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Individuals' responsiveness to marginal tax rates: Evidence from bunching in the Australian personal income tax

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Abstract

We examine individuals' responsiveness to marginal tax rates using the universe of Australian taxpayer records from 2000 to 2018. Unlike studies from other countries, we find sharp bunching at all kink points. The estimated Elasticities of Taxable Income (ETI) range from effectively zero for wage earners to 0.23 for self-employed individuals. There is substantial heterogeneity in responses to changes in marginal tax rates across subgroups, with higher elasticities for married females, females with children, younger individuals, and those with greater opportunity to shift income within the household. Our findings suggest that individuals' responsiveness is a function of the marginal tax rates and the tax system's structure and administration.

Keywords: Elasticity of Taxable Income (ETI), bunching, marginal tax rates; taxpayer responsiveness

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1. Introduction

Taxes on personal income generate behavioral responses as individuals attempt to maximize their well-being, and these responses include minimizing their tax burden. The Elasticity of Taxable Income (ETI) measures individuals' behavioral responses to tax rates. ETI is a crucial parameter to inform the optimal design of the tax system. Under certain conditions, the ETI is a sufficient statistic for examining the efficiency (Feldstein (1999) and Chetty (2009)) and optimality **Invalid source specified.** of the tax system. However, ETI is not a structural parameter and is endogenous to the tax system. As a result, ETI estimates from one jurisdiction may not be informative for responses in another jurisdiction, even if they have similar tax rates.

In this paper, we estimate the ETI in Australia.[5] The Australian personal income tax system is progressive, with multiple tax brackets where the marginal tax rate increases as income increases. A few features of the Australian tax system make it an interesting case. First, the tax system is comprehensive and includes all sources of income (labor and capital), minimizing income classification issues under dual or hybrid tax systems. Second, there are no complex interactions between state and federal government taxes since personal income taxes are only levied by the Federal Government. Third, the Australian system is also unique in allowing a wide range of deductions, making it relatively easy for individuals to target a desired taxable income. Finally, the general structure of the Australian tax system has been stable for the last two decades, providing individuals with the opportunity to understand and build knowledge of the system.

A progressive income tax schedule creates kinks in the budget set at income bracket thresholds, where the marginal tax rate below the threshold is lower than the rate above. This creates incentives to locate or “bunch” right below the threshold, creating bunching on the distribution of taxable income at those income thresholds. We use the model of Saez (2010) to explore bunching at the income bracket thresholds to estimate the ETI for different sub-groups and investigate their changes over time.

We use administrative data from the Australian Taxation Office (ATO). The data are a panel of all individuals who lodged a tax return from 2000 to 2018 and has detailed information on individuals’ taxable income, including labor income, capital gains, and

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[5] This paper uses ETI for the estimated elasticity of taxable income. Whenever we need to refer to the structural elasticity of taxable income, we make that clarification.

rental income. The data include primary individual and household demographic information collected on the tax return, including gender, age, occupation, number of children, and marital status.

Our empirical analysis provides five conclusions. First, we find evidence of significant bunching at all income thresholds of the tax schedule.[6] Second, there is a considerable variation in the estimated ETI across different income levels ranging from 0.03 to 0.16.

Third, responses to a change in marginal tax rates for self-employed individuals and taxpayers who employ trusts are higher than for wage and salary earners. This is primarily due to the possibility of shifting the realization of income across time periods and using trust funds to achieve income splitting within and across households.

Fourth, there is significant variation in the responses to changes in the tax system across demographic groups and over time. The estimated ETI are higher for married females, females with children, younger individuals, and those with greater opportunity to shift their income within the household. The ETI falls following a significant change in tax thresholds and then increases over subsequent years, suggesting potential frictions, including updating knowledge and the inability to adjust income in the short run.[7]

Finally, we find suggestive evidence that tax system administration and individuals' awareness of it, in addition to the structure of the tax system, including the marginal tax rates and income thresholds, are essential determinants of the ETI. Following the introduction of the pre-filling of tax returns using data matching in 2008, the estimated ETI declined before increasing and stabilizing in recent years.

The rest of the paper is structured as follows. We first provide some background on estimating taxpayer responsiveness to the tax system and ETIs in particular. We then outline the Australian personal income tax system and the data we use. Finally, we present our empirical analysis and findings and conclude with policy implications.

2. Background

Traditional approaches to estimating the ETI explore variations in tax rates over time

[6] In the US, there is bunching at the tax-free threshold, where there is no evidence of bunching at any other higher kink points, even for the sub-sample of self-employed individuals who are more likely to bunch (Saez, 2010).

[7] Zaresani et al. (2023) estimate the size of the adjustment friction in the Australian tax system.

(Feldstein (1995), Auten and Carroll (1999), Gruber and Saez (2002), Kopczuk (2005), Giertz (2008), Kleven and Schultz (2014), Weber (2014)).[8] This approach suffers from issues related to changes in the tax base (which often occur simultaneously as changes in tax rates), mean reversion, and potential endogeneity of tax rate changes. A bunching ETI estimator avoids some of these issues by only relying on differences in marginal tax rates and the observed bunching at a given threshold.[9]

Slemrod (1985), examining the prevalence of tax avoidance in the US, was one of the first studies to use bunching analysis to study individuals' behavior. MaCurdy et al. (1990) examine bunching in hours worked for males at various kink points in the US tax system. They find no evidence of bunching using survey data. Several early studies examined bunching at thresholds created by means of testing of social security payments. Friedberg (2000) finds bunching around the earnings test rules on elderly individuals in the US. The estimated income and substitution elasticities are relatively large, suggesting that the earnings test generates a significant deadweight loss. Blundell and Hoynes (2004) find evidence of bunching at the minimum hours of work required for the family tax credit in the UK.

Saez (2010) developed the first bunching estimator by exploring an assumed proportional relationship between the elasticity and bunching at a kink. He estimated the elasticity in the US's context of the Earned Income Tax Credit (EITC). This approach has gained considerable popularity in the public finance literature with the availability of high-quality administrative data.

Due to data availability, most ETI analyses have focused on the US and Scandinavian countries, particularly Denmark and Sweden.[10] Chetty et al. (2011) examine the role of optimization frictions in explaining the difference between macro and micro labor supply elasticities in Denmark. Le Maire and Schjerning (2013) build on Saez (2010) and Chetty et al. (2011) to develop a dynamic model to differentiate between labor supply responses and income shifting by Danish individuals. Bastani and Selin (2014) find significant bunching for Swedish wage earners. Outside the US and Scandinavia, Kleven and Waseem (2013) find large and sharp bunching at the

[8] Saez et al. (2012) provide a comprehensive review of the ETI literature, although they concentrate on the traditional cross-sectional and panel data (difference-in-differences) empirical approaches. For a comprehensive review of the bunching literature, see Kleven (2016).
[9] We focus on the observed ETI rather than the structural ETI. See Kleven and Waseem (2013) for more information.
[10] For a comprehensive review of the bunching literature, see Kleven (2016).

notches in the Pakistani personal income tax system.

Research in Australia has been more limited, in large part due to administrate data availability. Chapman and Leigh (2009) examine the effect of notches created by the first loan repayment threshold under Australia's Higher Education Contribution Scheme (HECS).[11] They find small but significant bunching but do not estimate the degree of bunching or the associated ETI. Stavrunova and Yerokhin (2014) and Kang et al. (2015) examine the take-up of private health insurance around the notch created by the Medicare Levy Surcharge.[12] Both studies show graphically significant bunching around the threshold for singles with no children but do not estimate the degree of bunching or income responses. We contribute to this literature by providing estimates of ETI in Australia using the universe of all individuals.

3. Institutional settings and data

3.1. Australian tax system

Australia's income tax is a progressive individual-based system, accounting for 45% of the federal Government's total receipts.[13] Taxable income includes wage earnings, self-employment income, transfer payments, dividends, interest income, capital gains, and rental income. At the same time, most forms of in-kind income (or fringe benefits) are also subject to taxation. The tax system includes all sources of worldwide income, including labor and capital income.

