each dollar lost through mechanical effects, 35 cents are gained due to behavioural effects. Since the total change in the revenue is negative, this policy change was not Pareto improving.

Table 6 also presents the estimates for different sub samples. The estimated total revenue for all sub samples is negative, except for self employed individuals with trust income. The estimated fiscal externalities is very high at 1.243, indicating that for each dollar lost through mechanical effects, AUD 1.243 is gained due to behavioural effects. The fiscal externalities for those with trust income shows an almost one to one relationship between the behavioural and mechanical effects.

These findings shed light on the intricate interplay between tax policy changes, taxpayer behaviour, and government revenue, offering valuable insights for tax policy makers.

5.2 Conclusion

This paper delves into the crucial realm of income taxation, particularly focusing on the behaviour of high-income individuals in response to progressive tax systems. The main objective was to provide empirical insights into the tax sheltering cost among high-income taxpayers, shedding light on an area that has been relatively scarce in terms of empirical estimates.

Our study utilized a unique policy change within the Australian personal income tax system, which raised the top tax threshold, creating incentives for individuals to tax shelter their income and reduce their tax liability. Through the examination of taxable income "bunching" behaviour, we estimate both the Elasticity of Taxable Income (ETI) and the cost of tax sheltering, using both static and dynamic models.

Our findings yielded several significant conclusions. Firstly, there is clear evidence of behavioural responses to higher taxes from high-income individuals, with most of the bunching observed in those who have greater flexibility in adjusting their taxable income. This suggests that these adjustments are driven by tax sheltering rather than labour supply responses.

Secondly, the estimates of ETI from both static and dynamic models were higher when accounting for the costs of tax sheltering. This highlights the importance of considering these costs in understanding the responsiveness of high-income individuals to changes in tax rates.

Thirdly, we found no fixed cost associated with tax sheltering, with the estimated marginal cost being relatively low. Over time, the probability of drawing a zero-cost increased, suggesting that individuals adapt to the tax system and find more efficient ways to shelter their income.

Furthermore, our estimates show a significant heterogeneity in estimated ETI by various demographic and economic factors, indicating that the response to tax changes varies among different groups of high-income individuals.

Our study also highlighted the role of trust structures as a means for high-income individuals to minimize their tax burdens, indicating the need for a comprehensive approach in tax policy design. Lastly, our analysis revealed that the fiscal externalities resulting from the policy change were substantial, with a negative net effect on government revenue when accounting for behavioural responses.

In sum, our study contributes to the ongoing policy debates surrounding progressive income tax systems, offering valuable insights into the efficiency costs of taxation and emphasizing the importance of considering the cost of tax sheltering when designing tax policies for high-income individuals. The findings provide a foundation for future discussions and tax policy considerations.

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Tables

Table 1: Summary statistics

	Three years before policy change	Three years after policy change
Economics outcomes		
Total income (,000 AUD)	166.0	164.1
	(38.7)	(30.5)
Taxable income (,000 AUD)	156.1	156.8
	(19.0)	(19.3)
Net tax amount (,000 AUD)	46.0	43.3
	(17.9)	(15.1)
Total deductions (,000 AUD)	9.8	7.2
	(32.6)	(22.0)
Total tax withhold (,000 AUD)	36.4	36.9
	(26.1)	(22.6)
Wage and salary income (,000 AUD)	101.9	113.7
	(69.9)	(65.7)
Trust income (,000 AUD)	0.29	0.42
	(8.2)	(9.1)
Gross taxable income (,000 AUD)	150.1	146.4
	(56.6)	(51.1)
Occupation:		
Managers	0.28	0.28
Professionals	0.29	0.31
Technicians and trade	0.05	0.09
Community and personal services	0.01	0.02
Clerical and administrative	0.05	0.08
Sales	0.03	0.02
Machinery operators and drivers	0.02	0.03
Labourers	0.01	0.02
Self employed	0.48	0.38
	(0.50)	(0.49)
Has trust income	0.31	0.27
Self employed with trust income	0.76	0.73
Used tax agent	0.86	0.81
Tax file preparation time (hours)	11.3	7.9
	(63.5)	(50.2)
Tax affairs fee (,000 AUD)	0.42	0.42
	(2.5)	(2.5)
Demographics		
Age (years)	47.5	46.13
	(12.6)	(11.8)
Male	0.75	0.75
Has spouse	0.74	0.74
Has child	0.67	0.69
Major city	0.74	0.77
Main earner	0.90	0.88
Male main earners	0.82	0.84
Number of individuals	45,137	64,934
Total number of observations	64,670	102,209

Note: This table presents summary statistics for our study sample, including Australian tax-resident filers aged 18 and above with taxable incomes ranging from AUD 130,000 to AUD 200,000 during the financial years from 2005-2006 to 2010-2011. "Before" and "After" the policy change refer to the three years before and after the 2008-2009 policy change, which increased the top kink from AUD 150,000 to AUD 180,000. Dollar values are represented as means in thousands of AUD, with standard deviations shown in parentheses. Other statistics represent proportions. Gross taxable income excludes trust income but includes total deductions in the taxable income. Occupations are categorized based on the Australian Bureau of Statistics (ABS) one-digit Australian and New Zealand Standard Classification of Occupations (ANZSCO). Approximately 30 percent of the sample did not report their occupations. Male main earner presents the portion of main earners who are male. Self employed with trust income statistics denotes the portion of individuals with trust income who are self employed. For summary statistics for sharp bunchers, and the all tax filers, see Table 1 and Table A.1 in Appendix A.

Table 2: Summary statistics of sharp bunchers at the top kinks

	Three years before policy change	Three years after policy change
Economic outcomes		
Total income (,000 AUD)	159.3	188.6
	(31.8)	(25.8)
Taxable income (,000 AUD)	149.8	179.8
	(2.8)	(2.6)
Net tax amount (,000 AUD)	42.4	46.8
	(17.4)	(19.8)
Total deductions (,000 AUD)	9.5	8.9
	(31.6)	(23.4)
Total tax withhold (,000 AUD)	32.5	33.7
	(24.1)	(28.1)
Wage and salary income (,000 AUD)	92.9	101.8
	(66.3)	(79.6)
Trust income (,000 AUD)	21.5	43.4
	(52.2)	(72.4)
Gross taxable income (,000 AUD)	137.8	145.272.7
	(55.1)	(72.7)
Occupation:		
Managers	0.27	0.27
Professionals	0.27	0.28
Technicians and trade	0.05	0.005
Community and personal services	0.001	0.001
Clerical and administrative	0.005	0.009
Sales	0.003	0.003
Machinery operators and drivers	0.001	0.001
Labourers	0.001	0.001
Self employed	0.52	0.57
Has trust income	0.35	0.44
Self employed with trust income	0.76	0.73
Used tax agent	0.87	0.85
Tax file preparation time (hours)	6.3	24.5
	(25.1)	(34.7)
Tax affairs fee (,000 AUD)	0.37	0.49
	(1.4)	(2.3)
Demographics		
Age (years)	46.9	46.6
	(12.8)	(12.7)
Male	0.7	0.68
Has spouse	0.74	0.75
Has child	0.67	0.71
Major city	0.74	0.80
Main earner	0.86	0.79
Male main earners	0.82	0.84
Number of individuals	11,778	10,865
Total number of observations	12,949	12,478

Note: This table presents summary statistics for sharp bunchers at the top kink before and after the policy change. The study sample comprises individuals whose taxable income fell within a AUD 5,000 range around the former top kink (AUD 145,000 to AUD 155,000) during the three years preceding the policy change (2005-2006 to 2007-2008) and within a AUD 5,000 range around the new top kink (AUD 175,000 to AUD 185,000) during the three years following the policy change (2008-2009 to 2010-2011). See note to Table 1.

Table 3: Estimates from static model

	Elasticity e	Fixed cost ϕ_f	Marginal cost ϕ_m
All sample	0.119	0.000	0.020
	[0.103, 0.135]	[-0.000, 0.000]	[0.012, 0.027]
Gender: Male	0.091	0.000	0.024
	[0.074, 0.106]	[-0.000, 0.000]	[0.017, 0.030]
Gender: Female	0.50	0.000	0.050
	[0.241, 0.758]	[-0.000, 0.000]	[0.008, 0.091]
Age: 18-44 years	0.140	0.000	0.020
	[0.119, 0.161]	[-0.000, 0.000]	[0.012, 0.028]
Age: 45-59 years	0.094	0.000	0.015
	[0.082, 0.105]	[-0.000, 0.000]	[0.006, 0.024]
Has spouse	0.105	0.000	0.018
	[0.092, 0.117]	[-0.000, 0.000]	[0.007, 0.028]
Has child	0.102	0.000	0.013
	[0.090, 0.114]	[-0.000, 0.000]	[0.007, 0.018]
Live in major city	0.111	0.000	0.006
	[0.1004, 0.121]	[-0.000, 0.000]	[-0.001, 0.013]
Main earner	0.087	0.000	0.024
	[0.074, 0.100]	[-0.000, 0.000]	[0.017, 0.029]
Employment type:	0.039	0.000	0.025
Wage and salary earners	[0.029, 0.049]	[-0.000, 0.000]	[0.018, 0.031]
Employment type:	0.207	0.000	0.006
Self employed	[0.002, 0.412]	[-0.000, 0.000]	[-0.027, 0.040]
Occupation:	0.064	0.000	0.050
Professional and managers	[0.048, 0.078]	[-0.000, 0.000]	[0.041, 0.059]
Used tax agent	0.131	0.000	0.019
	[0.111, 0.149]	[-0.000, 0.000]	[0.011, 0.026]
Spent more than	0.119	0.000	0.020
10 hours filling taxes	[0.104, 0.135]	[-0.000, 0.000]	[0.012, 0.028]

Note: This table presents the estimated cost and the Elasticity of taxable income (ETI) from the static model. These estimates capture immediate responses to the policy change using data from one year before and one year after the policy change. The 95% confidence intervals, calculated using bootstrapped standard errors, are presented in brackets. For estimates that consider only fixed costs, refer to Table A.2. For estimates with no costs, using the method by Saez (2010), please see Table A.3 in Appendix A.

Table 4: Estimates from dynamic model

	Elasticity	Fixed cost	Marginal cost	Cumulative probabilities of drawing positive cost				
	e	ϕ_f	ϕ_m	π_{-2}	$\pi_{-2}\pi_{-1}$	π_0	$\pi_0\pi_1$	$\pi_0\pi_1\pi_2$
All sample	0.174	0.000	0.021	0.437	0.153	0.242	0.038	0.003
	[0.164, 0.185]	[-0.000, 0.000]	[0.007, 0.036]	[0.114, 0.759]	[0.03, 0.275]	[0.073, 0.412]	[-0.000, 0.075]	[-0.001, 0.007]
Gender: Male	0.117	0.000	0.023	0.472	0.178	0.262	0.042	0.003
	[0.110, 0.124]	[-0.000, 0.000]	[0.006, 0.039]	[0.141, 0.803]	[0.039, 0.317]	[0.042, 0.482]	[0.005, 0.080]	[-0.000, 0.007]
Gender: Female	0.323	0.000	0.021	0.342	0.094	0.182	0.022	0.001
	[0.253, 0.392]	[-0.000, 0.000]	[0.001, 0.041]	[0.028, 0.657]	[-0.044, 0.231]	[-0.012, 0.377]	[-0.015, 0.058]	[-0.002, 0.005]
Age: 18-44 years	0.203	0.000	0.017	0.387	0.120	0.232	0.036	0.003
	[0.189, 0.217]	[-0.000, 0.000]	[-0.001, 0.036]	[-0.26, 0.800]	[-0.047, 0.287]	[-0.021, 0.486]	[-0.011, 0.083]	[-0.002, 0.007]
Age: 45-59 years	0.151	0.000	0.021	0.336	0.090	0.195	0.035	0.003
	[0.141, 0.160]	[-0.000, 0.000]	[-0.001, 0.043]	[-0.024, 0.697]	[-0.070, 0.251]	[-0.075, 0.466]	[-0.012, 0.082]	[-0.001, 0.007]
Has spouse	0.167	0.000	0.024	0.443	0.157	0.242	0.034	0.002
	[0.159, 0.174]	[-0.000, 0.000]	[0.013, 0.035]	[0.343, 0.543]	[0.098, 0.216]	[0.138, 0.346]	[0.008, 0.060]	[-0.001, 0.006]
Has child	0.179	0.000	0.017	0.407	0.132	0.236	0.038	0.003
	[0.170, 0.187]	[-0.000, 0.000]	[0.007, 0.028]	[-0.039, 0.852]	[-0.044, 0.308]	[-0.024, 0.497]	[-0.011, 0.088]	[-0.002, 0.008]
live in major city	0.185	0.000	0.022	0.433	0.150	0.239	0.034	0.002
	[0.176, 0.193]	[-0.000, 0.000]	[0.005, 0.040]	[0.180, 0.685]	[0.032, 0.268]	[-0.024, 0.502]	[-0.012, 0.081]	[-0.002, 0.007]
Main earner	0.116	0.000	0.027	0.455	0.165	0.281	0.044	0.004
	[0.110, 0.122]	[-0.000, 0.000]	[0.022, 0.032]	[0.087, 0.822]	[0.014, 0.317]	[0.091, 0.470]	[0.004, 0.085]	[-0.001, 0.008]
Employment type:	0.039	0.000	0.028	0.496	0.197	0.265	0.045	0.004
Wage and salary earners	[0.024, 0.044]	[-0.000, 0.000]	[0.009, 0.047]	[0.163, 0.828]	[0.053, 0.341]	[0.159, 0.370]	[0.017, 0.074]	[0.001, 0.007]
Employment type:	0.300	0.000	0.020	0.351	0.098	0.194	0.024	0.001
Self employed	[0.238, 0.362]	[-0.000, 0.000]	[-0.003, 0.043]	[-0.008, 0.710]	[-0.053, 0.250]	[-0.025, 0.413]	[-0.018, 0.066]	[-0.003, 0.006]
Professional and managers	0.125	0.000	0.027	0.446	0.159	0.279	0.045	0.004
	[0.120, 0.129]	[-0.000, 0.000]	[0.023, 0.030]	[0.048, 0.843]	[0.011, 0.307]	[0.138, 0.420]	[-0.003, 0.094]	[-0.001, 0.009]
Used tax agent	0.195	0.000	0.022	0.424	0.144	0.235	0.033	0.002
	[0.184, 0.205]	[-0.000, 0.000]	[0.009, 0.036]	[0.097, 0.751]	[0.028, 0.259]	[0.053, 0.417]	[-0.009, 0.075]	[-0.002, 0.007]
Spent more than	0.174	0.000	0.021	0.437	0.153	0.240	0.037	0.003
10 hours filling taxes	[0.166, 0.182]	[-0.000, 0.000]	[0.013, 0.029]	[0.336, 0.538]	[0.103, 0.203]	[-0.025, 0.506]	[-0.011, 0.086]	[-0.002, 0.007]

Note: This table presents the estimated cost and the Elasticity of taxable income (ETI), along with the cumulative probabilities of incurring a positive cost from the dynamic model. The cumulative probabilities are indexed according to the time relative to the policy change. These estimates capture the gradual emergence and dissolution of bunching at the top kink using data from two years before and three years after the policy change. The 95% confidence intervals, calculated using bootstrapped standard errors, are provided in brackets.

Table 5: Estimates from static and dynamic models for flexible bunchers

	Elasticity	Fixed cost	Marginal cost	Cumulative probabilities of drawing positive cost				
	e	ϕ_f	ϕ_m	π_{-2}	$\pi_{-2}\pi_{-1}$	π_0	$\pi_0\pi_1$	$\pi_0\pi_1\pi_2$
Self employed								
Static model	0.207	0.000	0.006					
	[0.002, 0.412]	[-0.000, 0.000]	[-0.027, 0.040]					
Dynamic model	0.300	0.000	0.020	0.351	0.098	0.194	0.024	0.001
	[0.238, 0.362]	[-0.000, 0.000]	[-0.003, 0.043]	[-0.008, 0.710]	[-0.053, 0.250]	[-0.025, 0.413]	[-0.018, 0.066]	[-0.003, 0.006]
Trust income holders								
Static model	0.500	0.000	0.029					
	[0.270, 0.730]	[-0.000, 0.000]	[-0.012, 0.071]					
Dynamic model	0.403	0.000	0.025	0.331	0.088	0.162	0.018	0.001
	[0.184, 0.621]	[-0.000, 0.000]	[0.012, 0.038]	[0.037, 0.625]	[-0.020, 0.195]	[-0.017, 0.340]	[-0.005, 0.040]	[-0.001, 0.003]
Self-employed with trust income								
Static model	0.500	0.000	0.029					
	[0.270, 0.730]	[-0.000, 0.000]	[-0.012, 0.071]					
Dynamic model	0.479	0.000	0.029	0.260	0.054	0.127	0.010	0.000
	[0.066, 0.891]	[-0.000, 0.000]	[0.005, 0.052]	[-0.039, 0.558]	[-0.037, 0.145]	[-0.071, 0.325]	[-0.017, 0.036]	[-0.002, 0.003]

Note: This table presents the estimates from both static and dynamic models for individuals with greater flexibility for bunching, including self-employed individuals, those with trust income, and self-employed individuals with trust income. The 95% confidence intervals, calculated using bootstrapped standard errors, are provided in brackets. Refer to the notes in Table 3 and Table 4 for more details.

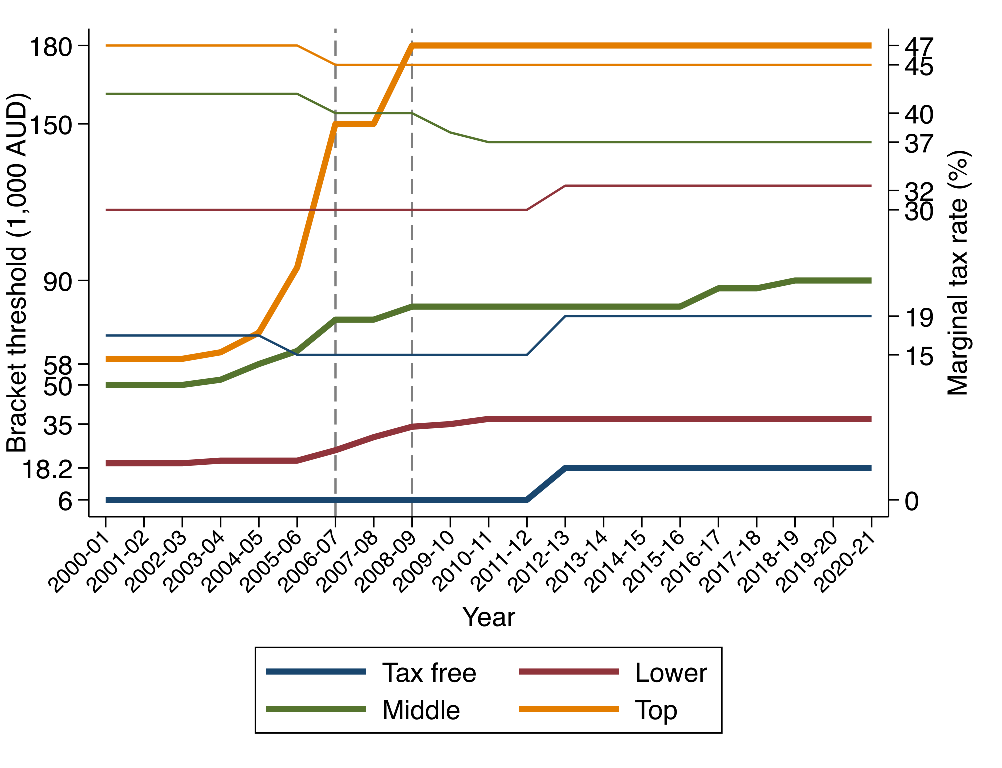
Table 6: Estimated changes to the government's income tax revenue due to the policy change

	Behavioural effects (,000,000 AUD)	Mechanical effects (,000,000 AUD)	Total change in revenue (,000,000 AUD)	Fiscal externality
All sample	7.099	-20.28	-13.181	-0.350
Gender: Male	2.884	-15.012	-12.128	-0.192
Gender: Female	4.199	-5.268	-1.068	-0.797
Age: 18-44 years	4.011	-9.412	-5.401	-0.426
Age: 45-59 years	2.309	-8.193	-5.884	-0.281
Age: Over 60 years	0.766	-2.674	-1.908	-0.286
Has spouse	4.797	-15.042	-10.245	-0.320
Has child	2.192	-6.630	-4.437	-0.331
Live in major city	5.878	-15.580	-9.701	-0.377
Main earner	2.169	-11.146	-8.977	-0.194
Employment type: Wage and salary earner	0.583	-10.818	-19.235	-0.054
Employment type: Self employed	6.551	-9.462	-2.910	-0.692
Occupation: Professional and managers	2.280	-11.716	-9.436	-0.194
Used tax agent	6.593	-17.061	-10.469	-0.386
Spent more than 10 hours filing taxes	7.089	-20.179	-13.089	-0.351
Has trust income	5.994	-6.283	-0.289	-0.954
Self employed with trust income	5.825	-4.687	1.138	-1.243

Note: This table presents the estimated changes in government income tax revenue resulting from the policy change, as calculated using Equation (11). The estimates are based on the distribution of taxable income from one year before the policy change in 2007-2008, and bunching is estimated using the method described in Appendix C. Fiscal externalities are calculated as the ratio of behavioural effects to mechanical effects.

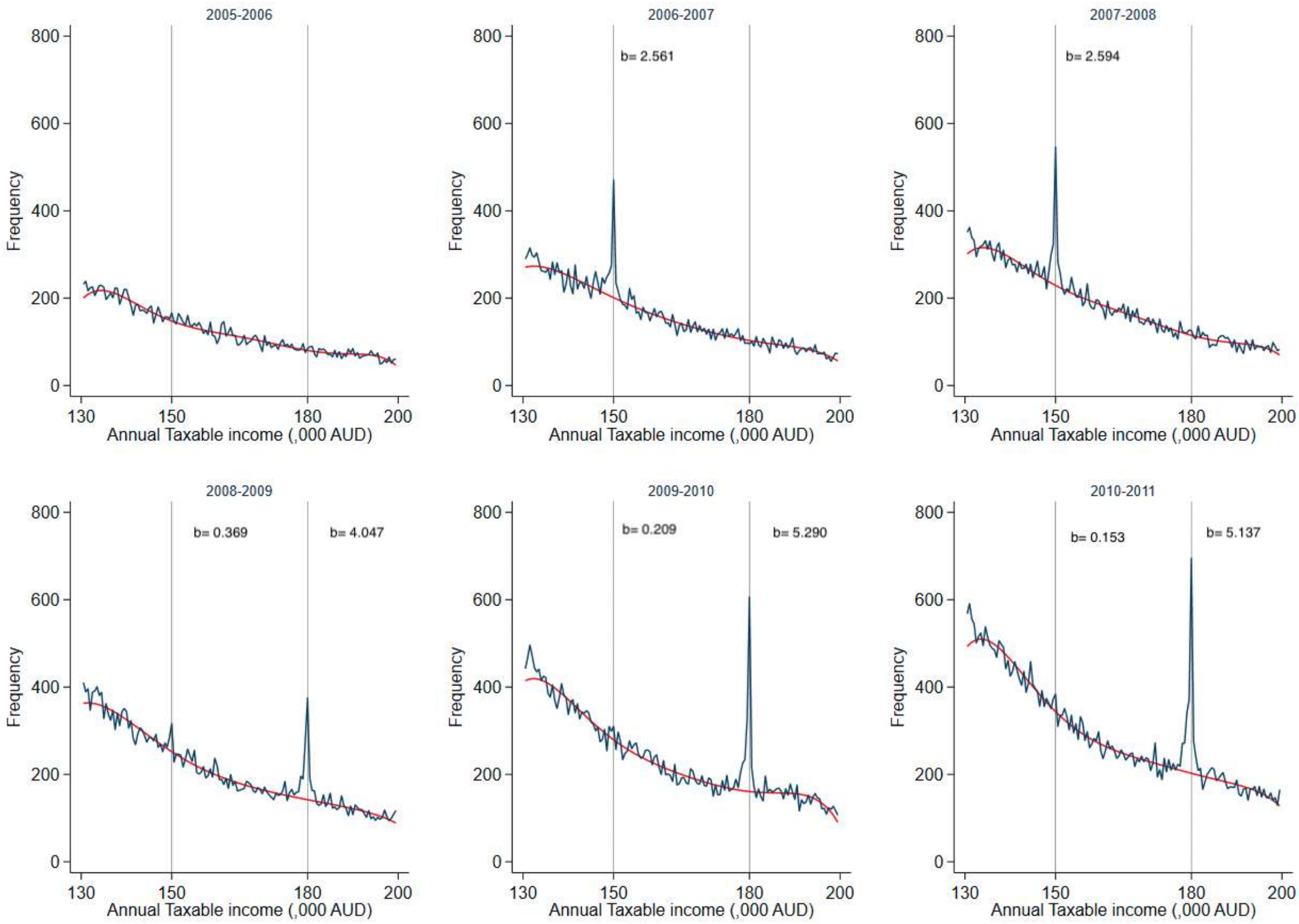
Figures

Figure 1: Changes in Australian personal income tax schedule



Note: This figure illustrates the changes in the Australian personal income tax schedule over the last two decades. The thicker line represents the tax bracket thresholds, and the thinner line indicates the corresponding marginal tax rates for each bracket. For more detailed information see: https://www.ato.gov.au/Rates/Individual-income-tax-for-prior-years/

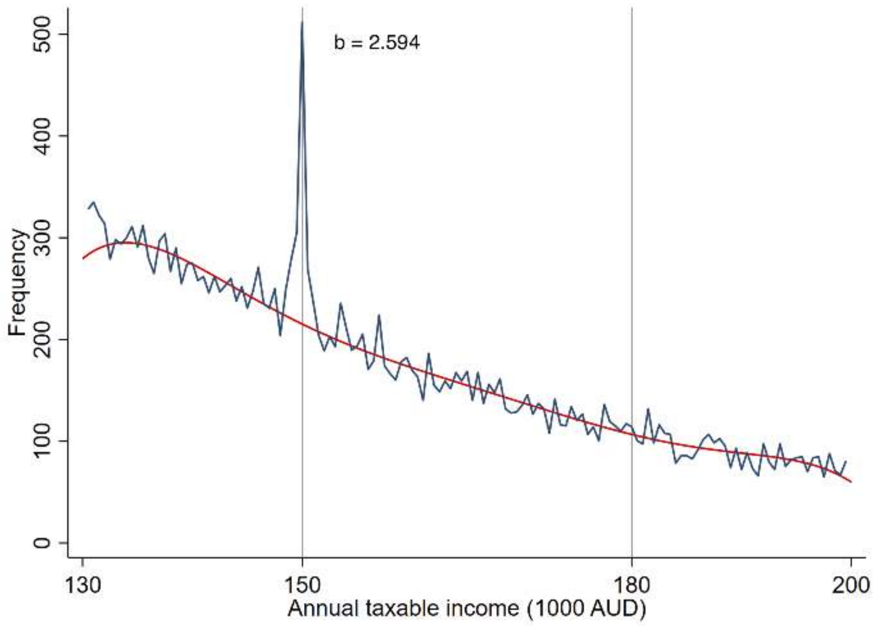
Figure 2: Distribution of annual taxable income at the top kink



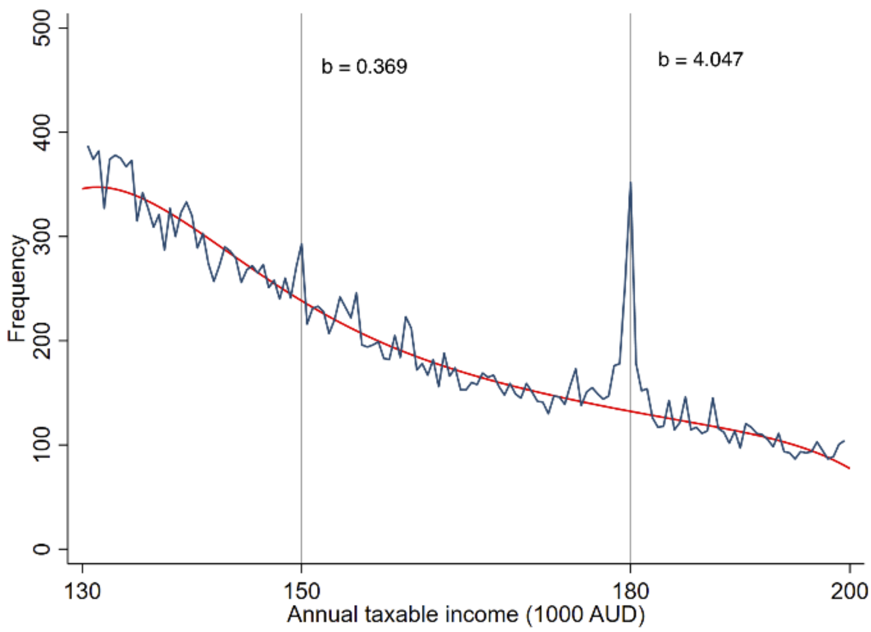
Note: This figure displays the distribution of taxable income around the top kink. The red line represents the fitted degree six polynomial, excluding six bins around the kink with a bin size of AUD 500. The grey lines denote the top kinks. The normalized bunching (b), as specified in Equation (C.5) and estimated using the procedure described in Appendix C.

Figure 3: Distribution of taxable income around the top kink

(a) Before policy change



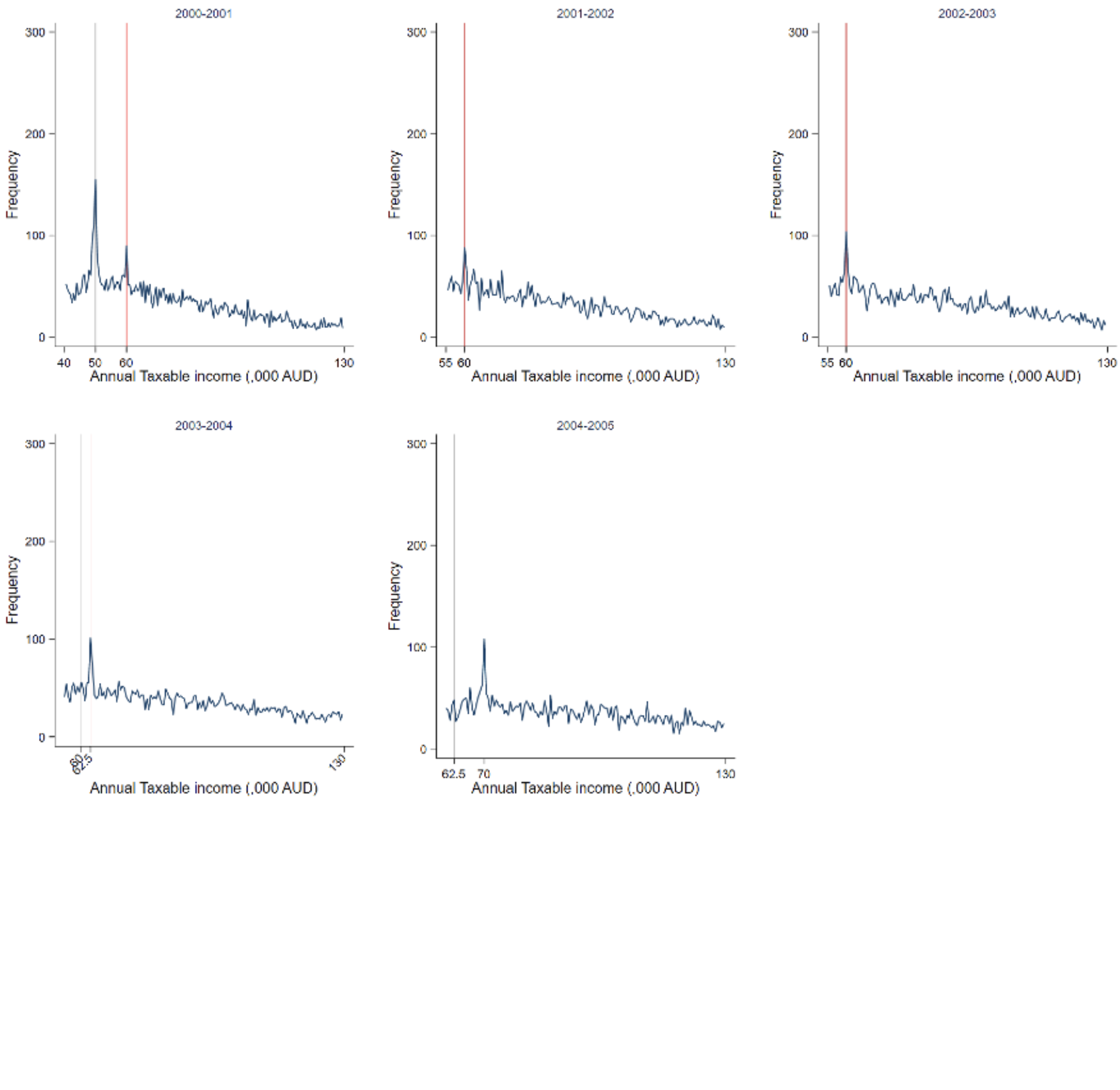
(b) After policy change



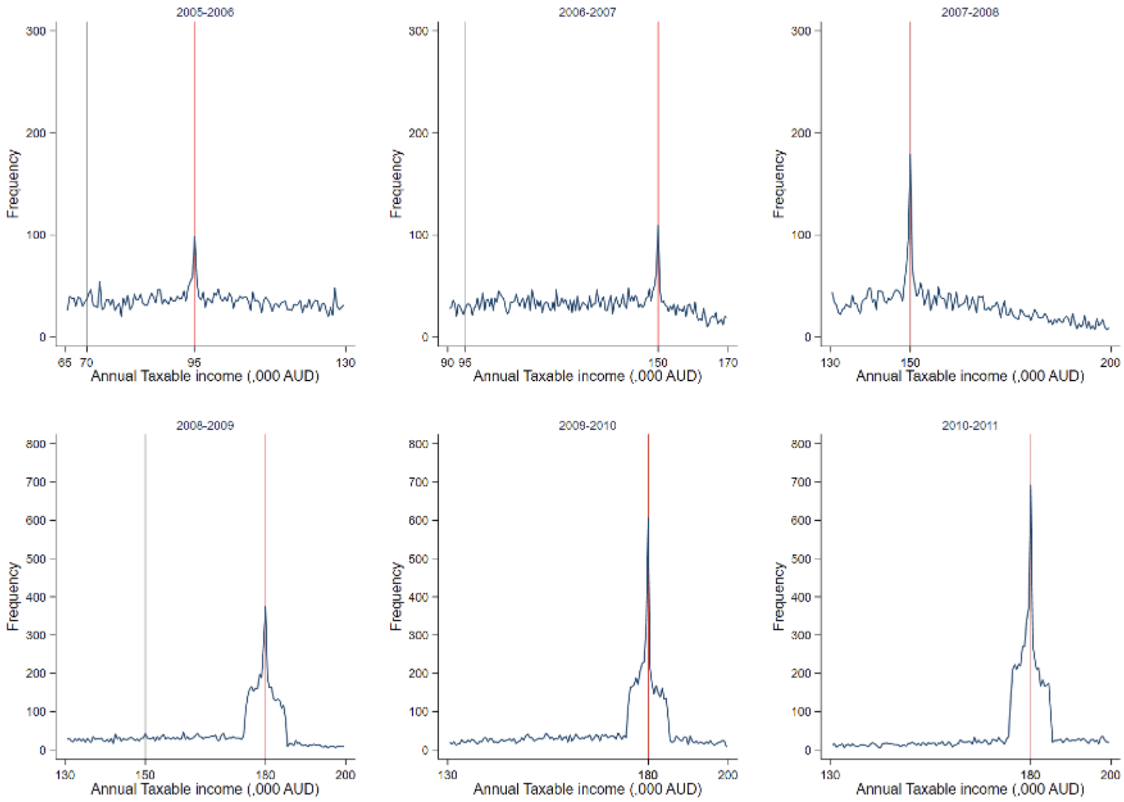
Note: This figure illustrates the distribution of taxable income around the top kink before (2007-2008) and after the policy change (2008-2009). Individuals who were bunching at the former top kink shift to the new top kink after the policy change, while some continue bunching at the former top kink. For more details, see the notes for Figure 2.

Figure 4: Tracking bunchers at new top kink

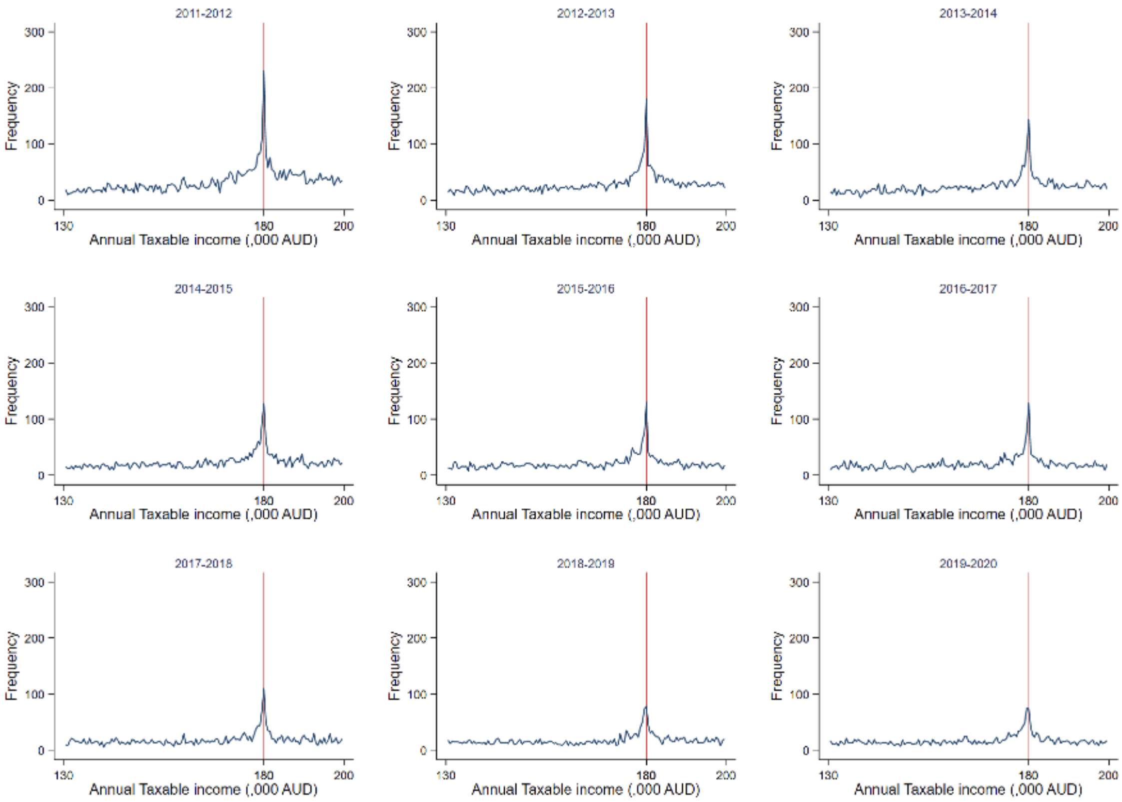
(a) 1999-2000 to 2004-2005 (before our study period)



(b) 2005-2006 to 2010-2011 (during our study period)