The Australian personal income tax system is comprehensive and includes all sources of income, including labor and capital. This minimizes income classification issues under dual or hybrid tax systems. Only the Federal Government levies personal income taxes; therefore, there are no complex interactions between state and federal governments.

The Australian system is unique in allowing a wide range of deductions accessible to anyone with earned and unearned income. This includes deductions for expenses incurred in earning income, including work-related travel, clothing expenses, interest

[11] The HECS is an income-contingent loan from the Australian Government for tuition fees. The loan repayments are conditional on the borrower's income.
[12] The Medicare Levy Surcharge applies to individuals with income above a threshold that does not hold private health insurance. The surcharge applies to total income, thus resulting in a notch.
[13] While Australia operates an individual-based personal income tax system, some elements of the transfer system are based on household or partner income, such as the Medicare Levy Surcharge and income and asset tests for government benefits.

expenses, and capital depreciation. Deductions are also available for charitable donations, specific retirement savings contributions, and some in-kind income.[14] Allowing for various deductions makes it easier for individuals to target a desired level of taxable income. However, most deductions and offsets are small relative to the top tax threshold. Individuals have potentially more latitude to claim large deductions regarding interest, dividends, and other investment income and for personal superannuation contributions.[15]

As mentioned, the Australian tax system is individual-based, which, combined with its progressivity, allows families to reduce tax liability by transferring income between family members, if at all possible. That is, a single-income family has a higher tax bill than a double-income family with the same total level of private income.

Figure 1 presents the individual tax schedule in 2010, which has five main brackets.[16] The general structure of the Australian tax system has been stable during our study from 2000 to 2018, though there have been some changes to income thresholds. This stability allows individuals to understand and build knowledge of the system.[17]

3.2. Data

We use individual-level administrative tax records collected by the Australian Taxation Office (ATO).[18] This data includes the universe of Australian individuals who lodged a

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[14] The Australian taxation system has only limited quarantining of expenses which also aids in helping individuals minimize their tax burden. For instance, interest expenses on borrowings can be used to offset labor or other forms of income. One exception to this is that capital losses are quarantined and can only be used against capital gains.

[15]A comprehensive list of tax deductions can be obtained by visiting https://www.ato.gov.au/individuals/income-deductions-offsets-and-records/deductions-you-can-claim/.

[16] Table A.1 in Appendix A presents the corresponding marginal tax rates. It is worth noting that the actual effective tax rates can differ from statutory rates due to the phase-out of certain tax offsets or other levies that are not explicitly included in the tax schedule. This includes Medicare Levy and phase-out rate of Low-Income Tax Offset. There are also a few temporary levies, including the flood levy and the budget repair levy. The flood levy was applied in 2012 only and was set at a rate of 0.5% for each dollar earned between $50,000 and $100,000 and 1% for each dollar above $100,000. The budget repair levy applied from 2014 to 2017 and was set at 2% for each dollar earned above $180,000.

[17] Australia, unlike many other countries, does not levy social security contributions. States levy proportional payroll taxes based on a firm's wage bill, which often depends on the number of employees. These payroll taxes tend to have high tax-free thresholds, and rates and rules vary across states. These payroll taxes were constant in our study sample. Australia introduced a 10% value-added tax on 1 July 2000. The rate and base of this VAT have been constant since its introduction. The effective VAT tax rate is lower than the statutory rate of 10% due to several exemptions, including the consumption of food, education, and health services and the input taxation of financial services.

[18]For more information about “ATO Longitudinal Information Files: Individuals” (*Alife: Individuals*), see Abhayaratna et al. (2022). Whereas the ALife data is a 10% sample of data, we use the entire universe

tax return from 2000 to 2018. The dataset has individual demographics collected on tax filers, including gender, age, and marital status.

Our study sample includes working-age (20-65 years) individuals living in Australia from 2000 to 2018.[19] We exclude individuals who report receiving a government pension or allowance due to limitations of the data regarding their withdrawal rates.[20] Our sample size is over 189 million observations across all years.

The primary advantage of using administrative data for bunching estimation is its accuracy. It is less prone to measurement error than survey data and is less likely to have non-responses or rounding errors. Our large sample size (189 million observations) is a further advantage of our dataset compared to that used in similar studies. As a result, we do not have to aggregate data over multiple years. Aggregation creates several problems. First, the bunching behavior is triggered only once, but the bunching individual is observed more than once. This results in overestimates of bunching and the corresponding ETI. Second, there are inherent difficulties in combining individuals across years when the thresholds have not been maintained in real terms or where the tax rates have changed over time. A minor limitation of our dataset is that it does not include individuals who are exempt from lodging taxes due to low income or who do not comply with their lodgement obligations.[21]

For the rest of this paper, we present the summary statistics, figures, and tables for the year 2010 (the middle point of our study period), and we present them for the rest of the years in the Appendix. Table 1 provides descriptive statistics for 2010. The average taxable income is $52,000, where 30% meet our definition of self-employed (see section 4.2.2 below). The average taxable income of wage and salary earners and the self-employed is similar. However, average deductions are higher for the self-employed than for wage and salary earners ($3,280 versus $2,350). The average age is 40, where the self-employed are slightly older than the wage and salary earners (45 versus 39 years). Self-employed individuals are also more likely to have a spouse and

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of records in our analysis. The construction and structure of the data are described in Abhayaratna et al. (2022).

[19] The tax schedule for non-resident individuals differs, and a special arrangement is applied to Australians earning labor income overseas.

[20] These payments are means-tested, and the actual effective tax rate faced by the taxpayer (marginal tax rate and withdrawal rate of benefits) may be understated in our analysis. The individuals may also respond to social security thresholds near the tax thresholds that we study.

[21] This does not affect our analysis since most of the non-lodging individuals are low-income and fall out of the scope of this analysis. Compliance in Australia with the tax system is very high.

have more children, consistent with being older. The summary statistics for other years are provided in Appendix C and paint a similar picture.

4. Empirical analysis

We use the bunching estimation method of Saez (2010) combined with Chetty et al. (2011) to estimate the ETI with respect to the net-of-tax rate at the kinks at the personal income tax bracket thresholds. Saez's (2010) model is based on an assumed proportional relationship between the elasticity and bunching at a kink. Bunching at a kink is estimated by comparing the mass of individuals on the distribution of taxable income at the kink point with an estimated counterfactual distribution that would hold in the absence of the kink.

We use the approach of Chetty et al. (2011) to estimate a counterfactual distribution of taxable income. We aggregate the data into taxable income bins and fit a polynomial to the observed distribution, excluding the bins at the bunching window, determined by an eyeball test.[22] The identifying assumption is that the counterfactual distribution would have been smooth in the absence of the kink. We use a bin size of $100 and choose the degree of the polynomial by estimating linear to degree 10 polynomials and then choosing the degree that provides the best fit based on the Akaike Information Criterion (AIC).[23] Our results are not sensitive to the choice of the polynomial. If we look at points in the distribution that have tax rate changes in some years but not others, the distribution is smooth in the absence of the kink providing further justification for our identification approach.

4.1. Estimation of the bunching model

Individuals can respond to the tax system in several ways. Feldstein (1995) proposed the ETI to capture the combined effect of the various responses to changes in marginal tax rates. The ETI is defined as the response of taxable income, z, to variations in the net-of-tax rate (1-τ).[24]

$$\varepsilon(z) = -\frac{\Delta z}{z} / \frac{\Delta \tau}{(1-\tau)} \qquad \textbf{(1)}$$

We use the methodology proposed by Saez (2010) and Chetty et al. (2011) to

[22] We check the robustness of our estimates to the selected bunching window in Appendix G.
[23] Chetty et al. (2011) arbitrarily use a degree 7 polynomial but note that some of their results were sensitive to the choice of the polynomial.
[24] This section closely follows Saez (2010), Bastani and Salin (2014), and Kleven (2016).

analyze the degree of bunching and the ETI at kink points in the tax schedule. We begin with a standard two-good labor supply model under which an individual maximizes a deterministic utility function, $U(c, z)$, where c is disposable income (or consumption) and z is taxable income. $U(c, z)$ is increasing in its first argument and decreasing in its second argument. Those assumptions reflect that consumption is a good and increases utility, but working is a bad and decreases utility. Since we assume constant wages, the only way to increase taxable income is through an increase in hours of work.