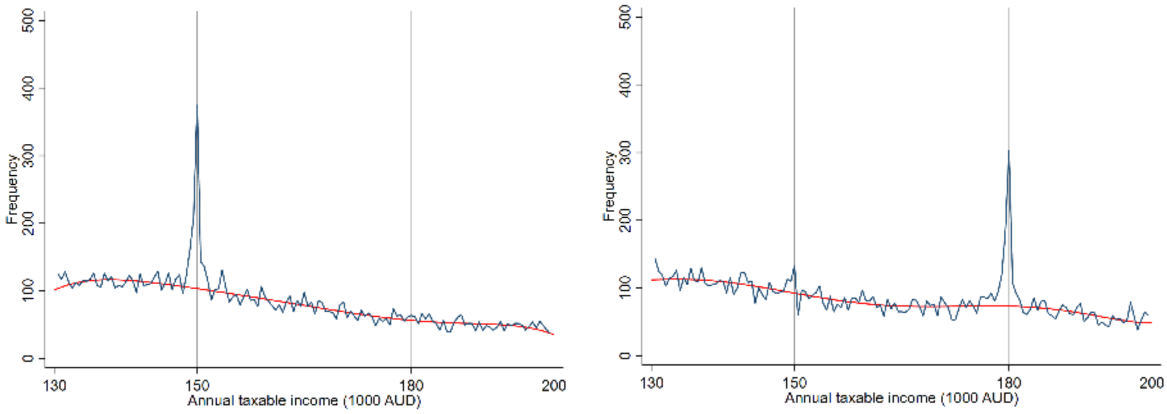
(c) 2011-2012 to 2019-2020 (after our study period)



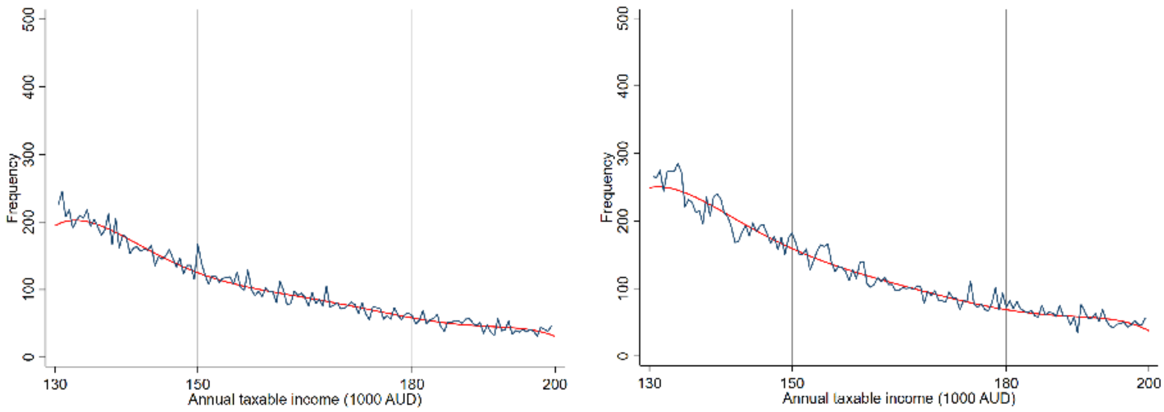
Note: This figure presents the taxable income distribution of individuals who bunched at least once within a AUD 5,000 window of the new kink at AUD 180,000 during the post-policy change period in our study (2008-2009 to 2010-11). The grey and red lines represent the former and new top kinks over the years. Panel (a) tracks the bunchers before our study period from 1999-2000 to 2004-2005. Panel (b) tracks the bunchers during our study period from 2005-2006 to 2010-2011. Panel (c) tracks the bunchers after our study period from 2011-2012 to 2019-2020. The figure suggests that bunchers at the top have a pattern of chronological bunching.

Figure 5: Distribution of taxable income around the top kink by employment type

(a) Self employed (before and after the policy change)



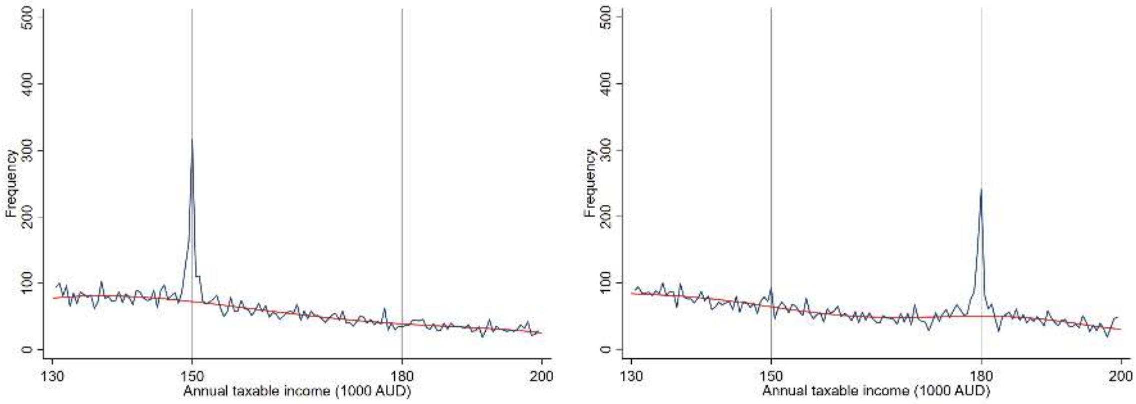
(b) Wage and salary earner (before and after the policy change)



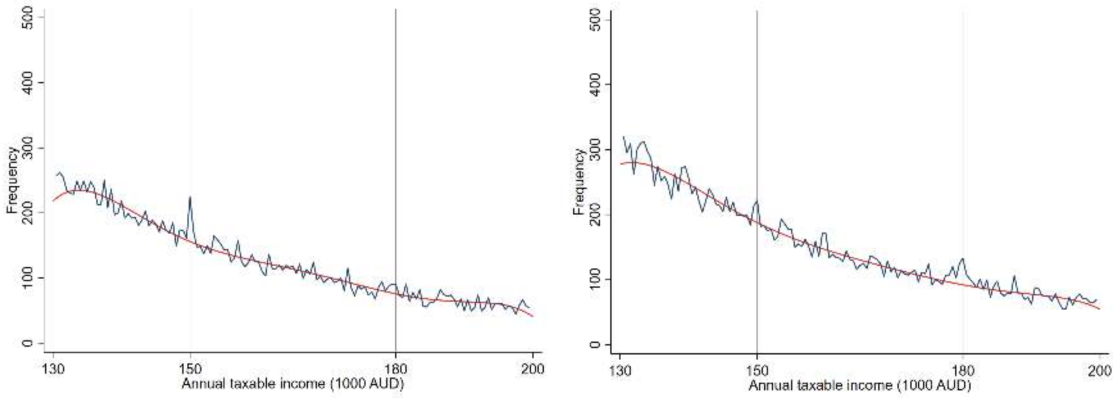
Note: This figure displays the distribution of taxable income within our study sample, categorized by employment type (self-employed versus wage and salary earners) one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure 6: Distribution of taxable income around the top tax threshold for individuals by trust income status

(a) With trust income (Before and after the policy change)



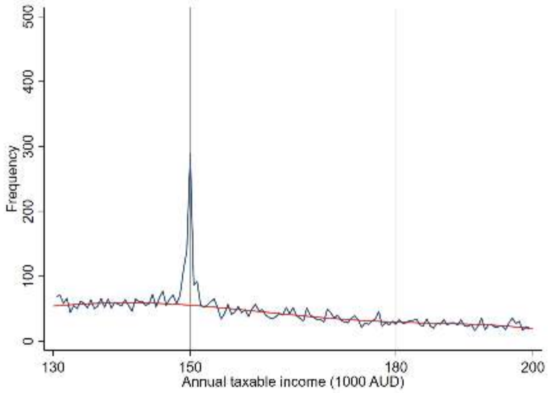
(b) With no trust income (Before and after the policy change)

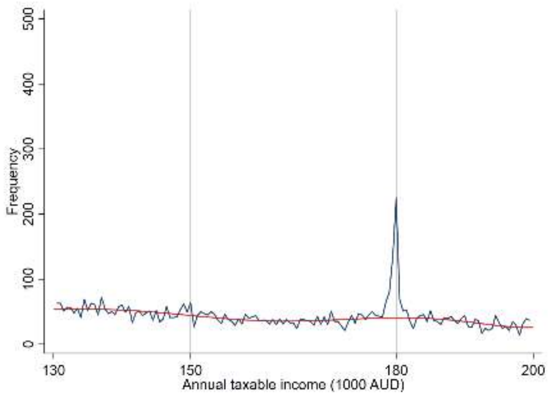


Note: This figure displays the distribution of taxable income within our study sample by trust income status, one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure 7: Distribution of taxable income around the top tax threshold for self-employed individuals with trust income

(a) Before and after the policy change

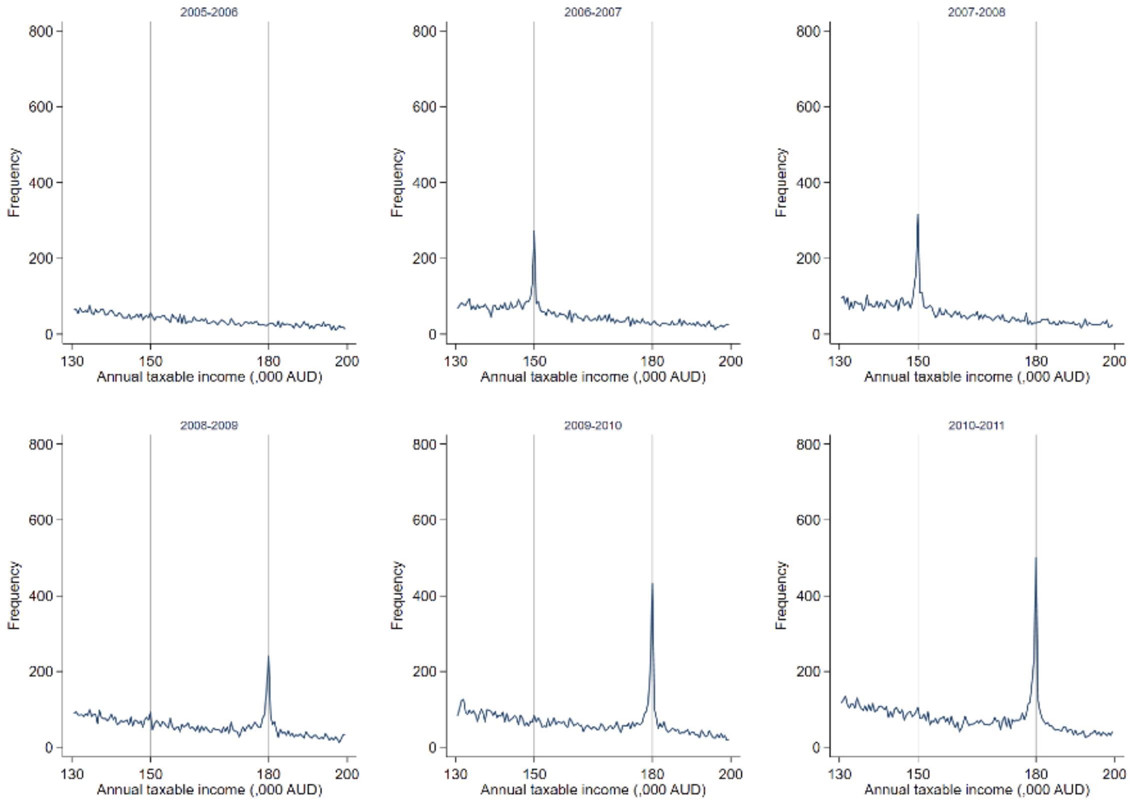




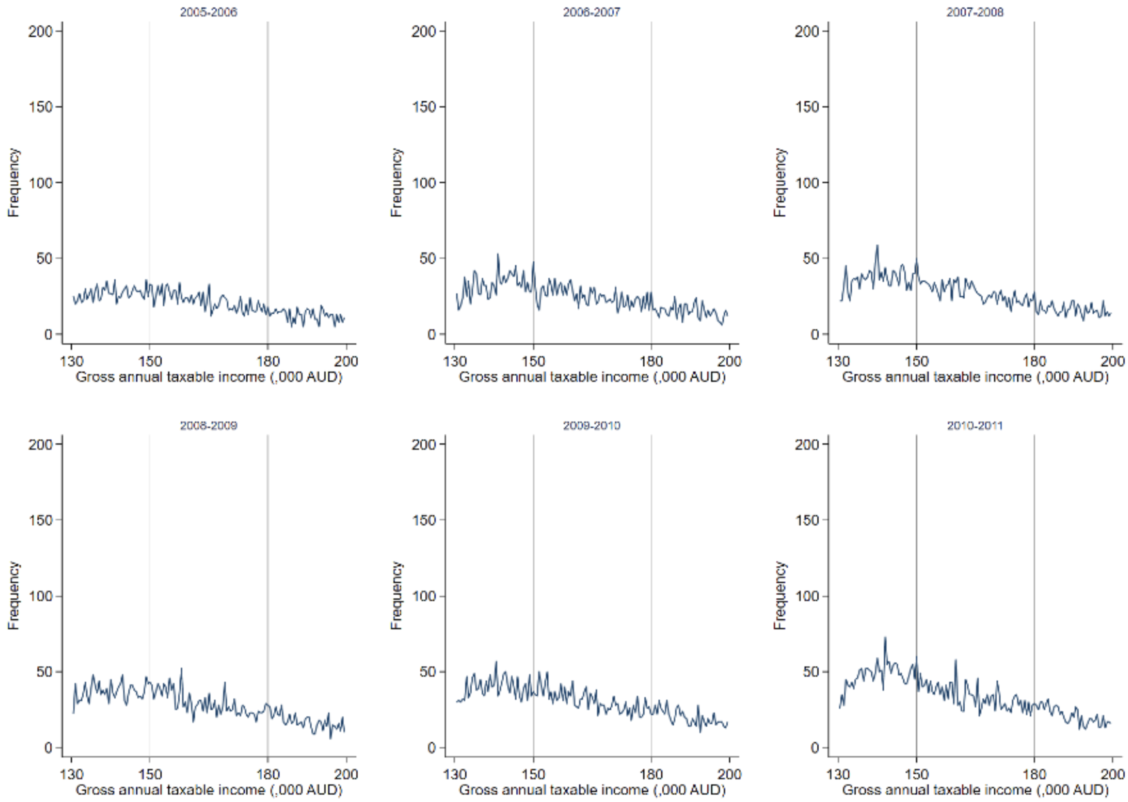
Note: This figure displays the distribution of taxable income for self employed individuals with trust income in our study sample, one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure 8: Distribution of taxable income, gross taxable income, deductions and trust income for individuals with trust income