The utility function is maximized subject to a quasi-linear budget constraint given by $c = z - T(z)$, where $T(z)$ is the income tax schedule. First, let us consider the case whereby all individuals face a constant proportional tax rate, such as $T(z) = \tau_1 z$. Before the reform, assume individuals' taxable income z is distributed according to the smooth density function $h_0(z)$, with heterogeneity in taxable income as a function of preferences and ability.

Let us assume that a reform is introduced such that the tax rate applying to all income above some point z^* is $\tau_2 > \tau_1$. Therefore, an individual's tax liability when their taxable income is greater than z^* is given by $T(z) = \tau_1 z^* + \tau_2(z - z^*)$, while for individuals below the kink, their tax liability remains unchanged: $T(z) = \tau_1 z$. Under this tax reform, each taxpayer's budget constraint will be convex. Individuals above the kink point, z^*, will want to reduce their taxable income because the tax rate above the kink is now higher. Once their taxable income is reduced to the kink z^*, there would be no incentive to reduce their taxable income further, as the tax rate below the kink is the same as that faced before the reform.

Assuming, for simplicity, all individuals have the same elasticity, all individuals above the kink will reduce their taxable income. However, only those with incomes between z^* and $z^* + \Delta z^*$ will reduce their taxable income to the kink point. Hence under these assumptions, the reform would result in a mass of individuals (B) who bunch precisely at the kink point z^*. B is given by (Bastani and Selin, 2014):

$$B = \int_{z^*}^{z^* + \Delta z^*} h_0(z)\, dz = h_0(\zeta)\, \Delta z \qquad \textbf{(2)}$$

for some $\zeta \in [z^*, z^* + \Delta z]$. This sharp bunching or mass at the kink point can be used to identify the ETI directly.

Substituting equation 2 into 1 and rearranging gives:

$$\tilde{\varepsilon}(z^*) = -\frac{B}{z\, h_0(\zeta)\, \frac{\Delta\tau}{(1-\tau)}} \quad \textbf{(3)}$$

In the case of a slight increase in the tax rate for incomes above z^* (that is where $\Delta\tau = d\tau$ and $\Delta z = dz$), $\zeta \rightarrow z^*$ the ETI is given by:

$$\lim_{\Delta\tau, \Delta z \rightarrow 0} \tilde{\varepsilon}(z^*) = \varepsilon(z^*) = -\frac{B}{z^*\, h_0(z^*) \log\left(\frac{\tau}{(1-\tau)}\right)} \quad \textbf{(4)}$$

As we focus on the behavior of individuals in response to small changes in the tax rate around the kink point, bunching is driven by changes in the marginal tax rate with essentially no change in average tax rates. Therefore, there are no income effects, and ε is thus the compensated ETI. From equation 4, we can also see the ETI, ε, around the kink point, is directly proportional to the number of individuals who bunch there, or the relative bunching, b, which is defined as:

$$b = \frac{B}{h_0(z^*)}. \quad \textbf{(5)}$$

4.1.1. Empirical approach

Now we proceed to estimate equation 5. Note that we directly observe both the tax rate τ and the kink point z^*, but we cannot observe the bunching, b, of individuals around the kink point. Ideally, we would measure the bunching by comparing the mass of individuals at the kink point with the counterfactual, h_0, of the mass of individuals in the absence of the kink, but we cannot observe that counterfactual distribution. We then need to construct a counterfactual distribution, which we will denote $\widehat{\text{as } h_0}$.

It is helpful to separate the density into three regions. The first region is the small bunching window $[z^* - \Delta_L, z^* + \Delta_H]$ for small values of Δ_L and Δ_H. Imperfect bunching occurs in this window and has a mean density h^* and cumulative density H^*. The other two regions are used to estimate the counterfactual density and lie to the left and right of the small bunching window. All three together represent the wide bunching window. These regions are given by: $\left[z^* - \Delta_L - \Delta_a, z^* - \Delta_L\right]$, which is to the left of the small bunching window and has a density of h_L and cumulative density of H_L; and $[z^* + \Delta_H, z^* + \Delta_H + \Delta_b]$, which is to the right of the small bunching window and has a density h_H and a cumulative density of H_H.

We can use the number of individuals in the two regions that lie to either side of the bunching window to infer the counterfactual distribution around the kink.

We use the approach in Chetty et al. (2011) and estimate the counterfactual distribution non-parametrically methods. We fit a polynomial to the income distribution, omitting the small bunching region around the kink.[25]

The procedure we take to estimate the counterfactual distribution is as follows. First, we group individuals into small earnings bins (Z_j) of \$100, indexed by j, centered around the kink point. Next, we identify and check the wide bunching window. We plot and inspect a histogram of all bins Z_j. We are looking for an income range that does not include significant bunching for other kinks or notches in the tax schedule. In addition, we also require a window that contains enough bins to allow us to estimate the counterfactual distribution when the 'small bunching window' is excluded.[26] The final step is determining the small bunching window, $[z_L, z_H]$, by visually inspecting the histogram Z_j. We determine this window as the range around the kink where individuals are observed to bunch. After the small bunching window is determined, the counterfactual distribution can be obtained from the following regression:

$$c_j = \sum_{i=0}^{p} \psi_i (z_j)^i + \sum_{i=z_L}^{z_H} \gamma_i \mathbf{1}[z_j = i] + \eta_j \qquad \textbf{(6)}$$

where c_j is the number of individuals in bin j; z_j is the mid-point of the earnings level of bin j; p is the polynomial order. ψ_i and γ_i are regression parameters. The excess number of individuals who bunch around the kink point is then calculated as the difference between the actual and predicted densities around the small bunching window:

$$\widehat{B} = \sum_{i=z_L}^{z_H} (c_j - \hat{c}_j) \qquad \textbf{(7)}$$

We then normalize this by the average counterfactual density around the small bunching window to derive our empirical estimate of $\widehat{b}$:

$$\widehat{b} = \frac{\widehat{B}}{\sum_{i=z_L}^{z_H} (\hat{c}_j/(z_H - z_l + 1))} \qquad \textbf{(8)}$$

We estimate standard errors using nonparametric bootstrap. Under this approach,

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[25] We choose the degree of the polynomial by estimating linear to 10th-order polynomials and choose the degree that provides the best fit based on the Akaike Information Criterion (AIC).
[26] In all cases, unless otherwise indicated, the large bunching window is $[Z_{-75}, Z_{75}]$.

we generate earnings distributions (and associated estimates for each variable) by randomly resampling the residuals η_j from equation 6.

Robustness tests are located in Appendices G and H. These include ensuring the kinks examined are local, examining the distributions before and after-tax changes, and undertaking sensitivity analysis on some key parameters.[27]

4.2. Graphical evidence

Figure 2 plots the distribution of taxable income in 2010. There is quite a sharp bunching at the four primary income tax thresholds (see Figure 1 and Table A.1). There are a few other notable points at which we also observe bunching. First, the first bin includes individuals with zero (or negative) taxable income. Second, the upper limit of the tax-free threshold ($6,000). This bunching is counter-intuitive and may reflect individuals' imperfect knowledge about the tax system at the lower end of the income distribution.

Third, there is bunching at the Low-Income Tax Offset (LITO), which effectively increases the tax-free threshold. In 2010, the LITO could offset up to $1,350 in tax, resulting in an effective tax-free threshold of $15,000, refunded at the end of the year. Fourth, there is bunching at the Medicare Levy Surcharge (MLS) threshold for single individuals. MLS applies to individuals with income above a threshold who did not have an eligible private health insurance plan during the corresponding tax year. The surcharge applies to total income, creating a rare notch in the system.