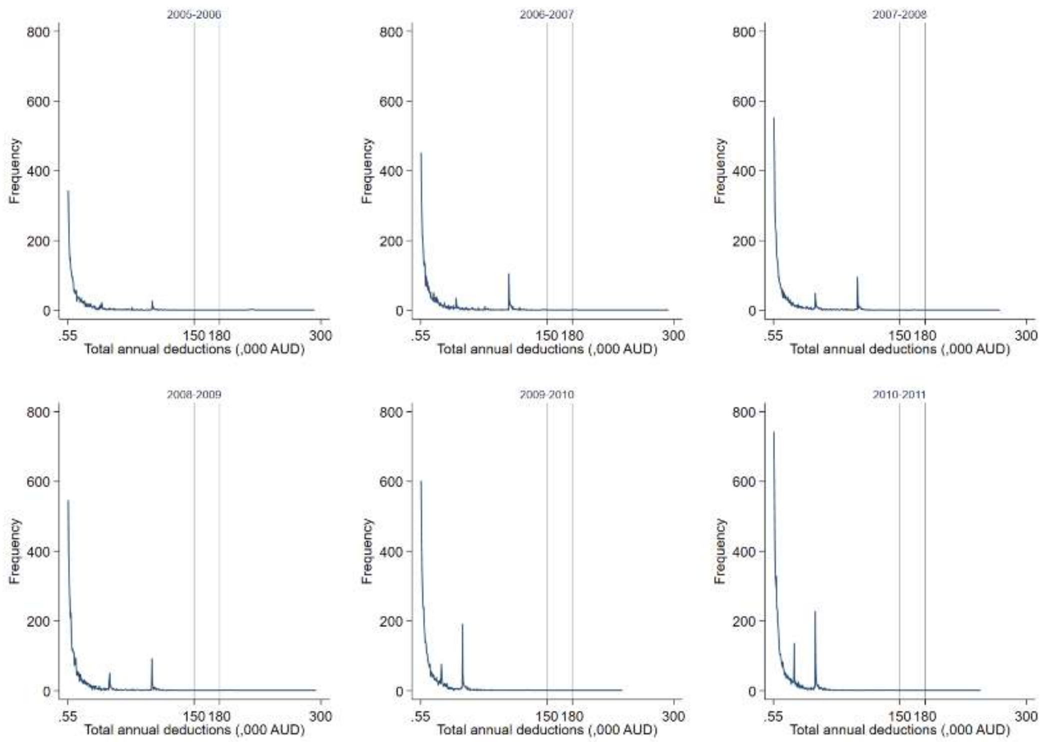
(a) Annual taxable income



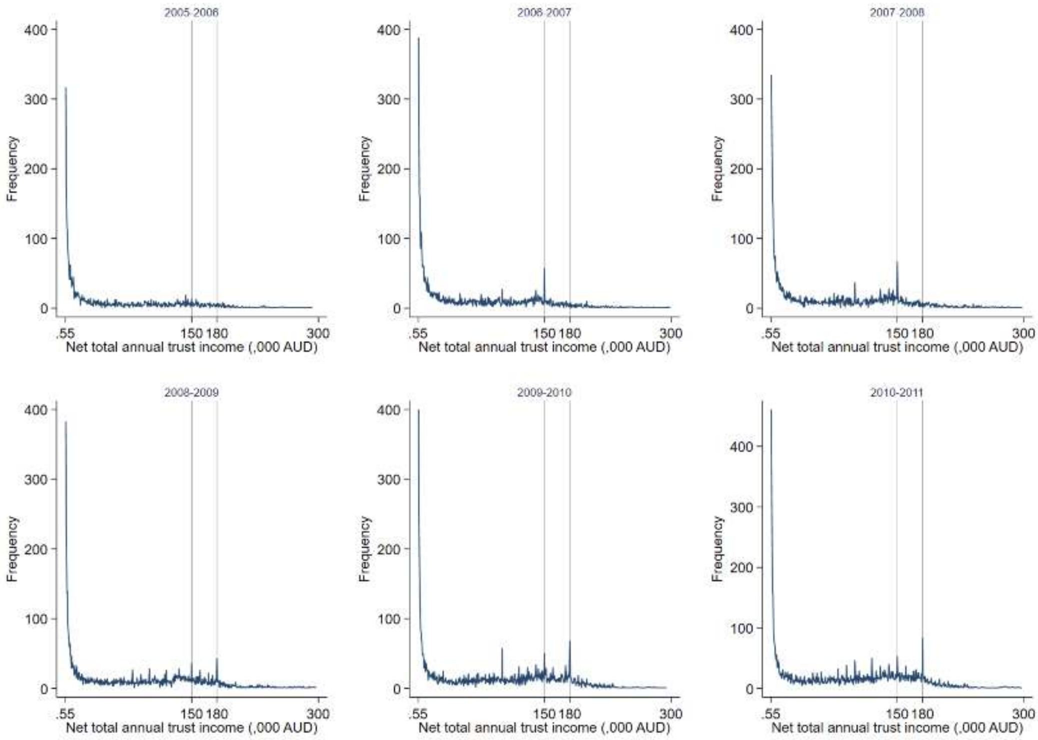
(b) Gross annual taxable income



(c) Total annual deductions



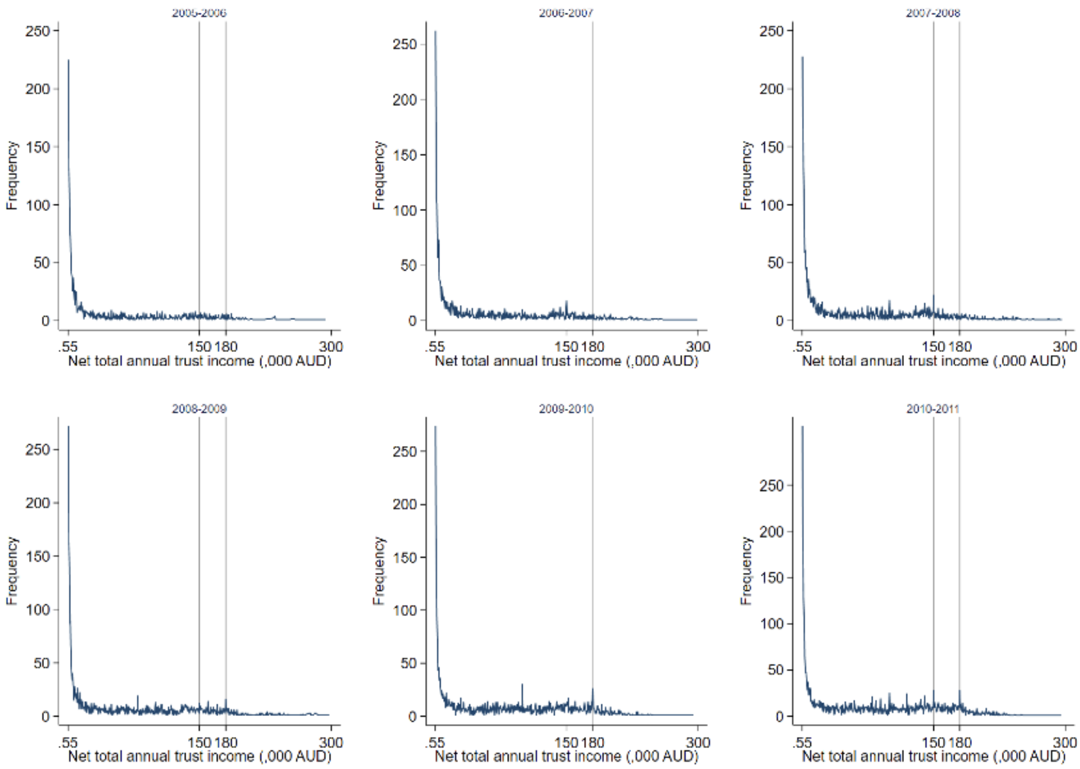
(d) Net total annual trust income



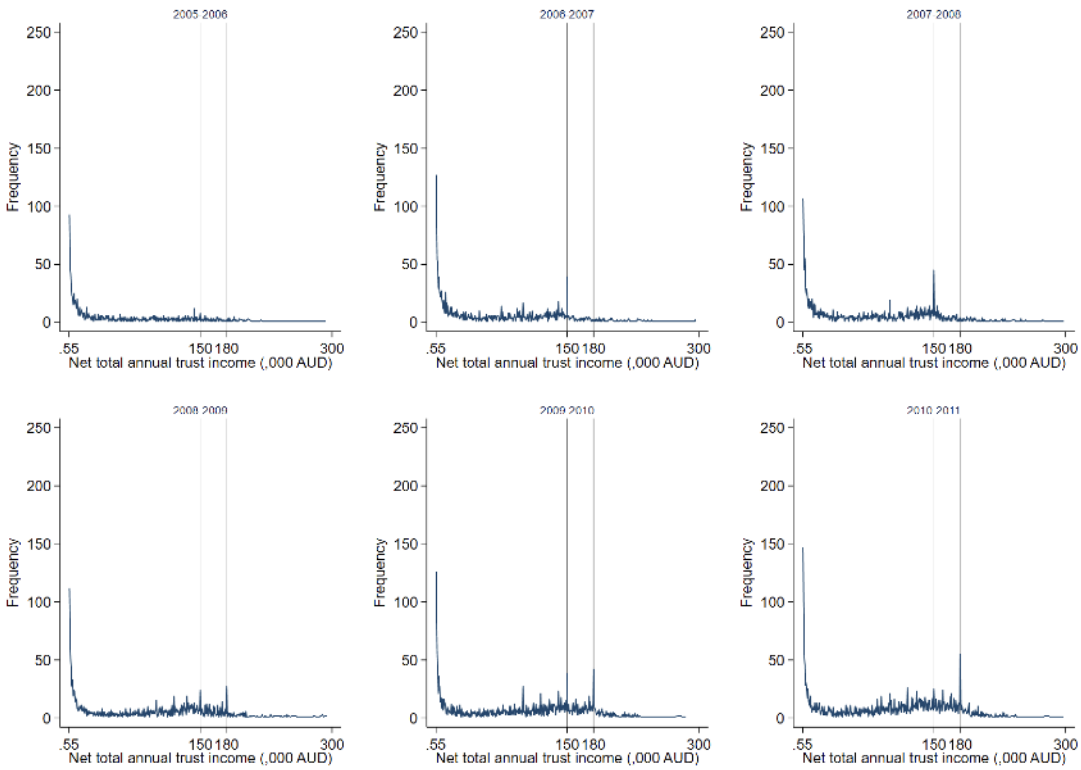
Notes: This figure plots the distribution of annual taxable income, gross annual taxable income, total deductions, and net total annual trust income for those with trust income in our study sample, those whose annual taxable income is within AUD 130,000 and AUD 200,000. The gross taxable income is defined as taxable income net of deductions and trust income. The bin size is AUD 500. Panel (a) and Panel (b) show that while there is quite sharp bunching at the top kinks at the distribution of taxable income, the bunching disappears once the deductions and trust income are netted out in the gross taxable income. Panel (c) and Panel (d) suggest that these individuals use mostly trust income for minimizing their tax liabilities.

Figure 9: Distribution of trust income by gender

(a) Males



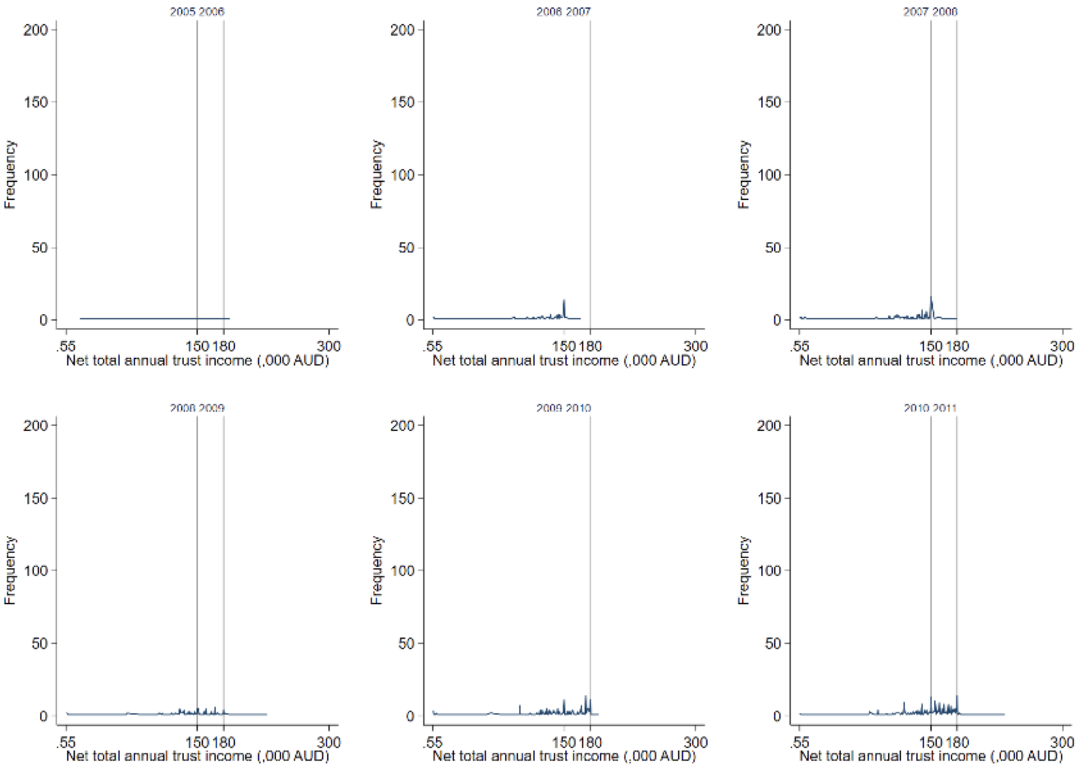
(b) Females



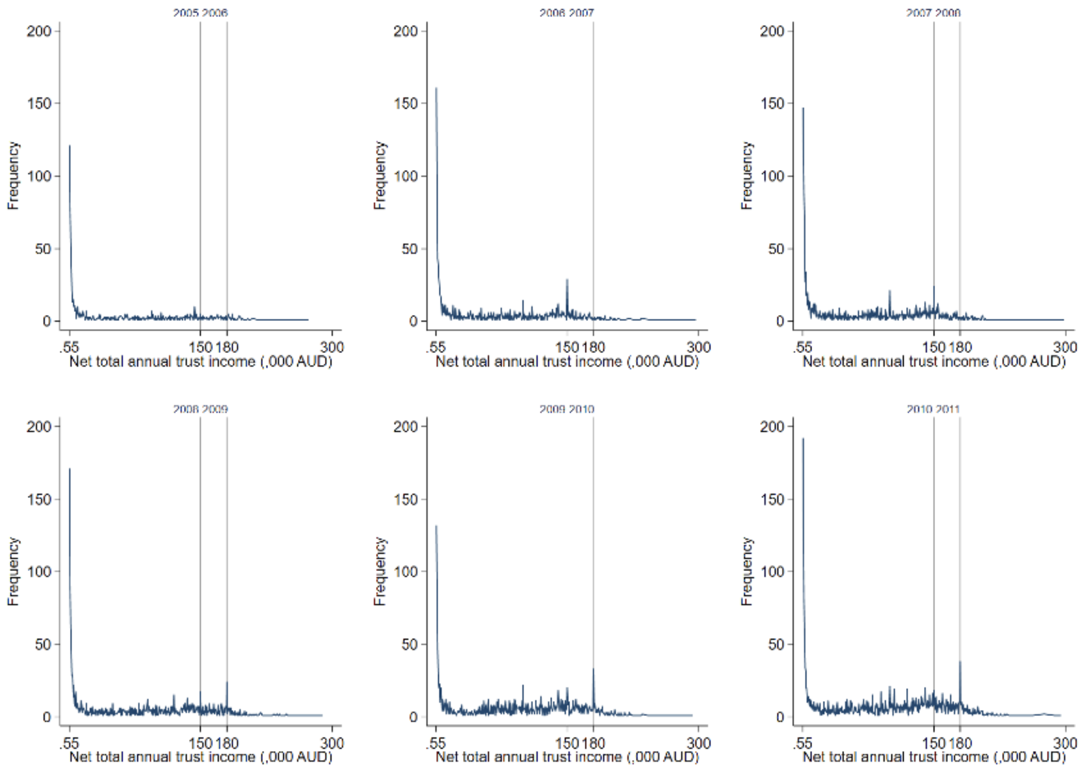
Notes: This figure displays the distribution of trust income in our study sample, categorized by gender. The study sample includes individuals with taxable income between AUD 130,000 and AUD 200,000 who had trust income. For additional details, refer to the notes for Figure 8.

Figure 10: Distribution of trust income by age

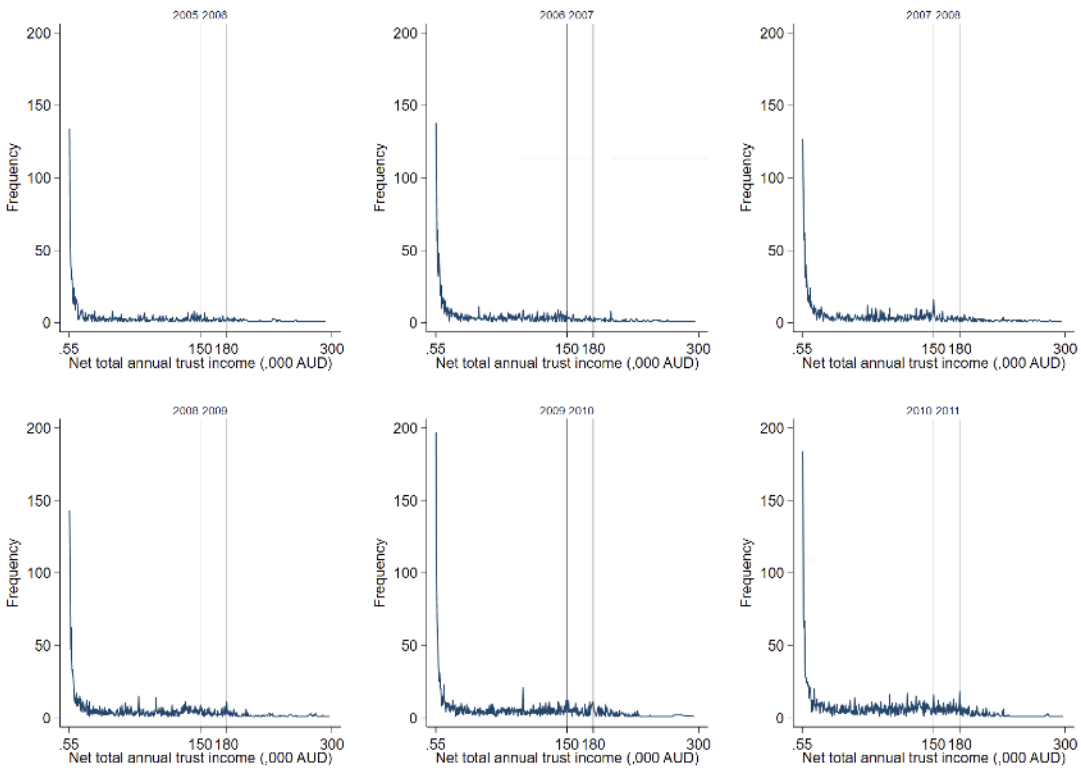
(a) 18-24 years



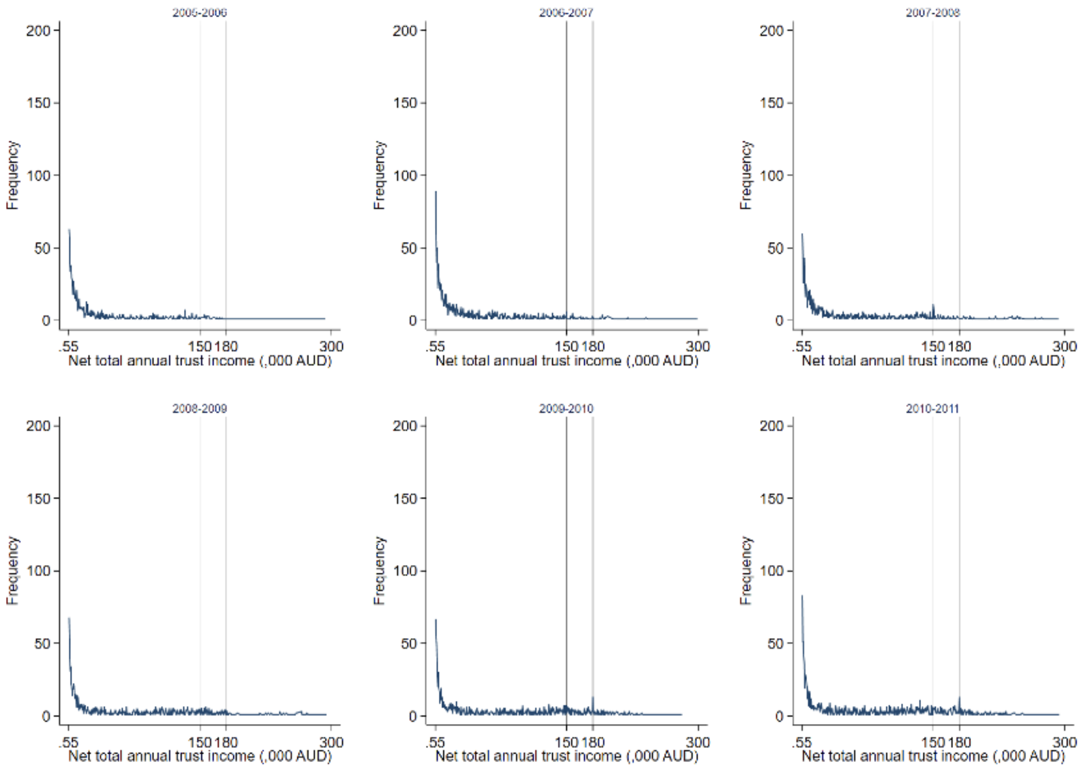
(b) 25-44 years



(c) 45-59 years

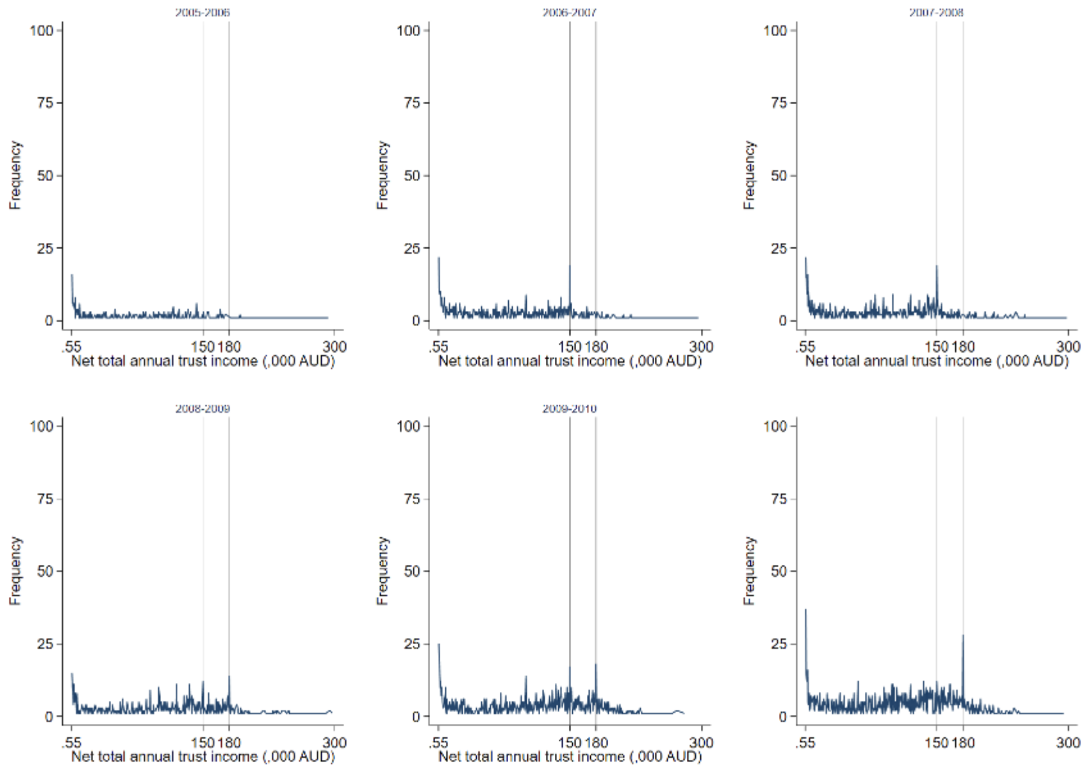


(d) 60 years and above



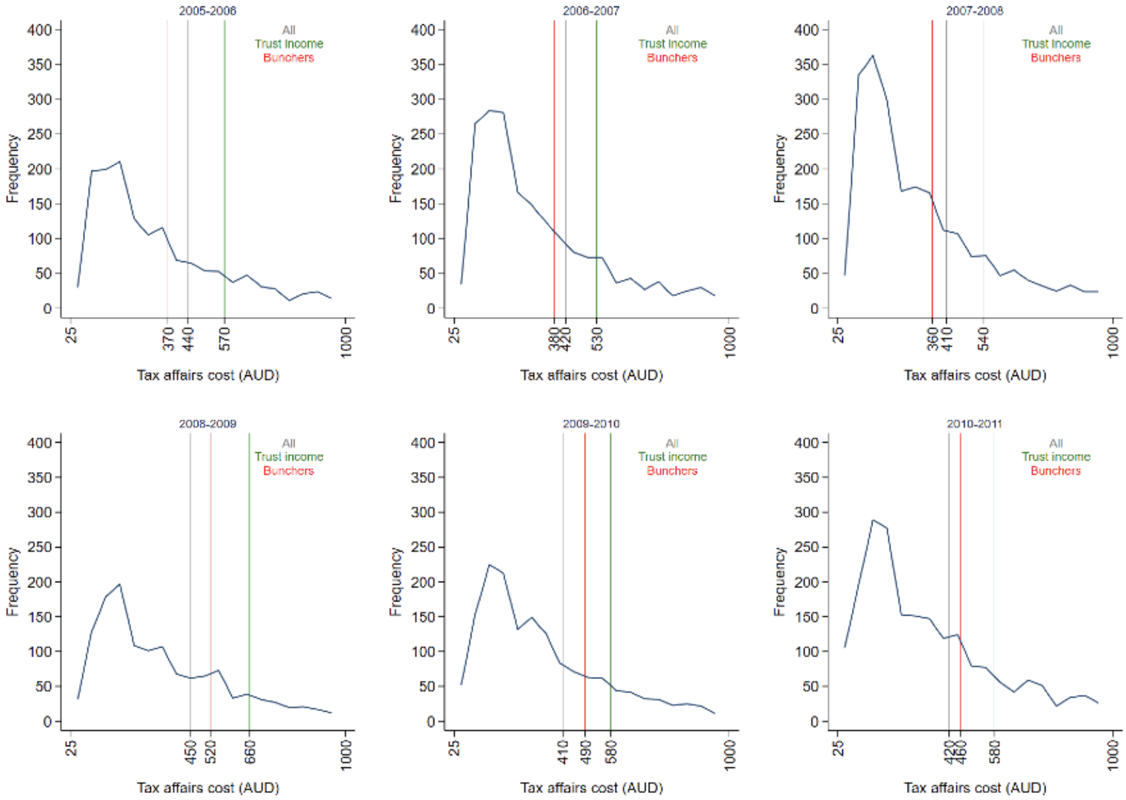
Notes: This figure displays the distribution of trust income in our study sample, categorized by age groups (18-24, 25-44, 45-59, and 60 years and above). The study sample includes individuals with taxable income between AUD 130,000 and AUD 200,000 who had trust income. For additional details, refer to the notes for Figure 8.

Figure 11: Distribution of trust income for those who are not the main earners



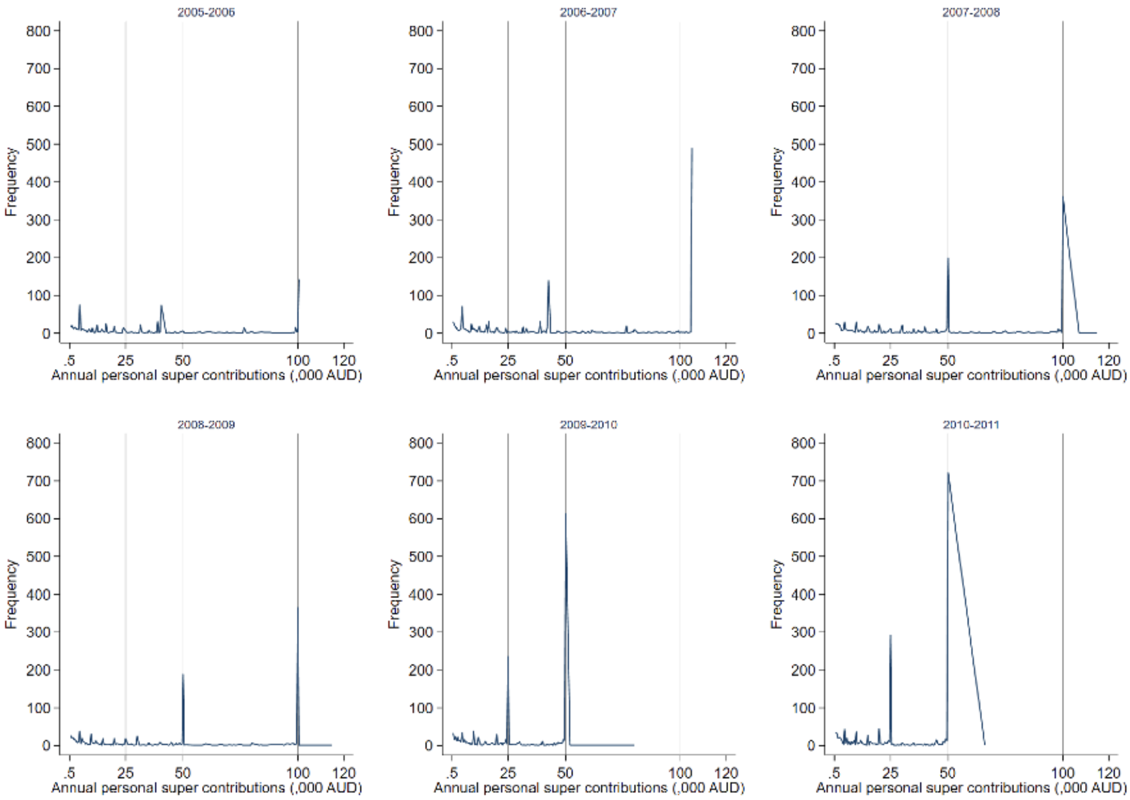
Note: This figure plots the distribution of trust income of those who are not the main earners in their family. The study sample includes individuals with taxable income between AUD 130,000 and AUD 200,000. See notes to Figure 8.

Figure 12: Distribution of tax affairs costs



Notes: This figure illustrates the distribution of tax affairs costs in our study sample. The study sample consists of individuals with taxable income between AUD 130,000 and AUD 200,000. Bunchers are defined as individuals with taxable income within a AUD 5,000 window around the top kink. The gray, green, and red lines represent the average tax affairs costs for all individuals, those with trust income, and bunchers, respectively. The costs show an increase in the policy change year, indicating a re-optimization cost.

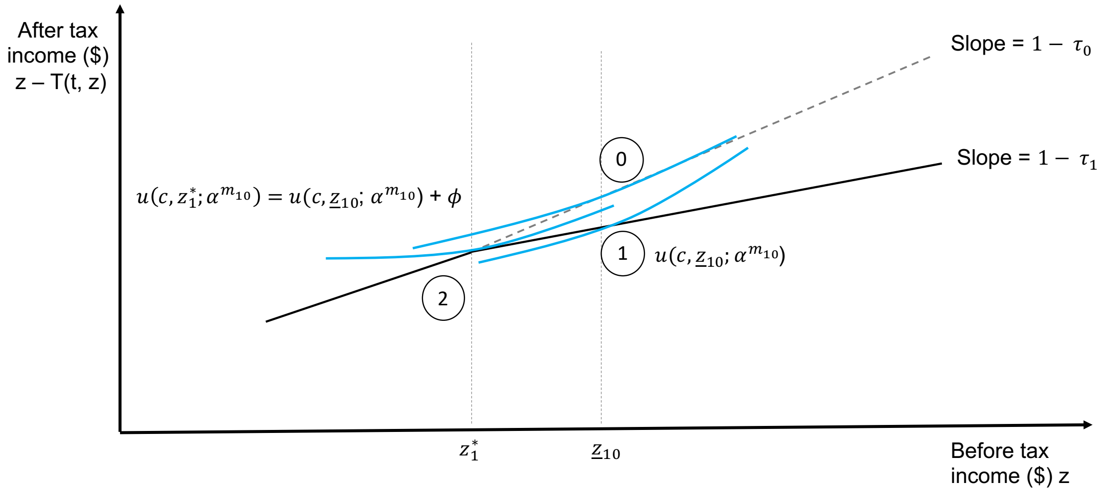
Figure 13: Distribution of personal contributions to super funds



Notes: This figure displays the distribution of annual personal contributions to tax favoured retirement funds, known as "superannuation" funds. Starting from 2007-2008, an age-based cap on contributions was introduced. This cap determined when the marginal tax rate increased from a 15 percent flat rate to an individual's marginal income tax rate. The cap was initially set at AUD 50,000 and AUD 100,000 for those below and over 50 years old, respectively. These caps were later reduced by 50 percent to AUD 25,000 and AUD 50,000 in 2009-2010. The study sample consists of individuals with taxable income between AUD 130,000 and AUD 200,000. Bunching at the contribution caps is observed, and it appears largely unaffected by changes in the top kink of the income tax schedule.

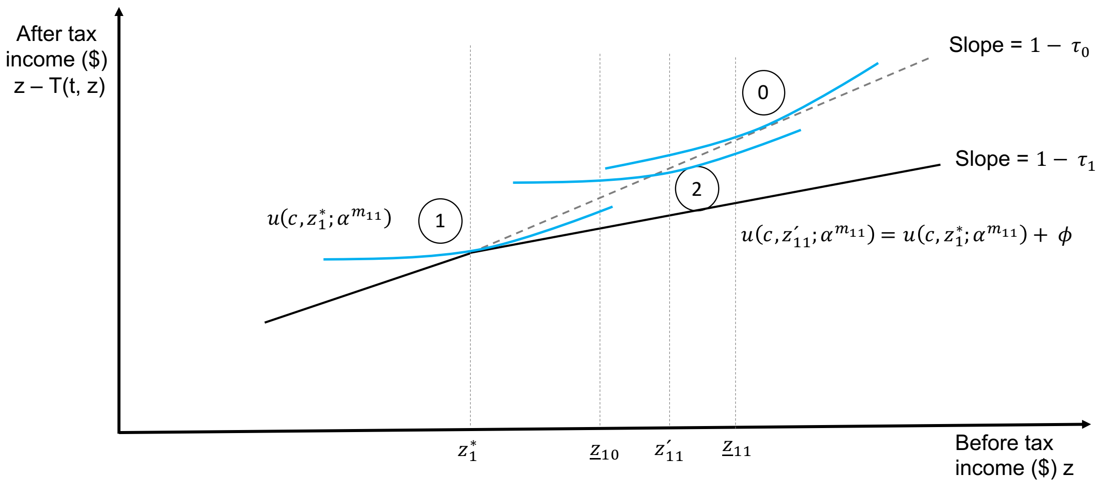
Figure 14: Taxable income responses of marginal buncher

(a) Former kink before policy change



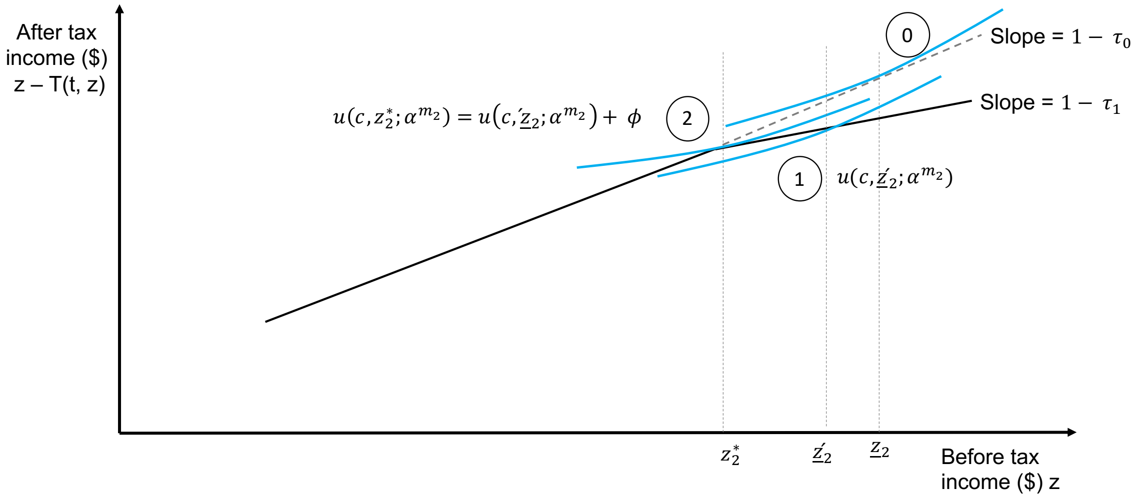
Note: This figure illustrates the change in taxable income for a marginal buncher located at the former kink z_1^*, characterized by ability $\alpha^{m_{10}}$, and initial taxable income $\underline{z}_{10}$ before the policy change. These individuals face a choice between remaining at $\underline{z}_{10}$ with a higher marginal tax rate of τ_1 or incurring a cost ϕ to bunch at z_1^* with a lower marginal tax rate of τ_0.

(b) Former kink after policy change



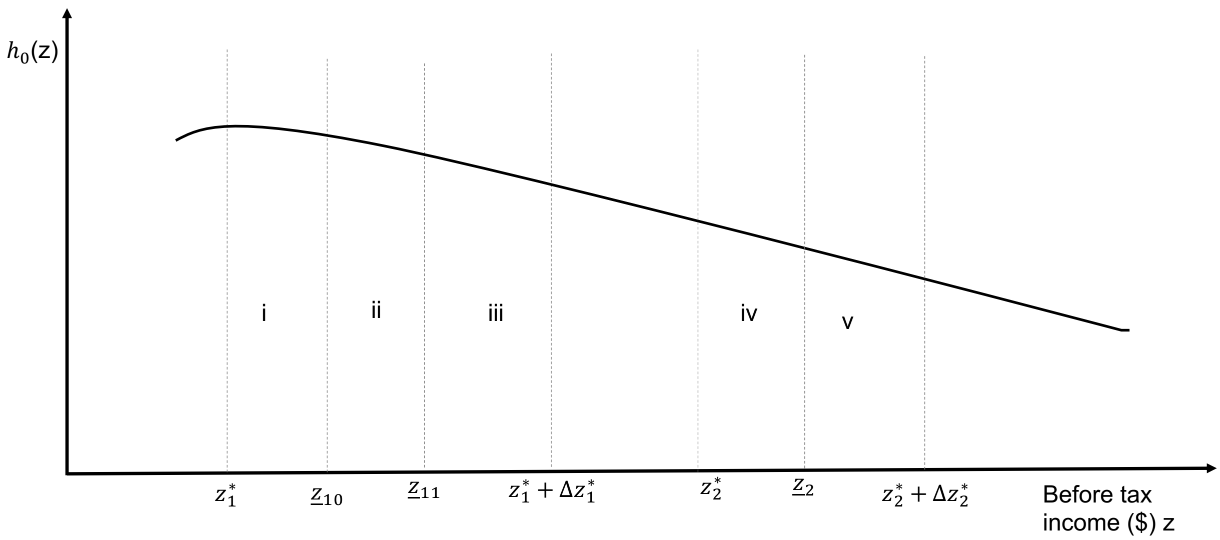
Note: This figure illustrates the change in taxable income for a marginal buncher with ability $\alpha^{m_{11}}$ and initial taxable income $\underline{z}_{11}$ at the former kink z_1^* after the policy change. Initially, when a kink at z_1^* is introduced, they choose to bunch at that kink. Subsequently, when the policy change increases the top kink to z_2^*, they face a decision between continuing to bunch at z_1^* or incurring a cost ϕ to increase their income to the optimal level, represented by the new taxable income z'_{11} under the new tax schedule.

(c) New kink



Note: This figure illustrates the change in taxable income for a marginal buncher with ability α^{m_2} and initial taxable income $\underline{z}_2$ at the new kink z_2^*. Initially, after introducing a kink at z_1^*, they decrease their taxable income to $\underline{z}_2'$. Subsequently, when the kink is moved to z_2^*, they face a decision between staying at $\underline{z}_2'$ with a higher marginal tax rate of τ_1 or incurring a cost ϕ to bunch at z_2^* with a lower marginal tax rate of τ_0.

Figure 15: Counter-factual distribution of taxable income



Note: This figure illustrates the counterfactual distribution of taxable income and bunching ranges at z_1^* and z_2^* kinks. The bunching range at z_1^* in the absence of cost is area $i + ii + iii$. When individuals face a cost, the bunching range shrinks to $ii + iii$. After the policy change, bunching at z_1^* is represented by area ii. Similarly, the bunching ranges at z_2^* without and with cost are represented by area $iv + v$ and v, respectively.

A Appendix: Tables

Table A.1: Summary statistics of all tax filing individuals

	Three years before policy change	Three years after policy change
Economics outcomes		
Total income (,000 AUD)	45.6	50.4
	(154.2)	(241.6)
Taxable income (,000 AUD)	42.8	47.5
	(150.2)	(139.1)
Net tax amount (,000 AUD)	9.0	9.1
	(65.1)	(38.7)
Total deductions (,000 AUD)	2.7	2.7
	(18.0)	(295.5)
Total tax withhold (,000 AUD)	8.5	9.1
	(17.9)	(20.6)
Wage and salary income (,000 AUD)	8.5	9.7
	(17.9)	(20.6)
Trust income (,000 AUD)	0.006	0.008
	(4.4)	(3.8)
Gross taxable income (,000 AUD)	42.5	46.9
	(148.6)	(231.4)
Occupation:		
Managers	0.09	0.09
Professionals	0.15	0.16
Technicians and trade	0.09	0.10
Community and personal services	0.07	0.08
Clerical and administrative	0.11	0.14
Sales	0.07	0.06
Machinery operators and drivers	0.04	0.05
Labourers	0.09	0.08
Self employed	0.36	0.35
Has trust income	0.16	0.14
Self employed with trust income	0.76	0.75
Used tax agent	0.73	0.71
Tax file preparation time (hours)	8.4	7.5
	(50.1)	(44.8)
Tax affairs fee (,000 AUD)	0.13	0.34
	(3.5)	(292.3)
Demographics		
Age (years)	42.5	42.7
	(15.5)	(15.6)
Male	0.52	0.52
Has spouse	0.57	0.57
Has child	0.57	0.50
Major city	0.61	0.69
Main earner	0.62	0.58
Male main earners	0.67	0.70
Number of individuals	1,363,727	1,438,569
Total number of observations	3,690,608	3,909,038

Note: This table presents the summary statistics of all tax filers. The sample includes all Australian resident individual tax filers above 18 years old from 2005-2006 to 2010-2011. For additional information, refer to the notes for Table 1.

Table A.2: Estimates of fixed tax sheltering cost and elasticity of taxable income

	Elasticity e	Average cost ϕ_a
Base model	0.099	0.801
	[0.092, 0.106]	[0.071, 1.531]
Gender: Male	0.056	0.329
	[0.049, 0.061]	[-0.885, 1.543]
Gender: Female	0.218	2.663
	[0.1476, 0.288]	[-3.467, 8.794]
Age: 18-44 years	0.116	1.061
	[0.103, 0.128]	[0.026, 2.095]
Age: 45-59 years	0.084	1.547
	[0.079, 0.089]	[0.253, 2.841]
Has spouse	0.092	0.698
	[0.085, 0.098]	[-0.107, 1.504]
Has child	0.100	4.754
	[0.092, 0.108]	[3.645, 5.862]
live in major city	0.110	1.054
	[0.102, 0.117]	[0.626, 1.483]
Main earner	0.057	0.437
	[0.051, 0.063]	[0.121, 0.725]
Employment type:	0.017	9.906
Wage and salary earner	[0.013, 0.020]	[-0.663, 2.474]
Employment type:	0.205	2.445
Self employed	[0.166, 0.243]	[-1.115, 6.006]
Professional and managers	0.056	0.033
	[0.037, 0.074]	[-4.571, 4.636]
Used tax agent	0.110	1.217
	[0.103, 0.117]	[0.229, 2.206]
Spent more than	0.099	0.714
10 hours filling taxes	[0.093, 0.106]	[0.032, 1.397]

Note: This table presents the estimated average tax sheltering cost and the Elasticity of Taxable Income (ETI) from the model specified in Section 4.1.1. The estimates capture immediate responses to the policy change using data from one year before and one year after the policy change. The 95% confidence intervals, computed using bootstrapped standard errors, are shown in brackets.