Appendix D presents the distribution of taxable income from 2000 to 2018. The general findings are similar to those from 2010, where there is bunching at all four main kinks. Inspection of the figures across all years suggests three facts. First, the distribution of taxable income is smooth in the absence of a kink. Second, individuals know the tax schedule, where bunching moves to the new kink as the bracket thresholds adjust over time. Third, when a threshold is adjusted, bunching at the old kink dissipates, and the income distribution returns to being smooth after a few years. An example of these patterns is highlighted in Figure 3. It plots the distribution of taxable income around the top kink in 2008 and 2009, where the top kink was

[27] For example, robustness checks for the size of the narrow and large bunching window and an alternative approach to determining the counterfactual using a prior year distribution are presented in the Appendix.

increased from $150,000 to $180,000. There is bunching at the top kink at $150,000 in 2008, and the distribution at $180,000 is smooth. Following the increase in the new kink at $180,000 the following year, bunching at the old kink at $150,000 dissipates, while there is now visible bunching at the new kink at $180,000.[28]

4.3. Estimated bunching and ETI

4.3.1. All individuals

Figure 4 plots the distribution of taxable income at four kinks of the tax schedule in 2010. The x-axis denotes normalized taxable income, adjusted so that the kink is at zero. Standard errors are estimated using a nonparametric bootstrapping approach. Appendix E presents the corresponding figures and estimates for the other years.[29]

In contrast with studies from other countries, we find significant bunching at all four kinks.[30] The bunching is also skewed to the left of the threshold. While the rationale for this behavior is unclear, we suspect some individuals might mistake kinks for notches and may believe the threshold produces a change in the average tax rate. They perceive there are benefits from locating below the threshold. It may also be that individuals can only imperfectly adjust their income, and they may prefer to err on the side of over-adjusting.

Figure 4 also presents the estimated bunching and the ETI at the kinks. Starting with the top kink, the estimated bunching is 18.81, suggesting that the number of people bunching at the top kink is 1,880% of the height of the counterfactual distribution at the kink. The estimated corresponding ETI is 0.085, suggesting that for a 10% increase in the net-of-tax rate, taxable income would fall by 0.85%. While the change in the net-of-tax rate at the top kink is generally the smallest of the thresholds in the Australian personal income tax system (39.5% to 46.5% in 2010, see Table A.1 in Appendix A for other years) and very small compared to other top thresholds

[28] Figure 3 shows a residual bunching at the old kink due to the frictions that prevent some individuals from adjusting their income following the change in the top threshold. See Zaresani et al. (2023) for a model estimating the ETI accounting for adjustment costs.

[29] Estimates of bunching and ETI are not presented for years where there is another kink or notch close to the kink, and as a result, the income distribution, excluding a small bunching range, is not smooth. For example, the Medicare Levy Surcharge (MLS) threshold is close to the second kink in many years and overlaps with the top kink in 2000. See Appendix H for more information.

[30] Saez (2010) finds evidence of bunching only at the first threshold in the US tax system. He suggests that this may reflect greater flexibility in work choices for individuals around this threshold and that the tax system at this point is likely to be less complex.

examined for other countries, the behavioral response is comparable to those found in other studies. A possible explanation is that bunching individuals at the top kink have more scope to adjust their taxable income. For example, transferring income to low-income spouses or children through trust structures or greater capacity to save income through concessionally taxed superannuation contributions. It may also reflect a higher proportion of "self-employed" individuals who can adjust their income more than wage and salary earners.

Figure 4 shows that bunching at the third kink is 5.47, and the corresponding estimated ETI is 0.065. The estimates for the second kink are 2.03 and 0.028. The first kink is the effective tax-free threshold plus the tax offset provided by the Low-Income Tax Offset (taxable income of $15,000 in 2010). The estimated bunching and the corresponding ETI are 3.78 and 0.15. The ETI at the effective tax-free threshold is higher than the others. This may reflect the likelihood that individuals at this threshold are part-time or casual workers or secondary income earners and might be more responsive to changes in their after-tax income.

One potential problem affecting the estimates around the effective tax-free threshold is that individuals below the threshold may not be required to lodge a return. As a result, the distribution to the left of the threshold, which is used to estimate the counterfactual, may be biased. We focus on the second, third, and top kinks for the remainder of the paper.

4.3.2. Wage and salary earners and self-employed individuals

Findings from previous studies suggest that self-employed individuals are more likely to bunch at a kink than wage and salary earners (see Saez (2010) for the US, Chetty et al. (2011) for Denmark, Kleven, and Waseem (2013) for Pakistan and Bastani and Selin (2014) for Sweden). It might be easier for them to adjust their taxable income and locate at a kink. They will likely have more scope to choose the number of hours they work. They also have less third-party reporting, so they may have more opportunity to avoid or evade taxes, including a greater ability to shift the timing of when income is realized or engage in the 'cash' economy.

The Australian tax administration system and tax returns do not allow us to readily identify self-employed individuals. We construct a proxy variable to indicate whether an individual may be self-employed based on their income type. We classify individuals as “self-employed” if they report business income (or losses), net trust or partnership income, or have dividends greater than 20% of their wages and salary income. Throughout the paper, this is the group to whom we are referring when we use the term "self-employed." See Appendix F for more details and sensitivity analysis with respect to an alternative definition of self-employed.

Figure 5 presents the distribution of taxable income in 2010 and the estimated bunching and ETI at four kinks separately for wage and salary earners in Panel (a) and self-employed individuals in Panel (b). As expected, the estimated bunching and ETI for self-employed individuals are larger than those for those who only earn wages and salaries. However, in contrast to studies from other countries, we find significant bunching for wage and salary earners at all kinks, even where the change in the net of the tax rate is relativity small.

At the top kink, the estimated bunching for self-employed individuals is 33.67, almost double the baseline estimate for all individuals. The corresponding estimated ETI is 0.152. The corresponding estimates for the wage and salary earners are 1.88 and 0.009. We find a similar pattern at the second and third kinks. The estimated bunching for self-employed individuals at the third kink is 22.66, over three times the baseline estimates for all individuals. The corresponding estimated ETI is 0.228. The corresponding estimates for wage and salary earners are 0.89 and 0.009. At the second kink, the estimated bunching for self-employed individuals is 6.14 compared to 0.72 for wage and salary earners. The corresponding observed elasticities are 0.084 and 0.01, respectively.

The ETI is not a structural parameter and depends on the tax system's underlying features (Saez et al., 2012). Features of the Australian tax system might explain the differences in our findings relative to studies from other countries. The Australian tax system provides individuals more scope to adjust their taxable income. Deductions are itemized and available for most work-related expenditures and specific contributions to superannuation accounts.[31] Documentation requirements for deductions are low. For example, individuals can claim up to $300 of work-related clothing expenses with

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[31]The main deduction from taxable income in Denmark is contributions to retirement savings accounts, while in the US, individuals can take a standard deduction. In comparison with the US tax system, which is probably the most comparable to Australia’s, our finding of clear evidence of bunching at all thresholds contrasts with the finding of Saez (2010). Our results suggest that the Australian tax system is more salient or that Australian individuals are more knowledgeable about the tax system.

no documentation. Investment expenditures are not ring-fenced, so individuals can claim interest expenses against income from other sources, such as wage and salary income. Corporate and trust structures allow individuals even more flexibility and additional forms of deductions to target their income better and thus reduce their tax liabilities. There is also significant scope to move income across years or split income with other individuals. For example, individuals can utilize discretionary trusts to direct some forms of income to lower-income relatives and beneficiaries. This may also help explain why the distribution around the thresholds is typically skewed to the left of the kink.