Table A.3: Estimates of elasticity of taxable income using Saez (2010) model

	Elasticity e
Base model	0.098 [0.0913, 0.105]
Gender: Male	0.055 [0.050, 0.060]
Gender: Female	0.214 [0.141, 0.286]
Age: 18-44 years	0.114 [0.101, 0.126]
Age: 45-59 years	0.082 [0.076, 0.086]
Has spouse	0.091 [0.083, 0.098]
Has child	0.093 [0.082, 0.102]
live in major city	0.108 [0.099, 0.117]
Main earner	0.056 [0.049, 0.063]
Employment type: Wage and salary earners	0.014 [0.009, 0.017]
Employment type: Self employed	0.201 [0.165, 0.236]
Occupation: Professional and managers	0.056 [0.049, 0.061]
Used tax agent	0.110 [0.103, 0.117]
Spent more than 10 hours filling taxes	0.098 [0.091, 0.105]

Note: This table presents the estimated Elasticity of Taxable Income (ETI) using the Saez (2010) model. The estimates capture immediate responses to the policy change using the data from the policy change year. The 95% confidence intervals using bootstrapped standard errors are in the brackets.

Table A.4: Estimates of tax sheltering cost and elasticity of taxable income for flexible bunchers

	Elasticity e	Fixed cost ϕ_f
Self employed		
Saez model	0.201 [0.165, 0.236]	
With costs	0.205 [0.166, 0.243]	2.445 [-1.115, 6.006]
Trust income holders		
Saez model	0.261 [-3.943, 4.465]	
With costs	0.265 [0.170, 0.361]	2.720 [-5.776, 11.213]
Self-employed with trust income		
Saez model	0.330 [-4.150, 4.811]	
With costs	0.265 [0.170, 0.360]	2.718 [-5.776, 11.212]

Note: This table presents the estimated tax sheltering cost and the Elasticity of Taxable Income (ETI) for individuals with greater flexibility for bunching, including self-employed individuals, those with trust income, and self-employed individuals with trust income. The table provides estimates with fixed costs, as well as estimates with no costs using the Saez (2010) model. The 95% confidence intervals, computed using bootstrapped standard errors, are shown in brackets. Refer to the notes for Table A.2 for more details.

Table A.5: Robustness of estimates of bunching to the selected parameters

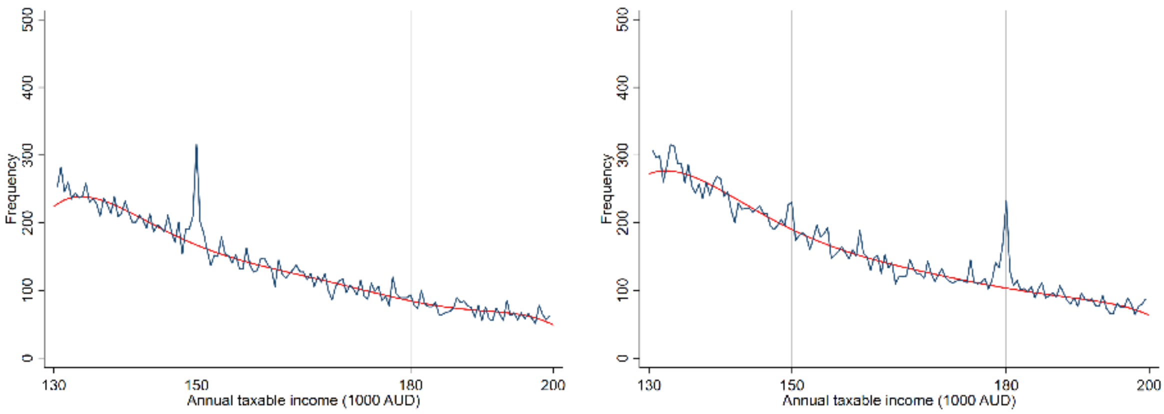
Bin size ($) δ	Degree of fitted polynomial D	Number of excluded bins at each side $l = u$	Normalized bunching at AUD 150,000 kink before policy change b_{10}	Normalized bunching at AUD 150,000 kink after policy change b_{11}	Normalized bunching at AUD 180,000 kink after policy change b_2
				Panel A: Base estimate	
500	6	6	2.94	0.369	4.047
				Panel B: Robustness to bin size	
250	6	12	4.677	0.322	7.380
1000	6	3	1.446	0.434	2.296
				Panel C: Robustness to degree of fitted polynomial	
500	5	6	2.164	0.599	3.830
500	7	6	2.621	0.429	3.914
				Panel D: Robustness to the number of excluded bins	
500	6	7	2.821	0.715	4.303
500	6	4	2.286	0.463	3.866

Note: This table presents the estimated normalized bunching at the kinks, as defined in Equation (C.5), with respect to the selected parameters. The estimation procedure is explained in detail in Appendix C. The selected parameters include the bin size, degree of the fitted polynomial, and the number of excluded bins around a kink. Note that changing the bin size also adjusts the number of excluded bins accordingly. Bootstrapped 95 percent confidence intervals for these estimates are provided in brackets.

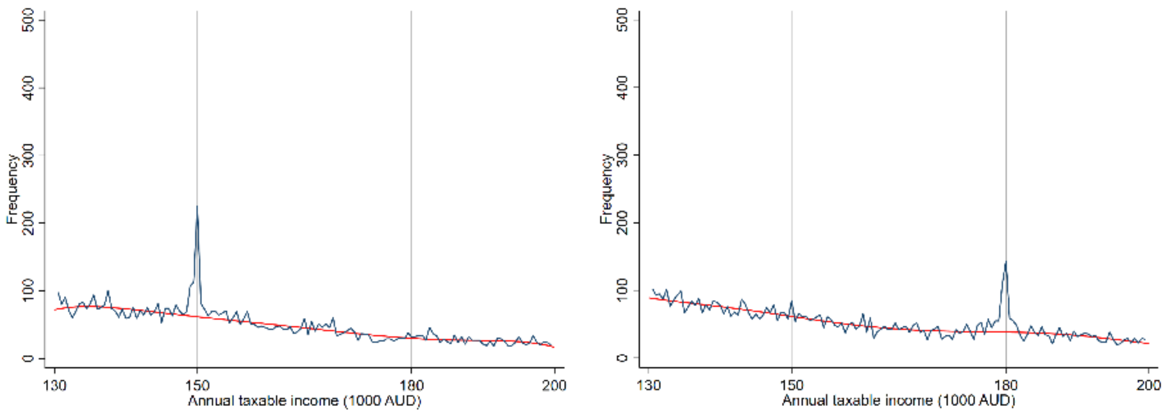
B Appendix: Figures

Figure B.1: Distribution of taxable income around the top kink by gender

(a) Male (before and after the policy change)



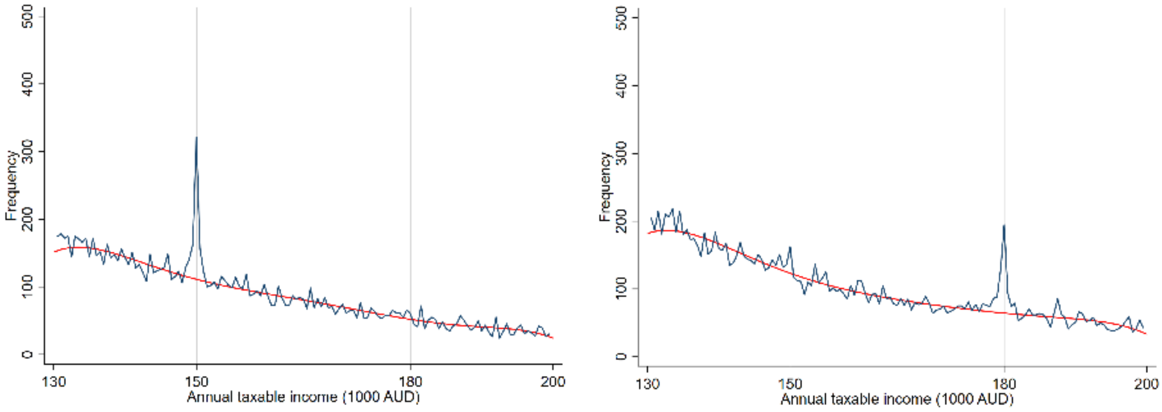
(b) Female (before and after the policy change)



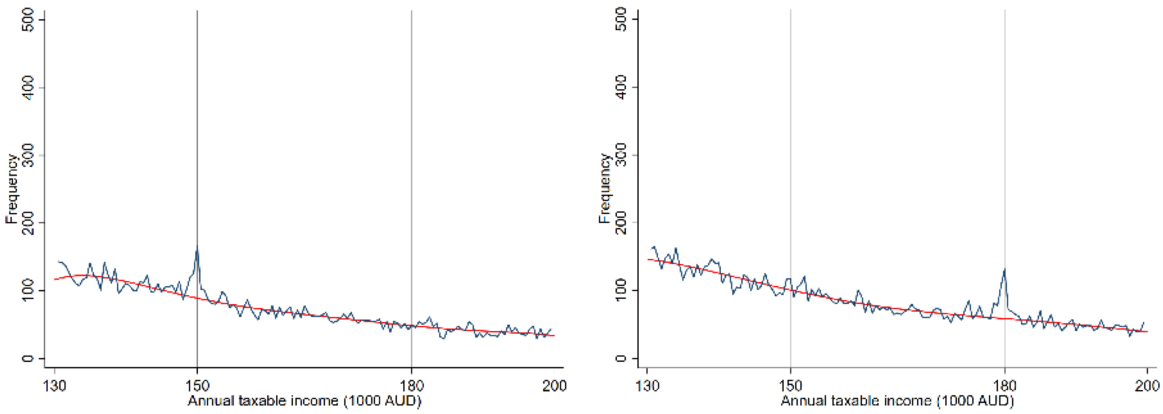
Note: This figure displays the distribution of taxable income within our study sample, categorized by gender one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.2: Distribution of taxable income around the top kink by age

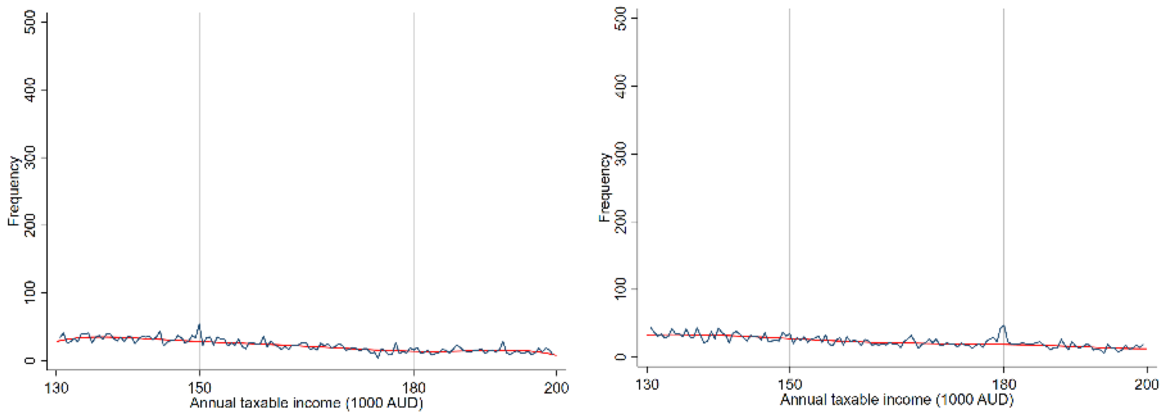
(a) 18-44 years (before and after policy change)



(b) 45-59 years (before and after the policy change)



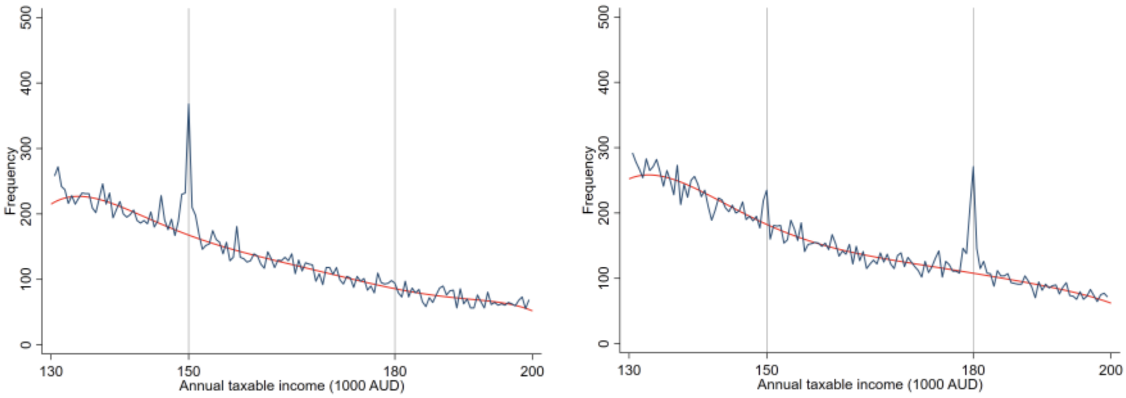
(c) 60 years and above (before and after the policy change)



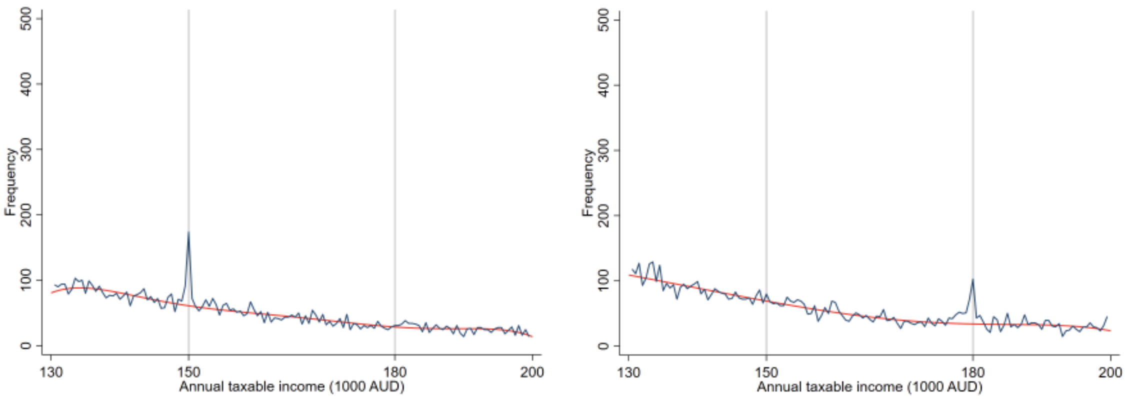
Note: This figure displays the distribution of taxable income within our study sample, categorized by age (18-44, 45-59 and 60 years and over) one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.3: Distribution of taxable income around the top kink by marital status

(a) Has spouse (before and after policy change)



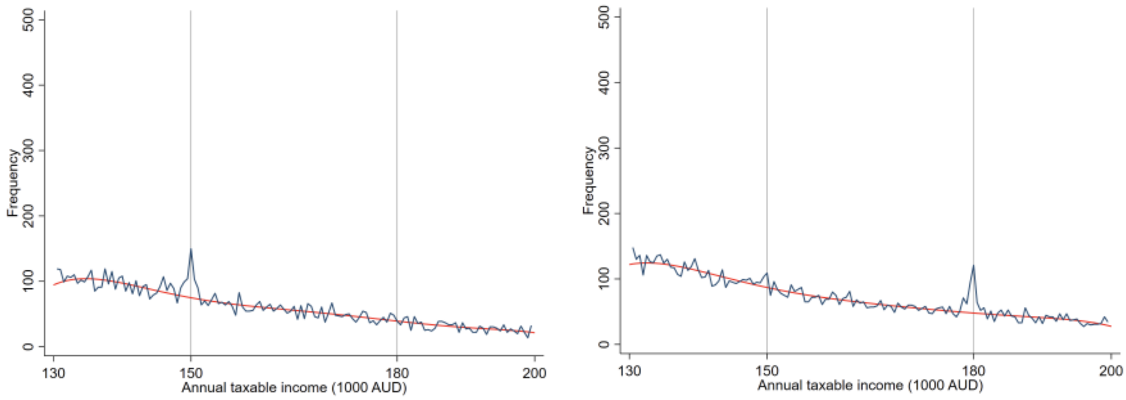
(b) Single (before and after the policy change)



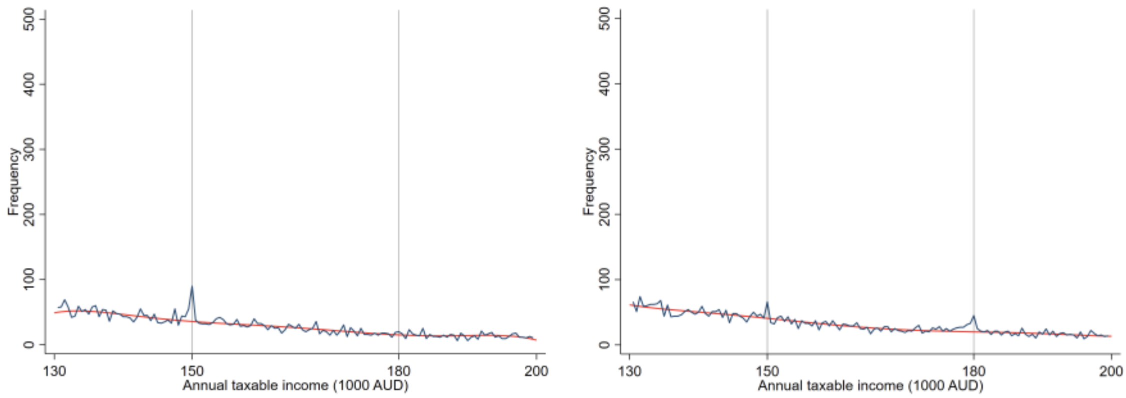
Note: This figure displays the distribution of taxable income within our study sample, categorized by marital status (having a spouse versus not having spouse) one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.4: Distribution of taxable income around the top kink by the number of children

(a) Has at least one child (before and after policy change)



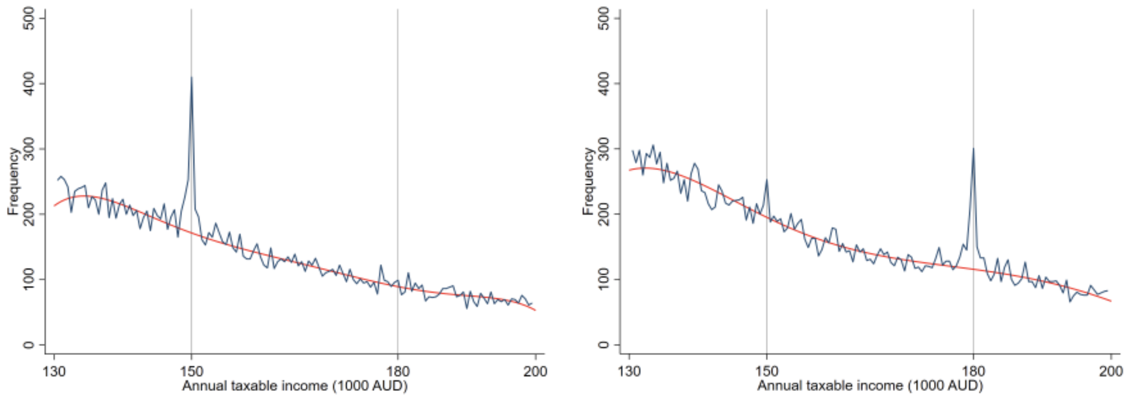
(b) No child (before and after the policy change)