4.3.3. Males and females

It is believed that females are more responsive to taxes since they are more likely to be the secondary earner in a household. Labor supply elasticities for married women are generally found to be much higher than those for married men or single women (Breunig, Cobb-Clark, and Gong (2008)). To investigate this in the Australian tax context, we break down our sample by gender. Figure 6 presents the distribution of taxable income in 2010 and the estimated bunching and ETI at the top three kinks broken for wage and salary earners in Panel (a) and self-employed individuals in Panel (b), broken down by gender.[32]

Figure 6 shows that while there is quite a small bunching at all kinks for wage and salary earners, there are no stark differences between males and females where the estimated ETI is zero. However, there is a sharp bunching at all kinks for "self-employed" males and females. The estimated bunching and ETI for females are larger than the estimates for males, suggesting that females are more responsive than males. While the largest estimated bunching is at the top kink (45.41 for females versus 26.22 for males), the largest estimated ETI is at the third kink (0.284 for females versus 0.182 for males). The larger estimates of ETI at the third kink could be due to the larger change in the marginal tax rates (see Table A.1 in Appendix A).

It is important that our definition of self-employed includes people who receive income from trust distributions. Women may be receiving trust distributions from family-controlled trusts, and the amount distributed in each year is quite flexible and can be

[32] We use the universe of Australian taxpayers; therefore, the size of the dataset allows us to examine subgroups.

targeted to remain below key threshold points in the income distribution.

In Figure 7, we extend our analysis to examine the differences between married females and single males.[33] These two demographic groups are frequently found to be the most responsive to tax rates. Married females are more responsive to the changes in marginal tax rates than single men. Table 2 presents the estimated bunching and ETI for females broken down by the number of children for wage and salary earners and self-employed individuals. The higher the number of children, the greater the responsiveness. Again, this may reflect behavior related to the trust funds. While there are limits on the amount of money that can be distributed to minor children from a discretionary trust, having more children provides more scope for distributions.

4.3.4. Age groups

Younger individuals are more likely to be risk-taking and have a lower attachment to the labor force. Therefore, they might be more aggressive in their tax planning arrangements.[34]

Figure 8 plots the estimated ETI for wage and salary earners and self-employed individuals by age group and gender.[35] The dashed line presents the 95% confidence intervals estimated using a bootstrapping procedure. For all age groups, the estimates for wage and salary earners are close to zero and significantly smaller than that for the self-employed.

The estimated ETI for younger self-employed individuals is the highest. This could be due to income splitting from other household members who are trying to minimize their tax liability. For instance, a small business owner (parent) may distribute profits using a discretionary trust to family members up to the point at which marginal tax rates across family members are equalized (see Section 5).

For self-employed individuals, we also find that the estimated ETI is higher for females than males. If young children or infirm people are present in the household,

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[33] We use the data from 2013 instead of 2010 since the martial status label on the tax return was not compulsory from 2005 to 2012, and the reliability is limited. Due to the interaction with the Medicare Levy Surcharge, we cannot examine the third kink for single males in 2013. However, in 2014 we found the ETI for married female wage earners is 0.025, while the elasticity for single male wage earners is 0.008.

[34] Braithwaite et al. (2006) find that younger individuals are more likely to admit that they do not declare all income, work in the cash economy, and over-claim deductions.

[35] We use five age groups: 18-24, 25-34, 35-44, 45-54, and 55-64 years old.

younger females may undertake non-paid caring roles instead of market work, and the observed difference may reflect this reduced workforce attachment. The difference between females and males closes for older individuals.

4.3.5. Time trends

We examine variations in taxpayer responses to changes in marginal tax rates over our study sample from 2000 to 2018. The Australian tax system offers a few advantages in this regard. First, the second kink has remained relatively constant in real terms over our study period, with the changes in the threshold broadly offsetting inflation. Second, the top tax rate has gone through periods where the threshold was increased substantially, and therefore the threshold is likely to apply to different groups of individuals at different points in time, allowing us to examine how individuals respond to changes in thresholds and how they learn over time.

Figure 9 plots the estimated ETI over time for all individuals, wage and salary earners, and self-employed individuals. The first panel shows the estimates at the second kink. The estimated ETI for all three groups trended downward until 2012 and trended upward afterward. This is because the second kink threshold gradually increased each year and has been relatively stable since then, providing individuals with time to become aware of the threshold and adjust their taxable income.[36]

The second panel of Figure 9 plots the estimated ETI at the top kink. The ETI increases from 2000 to 2008. During this period, the top threshold increased from around 1.4 times average earnings to 2.5 times average earnings (OECD, 2016). This trend may reflect that individuals higher up the income distribution have a greater opportunity to reduce their tax liability. Therefore, as the real value of the threshold increased over the period, the behavioral response around the threshold also increased. This is consistent with our earlier finding of greater bunching evidence at the top threshold, despite the smaller change in the net tax rate at that point. The ETI falls between 2000 to 2012, which could be due to the increase in ATO's data matching and validation, leading to enhanced compliance capabilities.[37]

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[36] The second kink increased from $21,600 in 2006 to $37,000 prior to 2012.

[37] The ATO introduced an extensive pre-filling tax return system for tax agents and self-preparers in 2008. Certain income items, including dividends and bank interest, are pre-filled in taxpayers' tax returns. While the taxpayer can override these values, such initiatives are likely to have reduced the scope for individuals to evade tax by underreporting these types of income. Lastly, it is also possible

The estimated ETI is broken down by age and gender for wage and salary earners and self-employed individuals at the second and top kinks, respectively, in Figure 9 and Figure 10. The figures suggest that the trends across the age groups follow a similar pattern to the overall results presented above. One difference is that for individuals aged between 55 to 64, we find an increase in the estimated ETI for both males and females in 2006 and the following few years. This corresponds to when concessional taxation arrangements were introduced for individuals approaching retirement, increasing incentives to reduce taxable income by contributing more income to superannuation.[38] For other individuals, the ETI is generally flat or falling over this period.

5. How do individuals bunch?

5.1. How do self-employed individuals bunch?

The estimated ETI for self-employed individuals is larger than for wage and salary earners. This section examines the possible drivers of bunching behavior and whether it is due to a real response, such as reducing labor supply, or instead to tax minimisation efforts.

Our data prevent us from exploring some hypotheses. For wage and salary income, we only observe annual earnings. We do not observe hours worked nor do we know whether people are paid an hourly wage as opposed to an annual salary. We are thus unable to say much about the effect on the ETI of people adjusting the number of hours worked. While we know the actual number and amount of deductions that individuals take, we cannot observe which individuals have more ability to use deductions to adjust their taxable income. A recent working paper, Breunig, Deutscher and Hamilton (2022), shows refund bunching at positive and salient values consistent with individuals and their tax agents using deductions to target round number tax refund

that because the thresholds have not been adjusted since 2009, the real value of the thresholds has fallen, and consequently, the threshold increasingly applies to individuals who have less capacity to adjust their income. See ATO (2015, p.45) and ATO (2011, p.100).

[38] Under the arrangements, individuals approaching retirement age could access their superannuation savings to top up their income (for example, if they chose to work less). However, they could also 'recycle' their income by making pre-tax contributions from their taxable income back into their superannuation savings, effectively reducing the marginal tax rate faced on some of their taxable income to 15%. In the first few years, there were no limits on the amount of income that could be recycled into super. Contribution limits were introduced in 2009. Today, individuals can contribute up to $27,500 into their superannuation funds at the reduced tax rate.

amounts.

Our definition of “self-employed” incorporates individuals who are receiving substantial amounts of their income from businesses, partnerships, investments or trusts. This definition is chosen on the basis that these individuals have the greatest opportunity to manipulate their taxable income. Businesses and partnerships have some discretion in terms of invoicing which allows them to bring forward income into a financial year or push income forward into a future financial year.

Trusts are extremely popular and widely used in Australia. There are nearly 1 million private trusts in Australia and the number of trust returns that are filed is nearly equal to the number of company tax returns that are filed—see Australian Taxation Office (2023). Most trusts in Australia are discretionary trusts which give great leeway to the trustee to determine how income is distributed to beneficiaries. Beneficiaries can be varied over time and do not have a fixed entitlement in trust funds so distributions can be timed to minimise tax consequences—see Evans (2019).

One common method of minimizing tax burden through a trust is for high-income individuals to direct income into the trust, perhaps by embedding a business in the trust. Income can then be distributed out of the trust to individuals on lower marginal tax rates. Such individuals could include spouses or children or elderly relatives on low or zero marginal tax rates. A recent article in the Australian Financial Review highlights that “The $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”.[39] See also Sainsbury and Breunig (2020) who discuss some of the easier ways in which trusts can be used to shift income to low marginal tax rate individuals or forward in time.

To provide further context around the bunching behaviour, we provide some figures that exclude deductions and trust income from net taxable income. We use the *ALife:Individuals* file described in footnote 18 above (see also Abhayaratna et al. (2022)). We create a “gross taxable income” variable which excludes trust income and which adds deductions back into income. Table I.1 in Appendix I provides descriptive

[39] *Australian Financial Review,* 1 February 2023. https://www.afr.com/wealth/personal-finance/ato-turns-screws-on-popular-trusts-amid-tax-evasion-claims-20230130-p5cghb

statistics for this exercise.[40]

Figure I.1 in Appendix I plots the distribution of net taxable income and our "gross taxable income" measure around the third and fourth kinks in 2010 for self-employed individuals who received income from a trust distribution.[41] The first panel of the figure shows that there is sharp bunching at both kinks ($80,000 and $180,000) in the distribution of net taxable income. The second panel shows that bunching disappears once deductions are added back into income and trust income is excluded. While this "gross taxable income" measure does not provide a compelling counter-factual for what people's income would look like in the absence of deductions or trusts, the figures suggest that trust income and deductions are playing important roles in tax minimization and in generating the observed bunching behaviour.

Table 3 presents the estimated bunching and ETI for self-employed individuals in 2010 at the third and top kinks, broken down by trust income status. More than 80% of self-employed individuals received income from a trust distribution, with the share of individuals receiving a trust distribution increasing with taxable income.[42] The estimated bunching is higher for those with trust income. The estimated bunching is much higher for those with a spouse and children, suggesting that trusts are used to split income with lower-income individuals in the same household. Note that trust income can also be distributed to individuals outside the household.

These findings, taken together, reflect that the responses are primarily driven by tax minimization efforts rather than a labor supply response.

We also find significant bunching for self-employed individuals without trust income. This might be due to other opportunities for reducing the taxable, such as holding income in corporate structures (corporate tax in Australia is 30% and 25% for small and medium businesses, respectively), deferring income to other years, and bringing forward expenses.

[40] This analysis was added at the request of a referee and we use the *ALife:Individuals* file, which is a 10 per cent sample, rather than the full data for this exercise. We were not able to access the full data in the time frame available to produce this analysis.

[41] Table I.1 presents the summary statistics for the sample used for plotting Figure I.1. We used a random 10% sample of data for the analysis (from the Australian Taxation Office's ALife data) rather than the full 100% file of tax return data which is used in the rest of the paper. Hence, we have put these results into an appendix.

[42] The dataset does not allow us to identify individuals who may utilize a trust without receiving a distribution. Therefore, we use individuals who received a distribution from a trust in the income year as a proxy. The data also does not allow us to distinguish between different types of trusts.

5.2. Why do wage and salary earners not bunch much?

We find evidence of a small amount of bunching for wage and salary earners at all kinks, but the corresponding estimated ETIs are fairly small. Adjustment costs might cause this due to the constraints on wage and salary earners' ability to change their labor supply or inattention biases (Chetty, 2012; Kleven and Waseem, 2013).[43] Adjustment costs result in differences between our estimated elasticities and the true structural elasticity and might explain the lower estimated ETI for wage and salary earners (Chetty, 2012).

We provide evidence that wage and salary earners face adjustment costs by exploring the changes to the top kink in 2009, where the kink was increased to \$180,000 from \$150,000. Figure 3 plots the distribution of taxable income around the top kink in 2008 and 2009. There are three groups of interest. First, individuals *below the bunching window in 2008* faced no change in their marginal tax rate; therefore, we would not expect them to adjust their income. Second, individuals previously *above the bunching window in 2008* (but below the new threshold) faced a reduction in their marginal tax rate, so we would expect a behavioral response from them but to remain above the 2008 bunching window, with proportionally more moving to the new window. Lastly, individuals who were *at the 2008 bunching* window before the change. These individuals are a mix of individuals from the previous two groups, and we expect a response somewhere between the previous two groups.

Table 4 presents the responses from the three groups above broken down for wage and salary earners and self-employed individuals. There are three main findings. First, the proportion of wage and salary earners who were below, above, or at the bunching window was similar across all three groups. Second, there is a smaller proportion of self-employed individuals at or below the bunching window who were previously above the bunching window. Third, many self-employed individuals in the old bunching window moved to the new bunching window. This is over five times more than comparable wage and salary earners and higher than any other group. This result indicates that, while bunching is more prevalent by self-employed individuals, it is primarily driven by a small subset with significant control over their taxable income.

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[43] Unlike notches that have a strictly dominated region, identifying frictions in a kink setting requires a more elaborate framework, see Zaresani et al., 2023.

Table 5 presents the responses immediately after the increase in the top kink. The table presents the proportion of individuals who were below, at, or above the 2009 bunching window from 2008 to 2018 for all individuals who had taxable income in the bunching window in 2009. In 2008, the year before the change in the top kink, the proportion of individuals whose taxable income was above, in, or below the 2009 bunching window was similar across the wage and salary earner and self-employed individuals. Around 76% of wage and salary individuals and 78% of self-employed individuals were below the bunching window, only 2% of wage and salary individuals and 1% of self-employed individuals had taxable income in the bunching window, 18% of both wage and salary and self-employed individuals had incomes above the 2009 bunching window.

Table 5 shows that in 2010, one year after the change in the top kink, only 5% of salary and wage earners in the bunching window in 2009 remained, whereas over 20% of the self-employed individuals remained in the bunching window. Even after nine years, in 2018, about 6% of self-employed individuals remained in the bunching window, while the proportion of wage and salary earners in the bunching window returned to the pre-change levels of 2008 within four years.

Table 5 provides two main conclusions. First, wage and salary earners face greater constraints in adjusting their taxable income. Second, self-employed individuals have greater opportunities to adjust their taxable income, and they might be able to adjust their taxable income downwards from areas well above the observed bunching window.[44]

5.2.1. Bounds of the structural elasticity

The presence of adjustment costs would create a wedge between the estimated ETI and the true structural elasticity. We use the method of Chetty (2012) to estimate bounds for the true structural elasticity while remaining agnostic about the structure of the adjustment costs. The bounds are functions of the estimated ETI, the size of the change in the marginal tax rate, and a friction parameter defined as the utility cost of

[44] This presents a real-world example of the difficulties in estimating the counterfactual, as highlighted by Blomquist et al. (2021), with the possibility of individuals adjusting their income from well outside the bunching window. However, the number of individuals with such significant extensive responses is small.

not responding to the tax change as a percentage of net--tax earnings. Details of the model are presented in Appendix B.

Table 6 presents the estimated bounds on the ETI estimates for wage and salary earners at the top three kinks. We estimate the model at each kink for three levels of friction parameters at 1%, 0.1%, and 0.05%.[45] The estimated bounds are pretty wide, particularly for the 1% parameter, the lower bounds are effectively zero, and the upper bounds are above one and above 4 for the third and fourth kinks. However, the upper bound for smaller parameters at 0.1% and 0.05% presents plausible estimates for the structural elasticity, similar to the estimates found for self-employed individuals.

6. Conclusion and policy implications

We examine bunching behavior in the Australian personal income tax system using the universe of Australian personal filers from 2000 to 2018. Unlike previous studies for other countries, we find evidence of significant bunching at all kinks and across most income years. We find significant variation in the ETI across the different kinks, with the estimated ETI for all individuals ranging from 0.03 to 0.15.