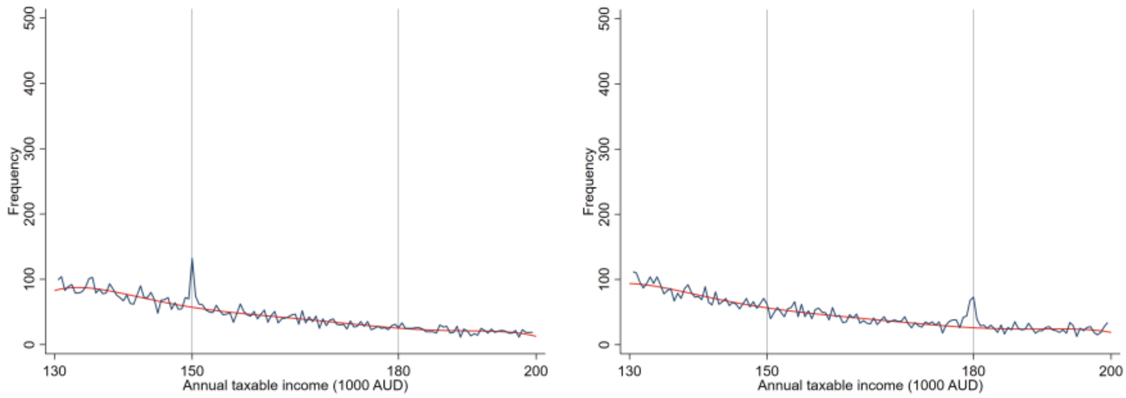
Note: This figure displays the distribution of taxable income within our study sample, categorized by the number of children (having at least one child versus no child) one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.5: Distribution of taxable income around the top kink by location of residence

(a) Major city (before and after policy change)



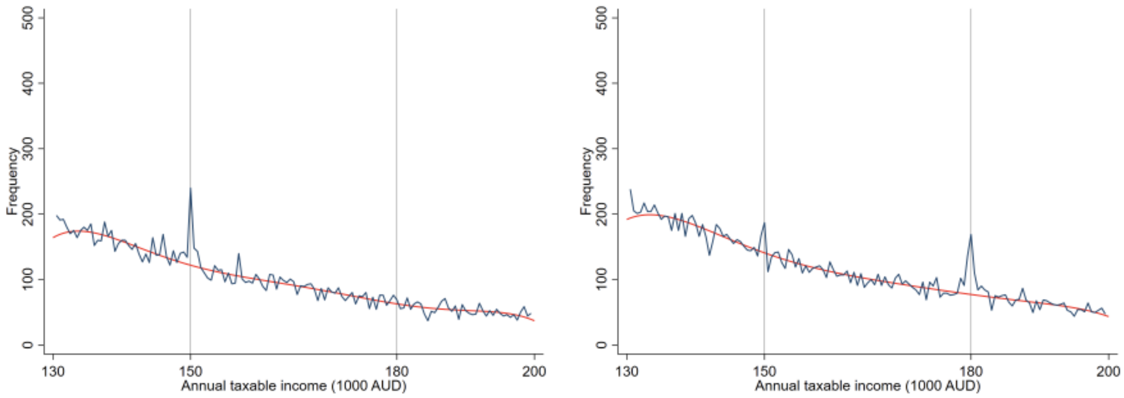
(b) No major city (before and after the policy change)



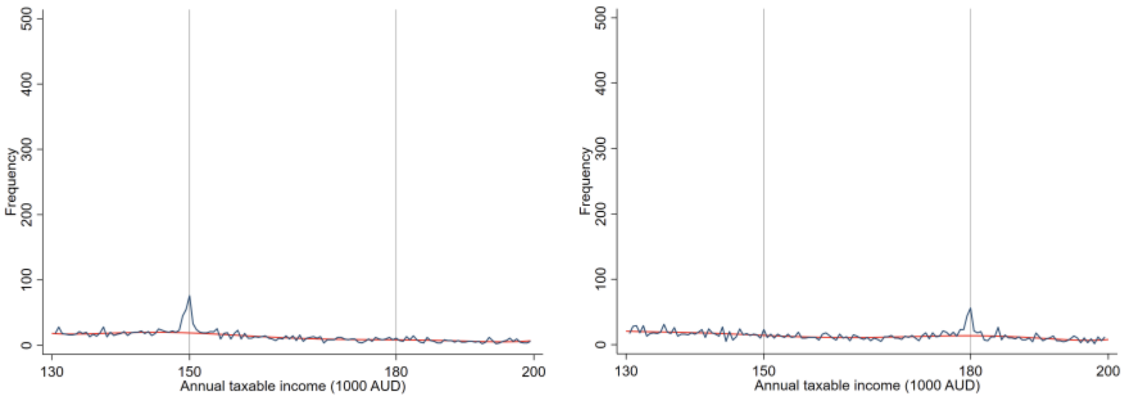
Note: This figure displays the distribution of taxable income within our study sample, categorized by the location of residence (residing in a major city versus no major city) one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.6: Distribution of taxable income around the top kink by family status

(a) Main earner (before and after policy change)



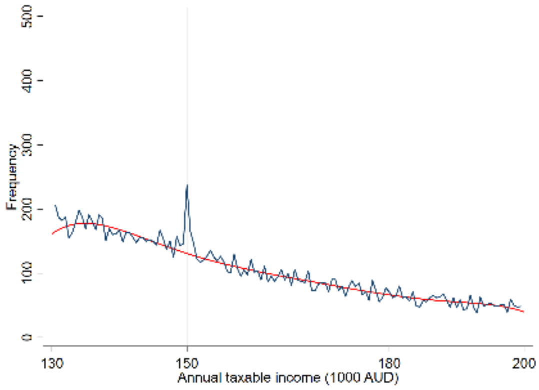
(b) Not main earner (before and after the policy change)



Note: This figure displays the distribution of taxable income within our study sample, categorized by main earning status (being main earner versus not being main earner) one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.7: Distribution of taxable income around the top kink for individuals with managerial and professional occupations

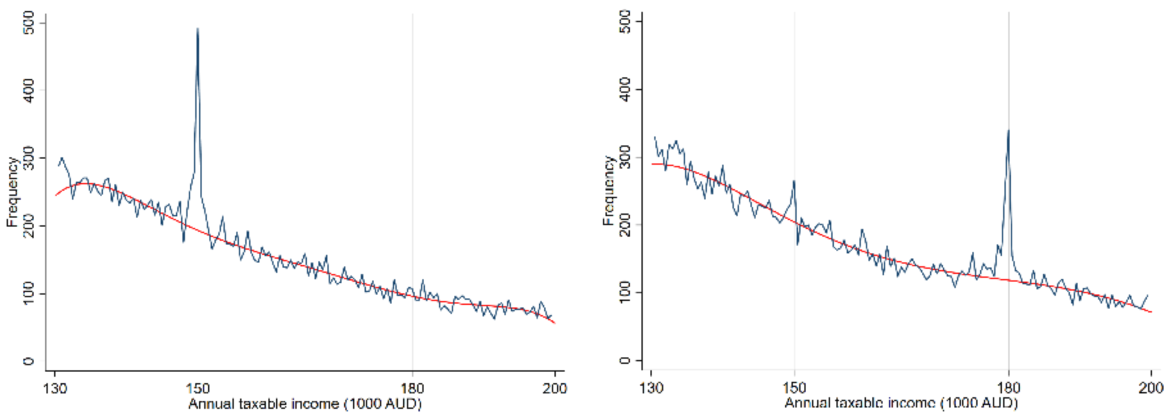
(a) Before and after the policy change



Note: This figure displays the distribution of taxable income within our study sample, who are in managerial and profession occupations, one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.8: Distribution of taxable income around the top tax threshold for individuals used a tax agent's help for filing their taxes

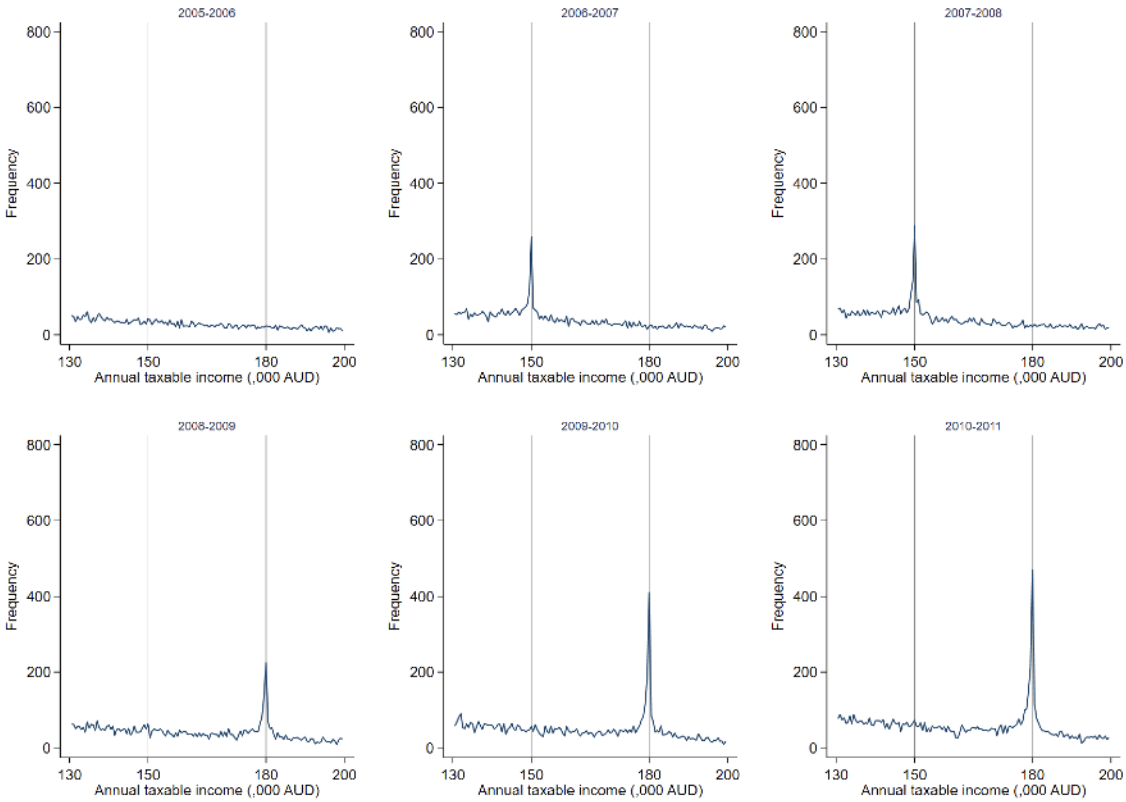
(a) Before and after the policy change



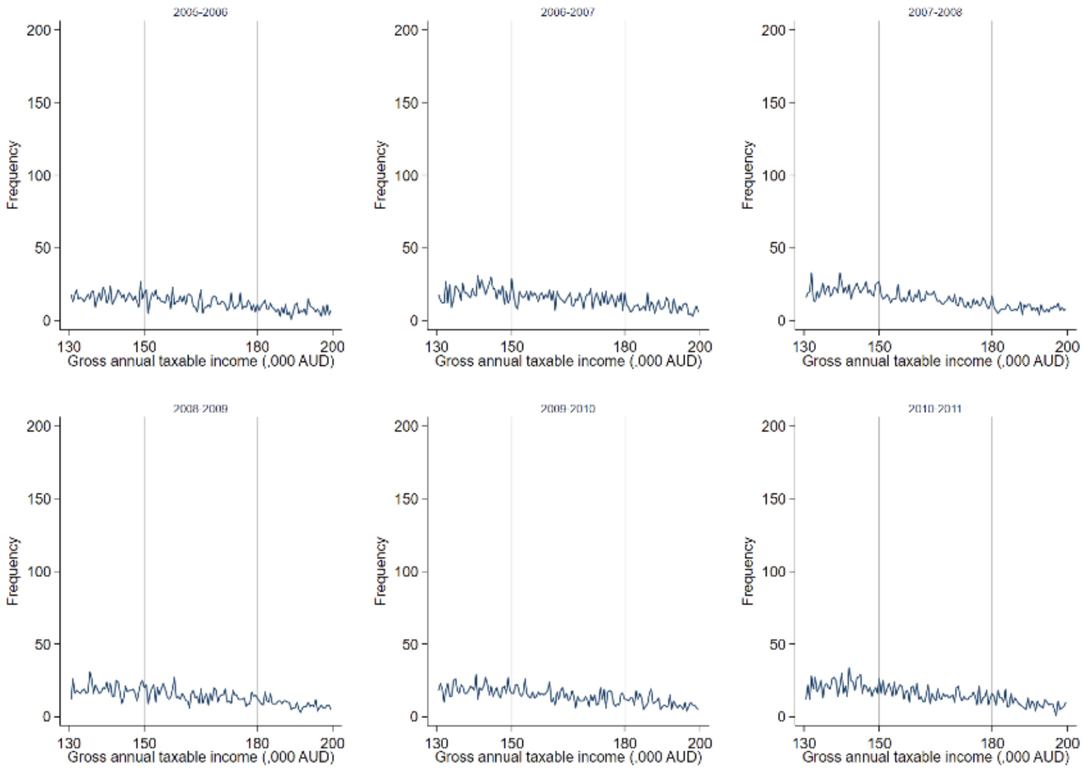
Note: This figure displays the distribution of taxable income within our study sample who used a tax agent for filing their taxes, one year before and one year after the policy change. For further information, refer to the notes to Figure 2.

Figure B.9: Distribution of taxable income, gross taxable income, deductions and trust income for self-employed individuals with trust income

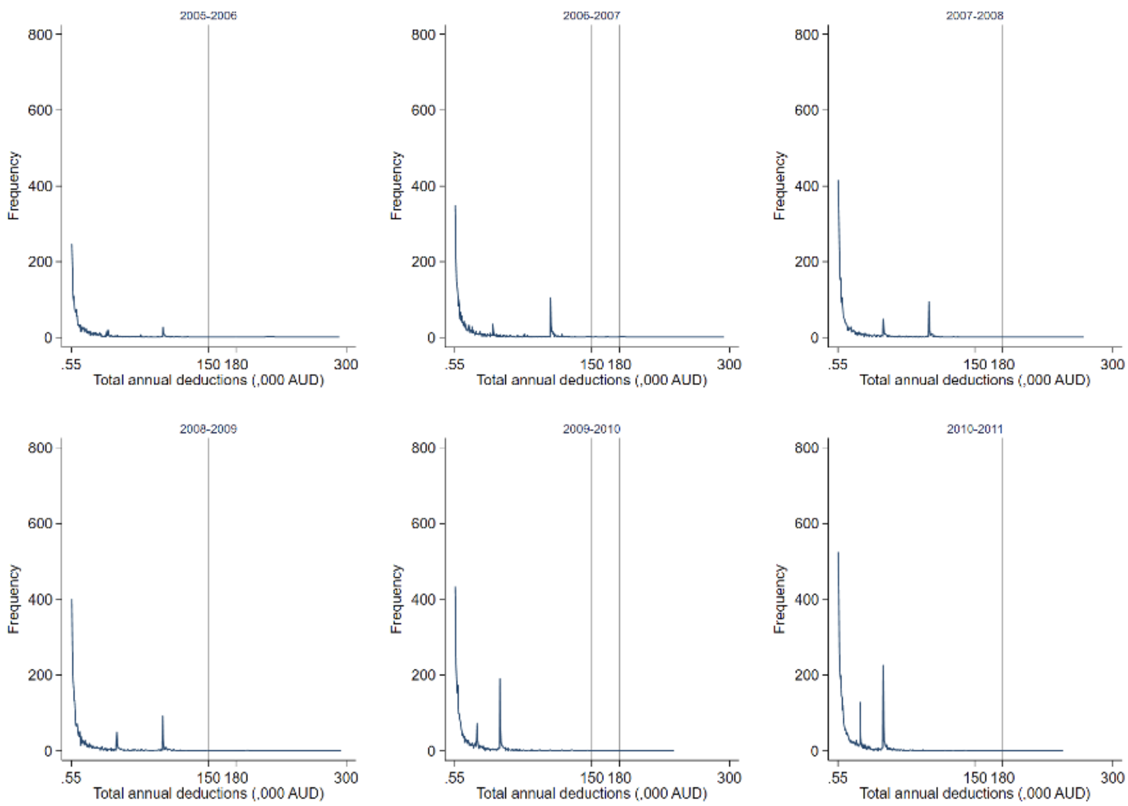
(a) Annual taxable income



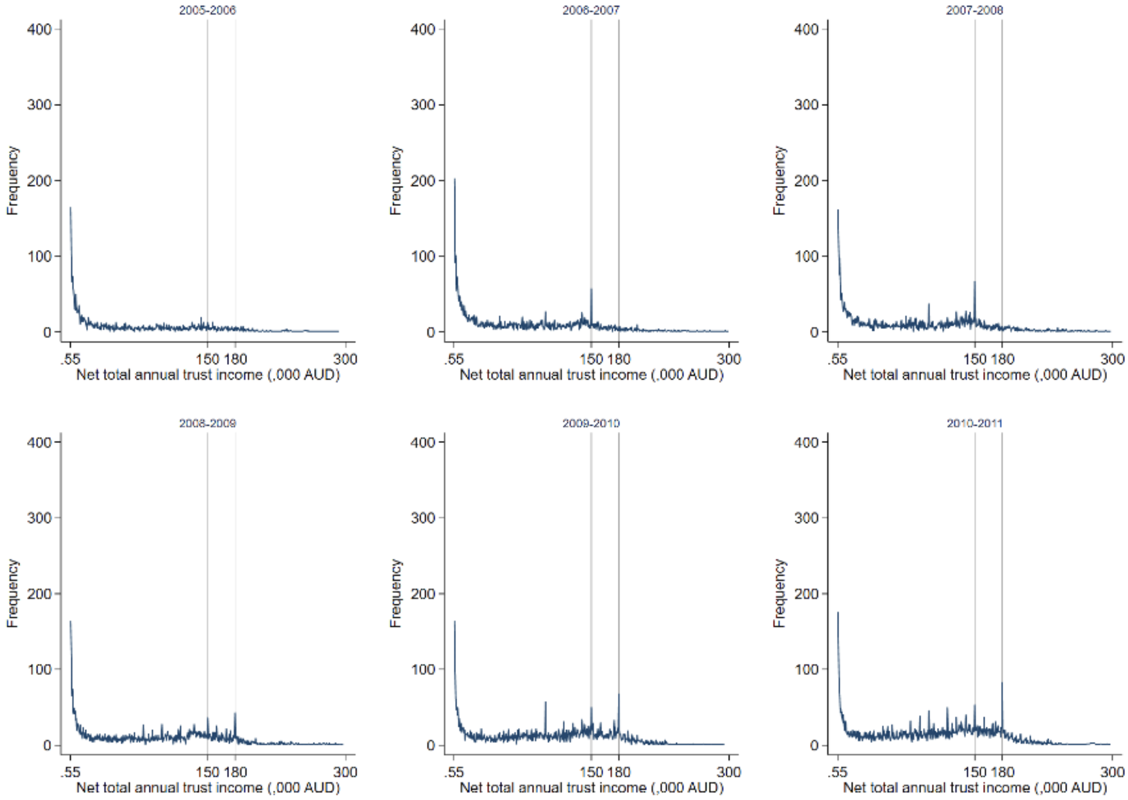
(b) Gross annual taxable income



(c) Total annual deductions



(d) Net total annual trust income



Notes: This figure plots the distribution of annual taxable income, gross annual taxable income, total deductions, and net total annual trust income for self employed individuals with trust income in our study sample, those whose annual taxable income is within AUD 130,000 and AUD 200,000. The gross taxable income is defined as taxable income net of deductions and trust income. The bin size is AUD 500. For more information, see noted to Figure 8.