The largest response is at the kink point created at the end of the effective tax-free threshold, where tax starts to be paid. In line with previous studies, we find that the responses to changes in marginal tax rates are significantly higher for self-employed individuals compared to wage and salary earners. We find that the ETI for self-employed individuals is greater than 0.08 and as high as 0.228, while the elasticity for wage and salary earners is effectively zero. Our definition of self-employed incorporates those who receive business or trust income or who receive a substantial portion of their income from dividends and interest.

We examine bunching behavior and the associated ETI for a range of population subgroups. We find that the estimated ETI is higher for married females, females with children, and younger individuals. This may be due to weaker labor force attachment but also reflects family tax planning arrangements. The higher elasticity for younger individuals may also reflect that they are less risk-averse, more likely to misreport income or work in the cash economy, or more likely, particularly for women, to substitute unpaid care work for formal labor market activity.

[45] The aggregate welfare would be 1%, 0.1%, and 0.05% higher without friction. These benchmarks are similar to Chetty (2012).

We examine trends in the ETI over the period 2000 to 2018. The ETI generally increased from 2000 to around 2008, possibly indicating individuals becoming more aware of the thresholds following significant system changes. Since 2008 there has been a noticeable downward trend in the ETI. The increased use of data matching and pre-filling by tax authorities could be a reason for this decline. This finding suggests the importance of tax administration and compliance activities on the ETI.

Investigating the drivers of bunching behavior, we find suggestive evidence that a significant degree of bunching by self-employed individuals might be due to using trusts as a vehicle for income splitting. We also find suggestive evidence that wage and salary earners bunch less since they face greater constraints in adjusting their taxable income.

Our findings highlight the importance of the design of the structure of the tax system as a whole and the administration of the tax system when considering potential behavioral responses, strengthening the need for research that produces country-specific estimates. Applying elasticity estimates from one country to another country's system design is likely to produce external validity problems.

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Tables

Table 1: Summary statistics for 2010

	Full sample	Wage and salary	Self-employed
Taxable income	52,039.4	52,094.6	51,917.3
	(150,076.4)	(106,674.8)	(217,228.4)
Salary and wage income	43,991.6	52,597.6	24,942.6
	(50,976.6)	(44,442.3)	(58,752.7)
Total deductions	2,638.3	2,348.9	3,278.9
	(28,353.3)	(7,497.1)	(49,581.3)
Age	40.4	38.5	44.8
	(12.6)	(12.5)	(11.8)
Female	0.47	0.47	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.55	0.69
	(0.49)	(0.50)	(0.46)
Number of children	1.02	0.92	1.25
	(1.17)	(1.13)	(1.22)
Self-employed	0.31		
	(0.46)		
Observations	10,397,721	7,162,021	3,235,700

Notes: Standard deviations are in parentheses.

Table 2: Estimated bunching and ETI for females by the number of children in 2010

	No children	1 child	2 children	3+ children
Second threshold - wage and salary earners				
Excess mass (b):	0.41	0.47	1.11	0.79
	(0.133)	(0.239)	(0.250)	(0.187)
ETI (ε):	0.005	0.006	0.014	0.010
	(0.001)	(0.001)	(0.001)	(0.001)
Second threshold - self-employed				
Excess mass (b):	7.01	7.31	7.94	9.76
	(0.346)	(0.700)	(0.564)	(0.608)
ETI (ε):	0.091	0.095	0.103	0.126
	(0.002)	(0.003)	(0.003)	(0.002)
Fourth (top) threshold - wage and salary earners				
Excess mass (b):	4.23	4.20	3.56	1.04
	(1.151)	(2.390)	(2.045)	(1.839)
ETI (ε):	0.017	0.017	0.014	0.004
	(0.003)	(0.007)	(0.006)	(0.003)
Fourth (top) threshold - self-employed				
Excess mass (b):	30.59	29.91	35.29	26.10
	(2.355)	(3.826)	(3.135)	(2.427)
ETI (ε):	0.122	0.119	0.141	0.104
	(0.007)	(0.011)	(0.009)	(0.007)

Notes: Standard deviations are in parentheses.

Table 3: Estimated bunching and ETI for self-employed individuals by trust status in 2010

a) Third kink

		Without trust income	With trust income		
	Self-employed	All self-employed	All self-employed	With spouse	With spouse and children
Excess mass (b):	22.7	8.8	32.8	45.7	51.7
Stand. error:	(0.55)	(0.50)	(0.82)	(1.62)	(2.53)
ETI (ε):	0.228	0.089	0.330	0.460	0.520
Stand. error:	(0.003)	(0.003)	(0.004)	(0.009)	(0.014)
Count ('000) (around small bunching window)	75.7	23.7	52.0	16.8	7.6

b) Top kink

		Without trust income	With trust income		
	Self-employed	All self-employed	All self-employed	With spouse	With spouse and children
Excess mass (b):	22.7	8.8	32.8	45.7	51.7
Stand. error:	(0.55)	(0.50)	(0.82)	(1.62)	(2.53)
ETI (ε):	0.228	0.089	0.330	0.460	0.520
Stand. error:	(0.003)	(0.003)	(0.004)	(0.009)	(0.014)
Count ('000) (around small bunching window)	75.7	23.7	52.0	16.8	7.6

Notes: Standard deviations are in parentheses.

Table 4: Responses following the change to the top kink in 2009

	Wage and salary earners		Self employed		All tax-filers	
Taxpayers in 2009 who were below the bunching window in 2008						
Income in 2009:						
below the 2008 window	3,297	43.3	3,514	54.6	6,811	48.4
at the 2008 window	281	3.7	175	2.7	456	3.2
above 2008 window	3,773	49.5	2,559	39.7	6,332	45.0
at the 2009 bunching window	*159*	*2.1*	*200*	*3.1*	*359*	*2.6*
Didn't lodge in 2009	271	3.6	192	3.0	463	3.3
Total	7,622	100.0	6,440	100.0	14,062	100.0
Taxpayers in 2009 who were above the bunching window in 2008						
Income in 2009:						
below the 2008 window	2,841	44.9	2,976	52.9	5,817	48.7
at the 2008 window	272	4.3	139	2.5	411	3.4
above 2008 window	2,995	47.4	2,356	41.9	5,351	44.8
at the 2009 bunching window	*122*	*1.9*	*228*	*4.1*	*350*	*2.9*
Didn't lodge in 2009	217	3.4	151	2.7	368	3.1
Total	6,325	100.0	5,622	100.0	11,947	100.0
Taxpayers in 2009 who were in the bunching window in 2008						
Income in 2009:						
below the 2008 bunching window	3,382	45.0	5,442	50.2	8,824	48.1
at the 2008 bunching window	338	4.5	326	3.0	664	3.6
above 2008 bunching window	3,528	47.0	4,773	44.0	8,301	45.2
at the 2009 bunching window	*176*	*2.3*	*1,273*	*11.7*	*1,449*	*7.9*
Didn't lodge in 2009	261	3.5	298	2.7	559	3.0
Total	7,509	100.0	10,839	100.0	18,348	100.0

Table 5: Individuals around the top kink from 2008 to 2018

	Below 2009 bunching window		In 2009 bunching window		Above 2009 bunching window		Did not lodge	
	Wage and salary earner	Self-employed	Wage and salary earner	Self-employed	Wage and salary earner	Self-employed	Wage and salary earner	Self-employed
2008	76.3	77.8	2.2	1.2	18.2	17.9	3.3	3.2
2009	0.0	0.0	100.0	100.0	0.0	0.0	0.0	0.0
2010	47.2	45.6	4.9	20.9	44.7	31.3	3.1	2.3
2011	40.9	45.1	3.0	15.8	50.7	35.0	5.4	4.0
2012	38.2	46.7	2.4	10.5	51.8	36.6	7.5	6.2
2013	36.6	46.7	2.2	8.0	51.7	36.6	9.5	8.6
2014	36.2	46.8	2.1	7.5	49.6	35.0	12.1	10.7
2015	36.9	47.4	1.5	7.4	47.4	32.1	14.2	13.1
2016	36.3	46.2	1.8	7.7	44.8	30.5	17.1	15.6
2017	36.1	44.8	1.7	6.4	42.7	30.4	19.5	18.5
2018	33.8	42.6	1.8	5.9	41.8	30.2	22.6	21.2