C Estimating Bunching at a Kink

We follow the approach of Chetty et al. (2011) and Kleven and Waseem (2013) to construct a counterfactual taxable income distribution denoted as $h_0(.)$. This is achieved by fitting a polynomial to the observed empirical income distribution $h(.)$, while excluding a visually selected range around the kink. To start, we divide the observed annual taxable income into bins of width δ, where f_i represents the frequency of taxable income within the range $[z_i - \delta/2, z_i + \delta/2]$. We then fit a flexible polynomial of degree D to the observed income distribution within a neighborhood $Q = [Q^l, Q^u]$ of the kink z^*. This is done by estimating the following regression equation:

$$f_i = \sum_{d=0}^{D} \beta_d (z_i - z^*)^d + \sum_{j=-l}^{l} \gamma_j \mathbb{1}\{z_i - z^* = \delta j\} + \epsilon_i \tag{C.1}$$

Here, $\mathbb{1}(.)$ denotes as an indicator function representing dummies for the bunching bins around the kink within the range $[z^* - \delta l, z^* + \delta u]$. These dummies help isolate the effects of the bunching bins on the estimated counterfactual income distribution, denoted as $\widehat{f}_i$. This counterfactual distribution is calculated as $\widehat{f}_i = \sum_{d=0}^{D} \beta_d (z_i - z^*)^d$. The initial estimate of bunching at z^* is given by:

$$B = \delta \sum_{j=l}^{u} (f_j - \widehat{f}_j) = \delta \sum_{j=l}^{u} \gamma_j \tag{C.2}$$

However, Equation (C.2) overestimates the true amount of bunching at a kink because it does not account for the fact that individuals who bunch at a kink might have chosen to locate to the right of the threshold if a flat tax rate τ_0 had been imposed. Furthermore, when a kink is shifted forward, those who bunch at the new kink have moved from points to the left of the threshold. This leads to the observed income distribution not matching the counterfactual distribution under the integration constraint (as referred to by Chetty et al. (2011)). To address this, we employ a technique introduced by Chetty et al. (2011). We iteratively shift the estimated counterfactual income distribution around the former kink at z_1^* to the right and around the new kink at z_2^* to the left.

The iteration process involves estimating the following equations, with n denoting the iteration number:

$$\begin{aligned} f_i \cdot \left(1 + \mathbb{1}\{i > u_1\} \frac{\widehat{B}_1^{\,n-1}}{\sum_{q>u_1} f_q}\right) &= \sum_{d=0}^{D} \beta_d^n (z_i - z_1^*)^d + \sum_{j=l_1}^{u_1} \gamma_j^n \mathbb{1}\{z_i - z_1^* = \delta j\} + \epsilon_i \\ f_i \cdot \left(1 + \mathbb{1}\{i < l_2\} \frac{\widehat{B}_2^{\,n-1}}{\sum_{q<l_2} f_q}\right) &= \sum_{d=0}^{D} \beta_d^n (z_i - z_2^*)^d + \sum_{j=l_2}^{u_2} \gamma_j^n \mathbb{1}\{z_i - z_2^* = \delta j\} + \epsilon_i \end{aligned} \tag{C.3}$$

The iteration continues until the area under the estimated counterfactual distribution equals that under the empirical one, given by $\sum_{i \in Q} f_i = \sum_{i \in Q} \widehat{f}_i$. The estimated bunching at z^* at iteration n is $B^n = \delta \sum_{j=l}^{u} (f_j - \widehat{f}_j) = \delta \sum_{j=l}^{u} \gamma_j^n$. The estimated counterfactual income distribution at z^*, obtained using (C.3), is denoted as $h_0(z)$:

$$\begin{aligned} h_0(z) &= \sum_{d=0}^{D} \beta_d (z - z^*)^d \\ h_0(z^*) &= \beta_0 \end{aligned} \tag{C.4}$$

To make the estimated bunching comparable across kinks, we normalize it by dividing it by the counterfactual mass at z^*, as shown in:

$$\widehat{b} = \frac{B}{h_0(z^*)} = \frac{B}{\beta_0} \tag{C.5}$$

We conduct a series of robustness checks to assess the sensitivity of our results to various parameters of bunching estimation. These checks include variations in the bunching range, alternative specifications of the tax function, and different sample periods. The estimates are provided in Table A.5.

D Empirical implementation of bunching models

D.1 Model with no tax sheltering costs

The model used to estimate the Elasticity of Taxable Income (ETI) without considering costs, as introduced by Saez (2010), serves as the foundation for the model that incorporates costs. Saez (2010) model explores the assumed proportional relationship between ETI and bunching at a kink. Individuals choose their taxable income z to maximize their quasi-linear utility function, specified as:

$$u(c, z; \alpha) = c - \frac{\alpha}{1 + \frac{1}{e}} \left(\frac{z}{\alpha}\right)^{1+\frac{1}{e}} \tag{D.1}$$

Here, z and c represent respectively taxable income and consumption defined as after-tax income $z - T(z, \tau)$, where τ denotes the marginal income tax rate. Individuals differ only in their ability, denoted by α, which is assumed to have a smooth distribution, implying a smooth distribution of taxable income with linear taxes. The utility maximizer's level of income for an individual with ability α under a linear marginal tax rate τ is given by:

$$z_\alpha = \alpha(1 - \tau)^e \tag{D.2}$$

Suppose there is a kink at z^* where the marginal taxes below and above the kink are τ_0 and τ_1, respectively, with $\tau_0 < \tau_1$. The smooth distribution of ability implies that individuals with ability $\alpha \in \left[\frac{z^*}{(1-\tau_0)^e}, \frac{z^*}{(1-\tau_1)^e}\right]$ who would have been located in the bunching range $(z^*, z^* + \Delta z^*]$ in the absence of the kink now bunch in a neighborhood of z^*. Δz^* is the income response range at z^* and is defined as:

$$\Delta z^* = z^* \left(\left(\frac{1 - \tau_0}{1 - \tau_1}\right)^e - 1\right) \tag{D.3}$$

Suppose $h_0(\cdot)$ denotes the counterfactual distribution of taxable income in the absence of the kink. Bunching at the z^* kink is the area under the counterfactual distribution in the bunching range. Assuming that $h_0(\cdot)$ in the bunching range is uniform, bunching at the z^* kink is defined as:

$$B^* = \int_{z^*}^{z^* + \Delta z^*} h_0(\zeta) d\zeta \approx \Delta z^* h_0(z^*) \tag{D.4}$$

Δz^* and B^* together define the ETI as:

$$e = \frac{\Delta z^* / z^*}{(\tau_1 - \tau_0)/(1 - \tau_0)} \tag{D.5}$$

We describe the method for estimating the counterfactual distribution and bunching at a kink in Appendix C. We use the distribution of taxable income from the the policy change year at 2008-2009 to estimate the ETI with no cost. We fit a sixth-degree polynomial ($D = 6$) to the binned distribution of taxable income (δ = AUD 500) around the former kink, excluding six bins on each side of the kink ($l = u = 6$), using the regression specified in (C.3) in Appendix C. The red line in Panel (a) of Figure 3 presents the fitted polynomial. We then estimate the bunching at the kink from (C.2). We back out Δz_1^* from (D.4) by using the estimated B^* and $h_0(z^*)$. Substituting Δz^* into (D.5) results in the ETI with respect to net-of-tax rates, defined as:

$$e = \frac{\ln\left(1 + \frac{\delta b}{z_1^*}\right)}{\ln\left(\frac{1-\tau_0}{1-\tau_1}\right)} \tag{D.6}$$

We estimate the standard errors using the method explained in Section 4.2.2 to make inferences about the estimations. The estimates are presented in Table A.3 in the Appendix A.

D.2 Model with fixed and marginal costs of tax sheltering

In this model, we introduce the assumption that the cost of adjusting taxable income from an initial level z_0 to z to shelter $|z - z_0|$ from taxes is given by:

$$\phi(z_0, z) = \phi_f + \phi_m|z - z_0| \tag{D.7}$$

Here, ϕ_f and ϕ_m represent the fixed and marginal costs of tax sheltering, respectively.

We use the utility function specified in D.1, and we need to estimate three parameters: the ETI (e), ϕ_f, and ϕ_m. Equations (D.9) to (D.16) together form three equations that jointly determine the three parameters. We provide more details below.

Let's assume there is a kink at z_1^* where the marginal tax rates below and above the kink are τ_0 and τ_1, respectively, with $\tau_0 < \tau_1$. Using the utility maximizer's level of taxable income with a linear tax rate of τ_0 specified in (D.2), we can calculate the ability of the marginal buncher as follows:

$$\alpha^{m_{10}} = \frac{\underline{z}_{10}}{(1-\tau_0)^e} \tag{D.8}$$

Feeding this into the marginal buncher equation presented in (1) using the utility function specified in (D.1) results in an equation that implicitly defines $\underline{z}_{10}$ as a function of e and the cost parameters ϕ_f and ϕ_m:

$$\left(\phi_m + (1-\tau_1)\right)\left(\underline{z}_{10} - z_1^*\right) - \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_{10} - {z_1^*}^{1+\frac{1}{e}}\underline{z}_{10}^{-\frac{1}{e}}\right) + \phi_f = 0 \tag{D.9}$$

We use Δz_{10}^* from (D.3) and the estimated bunching at z_1^* before the policy change (B_{10}) in the bunching equation specified in (2), resulting in:

$$\underline{z}_{10} = \left(\frac{1-\tau_0}{1-\tau_1}\right)^e z_1^* - \frac{\delta B_{10}}{h_0(z_1^*)} \tag{D.10}$$

where δ denotes the bin size. Together, (D.9) and (D.10) describe an equation involving e, ϕ_f, and ϕ_m.

We use the residual bunching at z_1^* kink after the policy to construct another equation. $\underline{z}_{11}$ is the initial income of a marginal buncher at z_1^* from (D.2). Then the ability of the marginal buncher $\alpha^{m_{11}}$ is:

$$\alpha^{m_{11}} = \frac{\underline{z}_{11}}{(1-\tau_0)^e} \tag{D.11}$$

Feeding (D.11) into the marginal buncher equation defined in (3) using the utility function specified in (D.1) results into:

$$(\phi_m - (1-\tau_0))(\underline{z}_{11} - z_1^*) - \frac{1-\tau_0}{1+\frac{1}{e}}\left({z_1^*}^{1+\frac{1}{e}}{\underline{z}_{11}}^{-\frac{1}{e}} - \underline{z}_{11}\right) + \phi_f = 0 \tag{D.12}$$

Feeding the estimated bunching at z_1^* after the policy change (B_{11}) into bunching condition defined in (4) results in:

$$\underline{z}_{11} = \underline{z}_{10} + \frac{\delta B_{11}}{h_0(z_1^*)} \tag{D.13}$$

where together (D.12) and (D.13) describe the second equation.

We repeat a similar procedure for the bunching at the new kink at z_2^*. The following equations together describe the third equation:

$$\alpha^{m_2} = \frac{\underline{z}_2}{(1-\tau_0)^e} \tag{D.14}$$

$$(\phi_m + (1-\tau_1))(\underline{z}_2 - z_2^*) - \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_2 - {\underline{z}_2}^{-\frac{1}{e}}{z_2^*}^{1+\frac{1}{e}}\right) + \phi_f = 0 \tag{D.15}$$

$$\underline{z}_2 = \left(\frac{1-\tau_0}{1-\tau_1}\right)^e z_2^* - \frac{\delta B_2}{h_0(z_2^*)} \tag{D.16}$$

Here, α^{m_2} and $\underline{z}_2$ denote the ability and initial utility-maximizing taxable income of the marginal buncher at z_2^* kink, and b_2 is the normalized bunching at the kink.

We use the distribution of taxable income from both before (2008-2009) and after the policy change (2009-2010), as plotted in Figure 3, for our estimations. We estimated the bunching at $z_1^* =$ AUD 150,000 before (B_{10}) and after the policy change (B_{11}), and bunching at $z_2 =$ AUD 180,000 using the procedure described in Section C. We set the parameters as $\delta = 500$, $D = 6$, $l = u = 6$. The red line in Figure 3 represents the fitted polynomial.

The marginal tax rates below and above the kinks are $\tau_0 = 0.40$ and $\tau_1 = 0.45$. (D.9) to (D.16) together define a system of equations that we solve numerically to determine e, ϕ_f, and ϕ_m. We use the method explained in Section 4.2.2 to estimate standard errors and make inferences about the estimated parameters. The estimates are presented in Table 3.

We also estimate a model with only fixed costs by setting $\phi_m = 0$. We solve Equations (D.9) to (D.13) to determine e and ϕ_f. The estimates are presented in Table A.2.

D.3 Dynamic model with cost of tax sheltering

The dynamic model explores the evolution of bunching from the former threshold at z_1^* to the new one at z_2^* with marginal tax rates of τ_0 and τ_1 respectively below and above the threshold where $\tau_0 < \tau_1$. We use bunching at z_1^* two years before the policy change and residual bunching at z_1^* and bunching at z_2^* three years after the policy. The time periods below are relative to the policy change.

$\underline{t = -2}$

Bunching at z_1^*

$$(\phi_m + (1-\tau_1))\left(\underline{z}_{10}^{t=-2} - z_1^*\right) - \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_{10}^{t=-2} - z_1^{*1+\frac{1}{e}}\underline{z}_{10}^{t=-1-\frac{1}{e}}\right) - \phi_m = 0 \quad \text{(from Equation (D.9))}$$

$$\underline{z}_{10}^{t=-2} = \left(\frac{1-\tau_0}{1-\tau_1}^e\right) z_1^* - \frac{B_1^{t=-2}}{h_0(z_1^*)^{t=-2}} \quad \text{(from Equation (D.10))}$$

$\underline{t = -1}$

Bunching at z_1^*

$$(\phi_m + (1-\tau_1))\left(\underline{z}_{10}^{t=-1} - z_1^*\right) - \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_{10}^{t=-1} - z_1^{*1+\frac{1}{e}}\underline{z}_{10}^{t=-1-\frac{1}{e}}\right) - \phi_f = 0 \quad \text{(from Equation (D.9))}$$

$$\underline{z}_{10}^{t=-1} = \left(\frac{1-\tau_0}{1-\tau_1}^e\right) z_1^* - \frac{B_1^{t=-1}}{h_0(z_1^*)^{t=-1}} \quad \text{(from Equation (D.10))}$$

$$B_1^{t=-1} = \pi_{-1}B_1 + (1-\pi_{-1})B_1^* \quad \text{(from Equation (8))}$$

$$B_1^* = z_1^*\left(\left(\frac{1-\tau_0}{1-\tau_1}\right)^e - 1\right) h_0(z_1^*)^{t=-2} \quad \text{(from Equation (D.4))}$$

where B_1 denotes the immediate bunching at z_1^* at $t = -2$ when the kink at z_1^* was introduced.

$\underline{t=0}$

Residual bunching at z_1^*

$$(\phi_m-(1-\tau_0))\left(\underline{z}_{11}{}^{t=0}-z_1^*\right)-\frac{1-\tau_0}{1+\frac{1}{e}}\left(z_1^{*1+\frac{1}{e}}\left(\underline{z}_{11}{}^{t=0}\right)^{-\frac{1}{e}}-\underline{z}_{11}{}^{t=0}\right)+\phi_f=0 \quad \text{(from Equation (D.12))}$$

$$\underline{z}_{11}{}^{t=0}=\underline{z}_{10}{}^{t=-1}+\frac{\delta B_1^{t=0}}{h_0(z_1^*)^{t=0}} \quad \text{(from Equation (D.13))}$$

$$B_1^{t=0}=(1-\pi_{-1})\pi_0\left(B_1^*-B_1\right)+\pi_0\left(\underline{z}_{11}{}^{t=0}-\underline{z}_{10}{}^{t=-1}\right)h_0(z_1^*)^{t=0} \quad \text{(from Equation (8))}$$

Bunching at z_2^*

$$(\phi_m+(1-\tau_1))\left(\underline{z}_2^{t=0}-z_2^*\right)-\frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_2^{t=0}-z_2^{*1+\frac{1}{e}}\underline{z}_2^{t=0-\frac{1}{e}}\right)-\phi_f=0 \quad \text{(from Equation (D.15))}$$

$$\underline{z}_2^{t=0}=\left(\frac{1-\tau_0}{1-\tau_1}^e\right)z_2^*-\frac{B_2^{t=0}}{h_0(z_2^*)^{t=0}} \quad \text{(from Equation (D.10))}$$

$\underline{t=1}$

Residual bunching at z_1^*

$$(\phi_m-(1-\tau_0))\left(\underline{z}_{11}{}^{t=1}-z_1^*\right)-\frac{1-\tau_0}{1+\frac{1}{e}}\left(z_1^{*1+\frac{1}{e}}\left(\underline{z}_{11}{}^{t=1}\right)^{-\frac{1}{e}}-\underline{z}_{11}{}^{t=1}\right)+\phi_f=0 \quad \text{(from Equation (D.12))}$$

$$\underline{z}_{11}{}^{t=1}=\underline{z}_{10}{}^{t=0}+\frac{\delta B_1^{t=1}}{h_0(z_1^*)^{t=0}} \quad \text{(from Equation (D.13))}$$

$$B_1^{t=1}=(1-\pi_{-1})\pi_0\pi_1\left(B_1^*-B_1\right)+\pi_0\pi_1\left(\underline{z}_{11}{}^{t=2}-\underline{z}_{10}{}^{t=-2}\right)h_0(z_1^*)^{t=0} \quad \text{(from Equation (8))}$$

Bunching at z_2^*

$$(\phi_m+(1-\tau_1))\left(\underline{z}_2^{t=1}-z_2^*\right)-\frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_2^{t=1}-z_2^{*1+\frac{1}{e}}\left(\underline{z}_2^{t=1}\right)^{-\frac{1}{e}}\right)-\phi_f=0 \quad \text{(from Equation (D.15))}$$

$$\underline{z}_2^{t=1}=\left(\frac{1-\tau_0}{1-\tau_1}^e\right)z_2^*-\frac{B_2^{t=1}}{h_0(z_2^*)^{t=1}} \quad \text{(from Equation (D.16))}$$

$$B_2^{t=1}=\pi_0\pi_1B_2+\left(1-\pi_0\pi_1\right)B_2^* \quad \text{(from Equation (9))}$$

$$B_2^*=z_2^*\left(\left(\frac{1-\tau_0}{1-\tau_1}\right)^e-1\right)h_0(z_2^*)^{t=0} \quad \text{(from Equation (D.4))}$$

$\underline{t=2}$

Residual bunching at z_1^*

$$\left(\phi_m - (1-\tau_0)\right)\left({\underline{z}_{11}}^{t=2} - z_1^*\right) - \frac{1-\tau_0}{1+\frac{1}{e}}\left({z_1^*}^{1+\frac{1}{e}}\left({\underline{z}_{11}}^{t=2}\right)^{-\frac{1}{e}} - {\underline{z}_{11}}^{t=2}\right) + \phi_f = 0 \quad \text{(from Equation (D.12))}$$

$${\underline{z}_{11}}^{t=2} = {\underline{z}_{10}}^{t=1} + \frac{\delta B_1^{t=2}}{h_0(z_1^*)^{t=2}} \quad \text{(from Equation (D.13))}$$

$$B_1^{t=2} = (1-\pi_{-1})\pi_0\pi_1\pi_2\left(B_1^* - B_1\right) + \pi_0\pi_1\pi_2\left({\underline{z}_{11}}^{t=0} - {\underline{z}_{10}}^{t=-2}\right) h_0(z_1^*)^{t=0} \quad \text{(from Equation (8))}$$

Bunching at z_2^*

$$\left(\phi_m + (1-\tau_1)\right)\left(\underline{z}_2^{t=2} - z_2^*\right) - \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_2^{t=2} - {z_2^*}^{1+\frac{1}{e}}\left(\underline{z}_2^{t=2}\right)^{-\frac{1}{e}}\right) - \phi_f = 0 \quad \text{(from Equation (D.15))}$$

$$\underline{z}_2^{t=2} = \left(\frac{1-\tau_0}{1-\tau_1}^{e}\right) z_2^* - \frac{B_2^{t=2}}{h_0(z_2^*)^{t=2}} \quad \text{(from Equation (D.16))}$$

$$B_2^{t=2} = \pi_0\pi_1 B_2 + (1-\pi_0\pi_1)\, B_2^* \quad \text{(from Equation (9))}$$

$$B_2^* = z_2^*\left(\left(\frac{1-\tau_0}{1-\tau_1}\right)^{e} - 1\right) h_0(z_2^*)^{t=0} \quad \text{(from Equation (D.4))}$$

We use the data from two years of pre- and three years of post-policy change from 2006-2007 to 2010-2011 for estimating the dynamic model. We use the method described in Appendix 4.2 for estimating bunching at each kink. We numerically solve the equations specified above to estimate e, ϕ_f, ϕ_m, and the cumulative probabilities of drawing positive cost π_{-2}, $\pi_{-2}\pi_{-1}$, π_0, $\pi_0\pi_1$, $\pi_0\pi_1\pi_2$. The estimates are presented in Table 4.