Table 6: Bounds on structural elasticity for the wage and salary earners

	Observed ETI		Price change	Bounds		Bounds 95% CI	
	□	s.e.(□)	log(τ/1□□)	□$_L$	□$_U$	□$_L$	□$_U$
Second threshold							
δ = 1%	0.0098	0.0005	0.2091	0.0001	1.8494	0.0000	1.8510
δ = 0.1%	0.0098	0.0005	0.2091	0.0005	0.2021	0.0004	0.2037
δ = 0.05%	0.0098	0.0005	0.2091	0.0009	0.1102	0.0007	0.1117
Third threshold							
δ = 1%	0.0089	0.0009	0.1242	0.0000	5.2048	0.0000	5.2077
δ = 0.1%	0.0089	0.0009	0.1242	0.0001	0.5363	0.0001	0.5393
δ = 0.05%	0.0089	0.0009	0.1242	0.0003	0.2769	0.0002	0.2797
Fourth (top) threshold							
δ = 1%	0.0085	0.0014	0.1394	0.0000	4.1365	0.0000	4.1411
δ = 0.1%	0.0085	0.0014	0.1394	0.0002	0.4288	0.0001	0.4333
δ = 0.05%	0.0085	0.0014	0.1394	0.0003	0.2226	0.0002	0.2271

Note: The Table presents estimates of the upper and lower bounds of the structural elasticity, ε^S_L, and ε^S_U, following the nonparametric approach outlined by Chetty (2012). Results are presented for the second, third, and fourth (top) tax thresholds and for different values of the degree of optimization friction (δ). Details of the model are presented in Appendix B.

Figures

Figure 1: Changes in the personal income tax system from 2000 to 2018

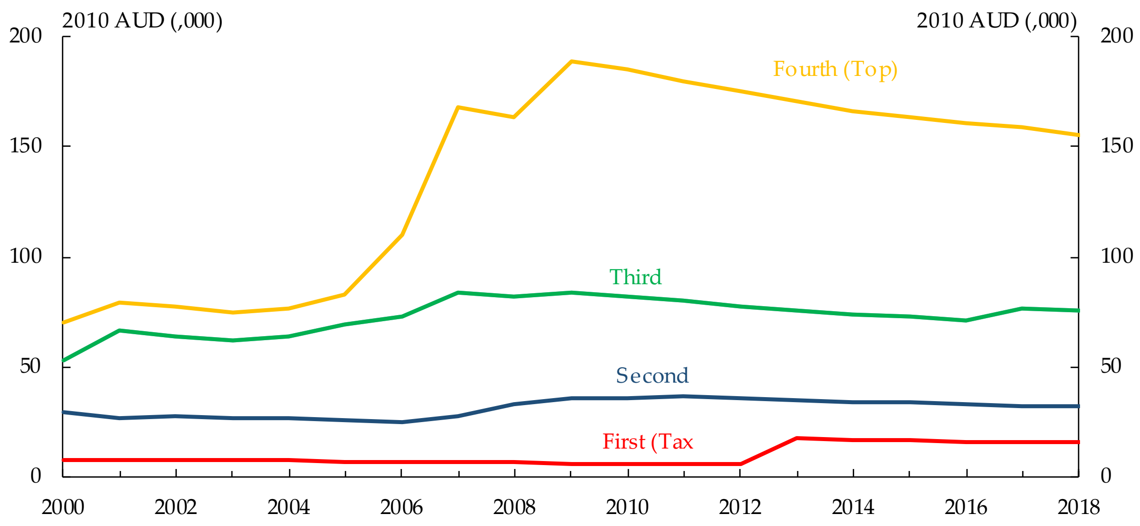


Figure 2: Distribution of taxable income in 2010

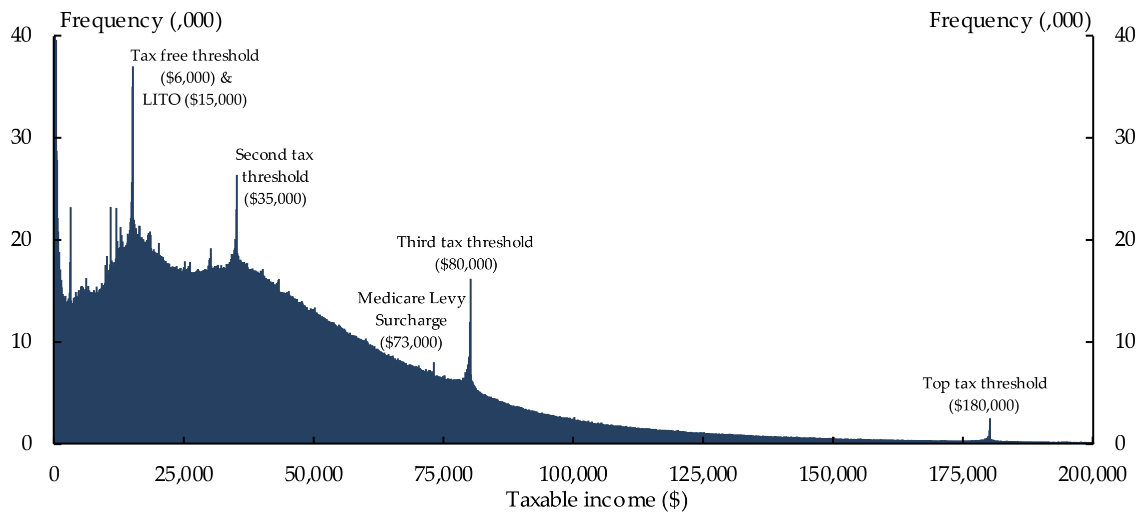


Figure 3: Distribution of taxable income around the top kink in 2008 and 2009

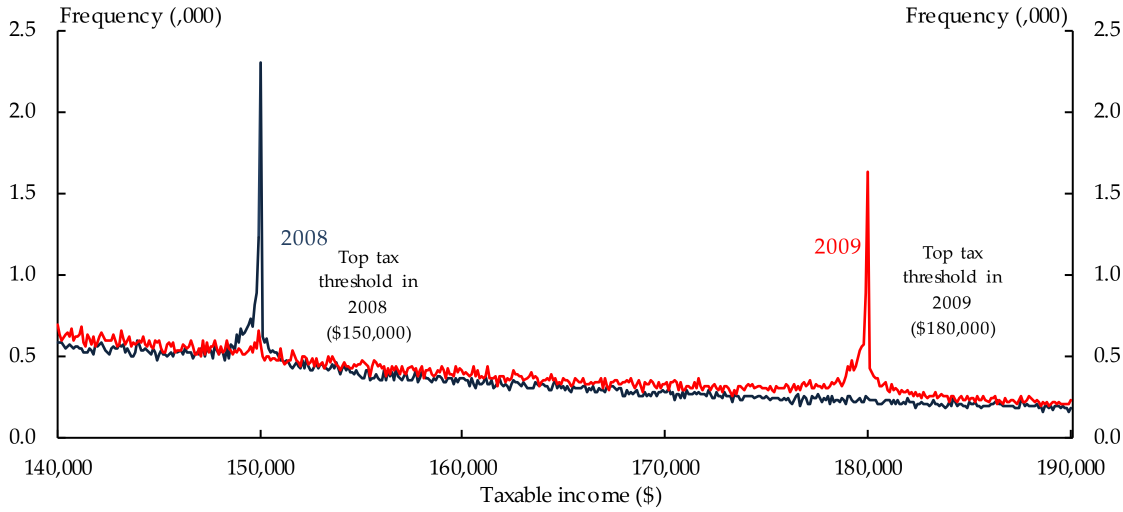
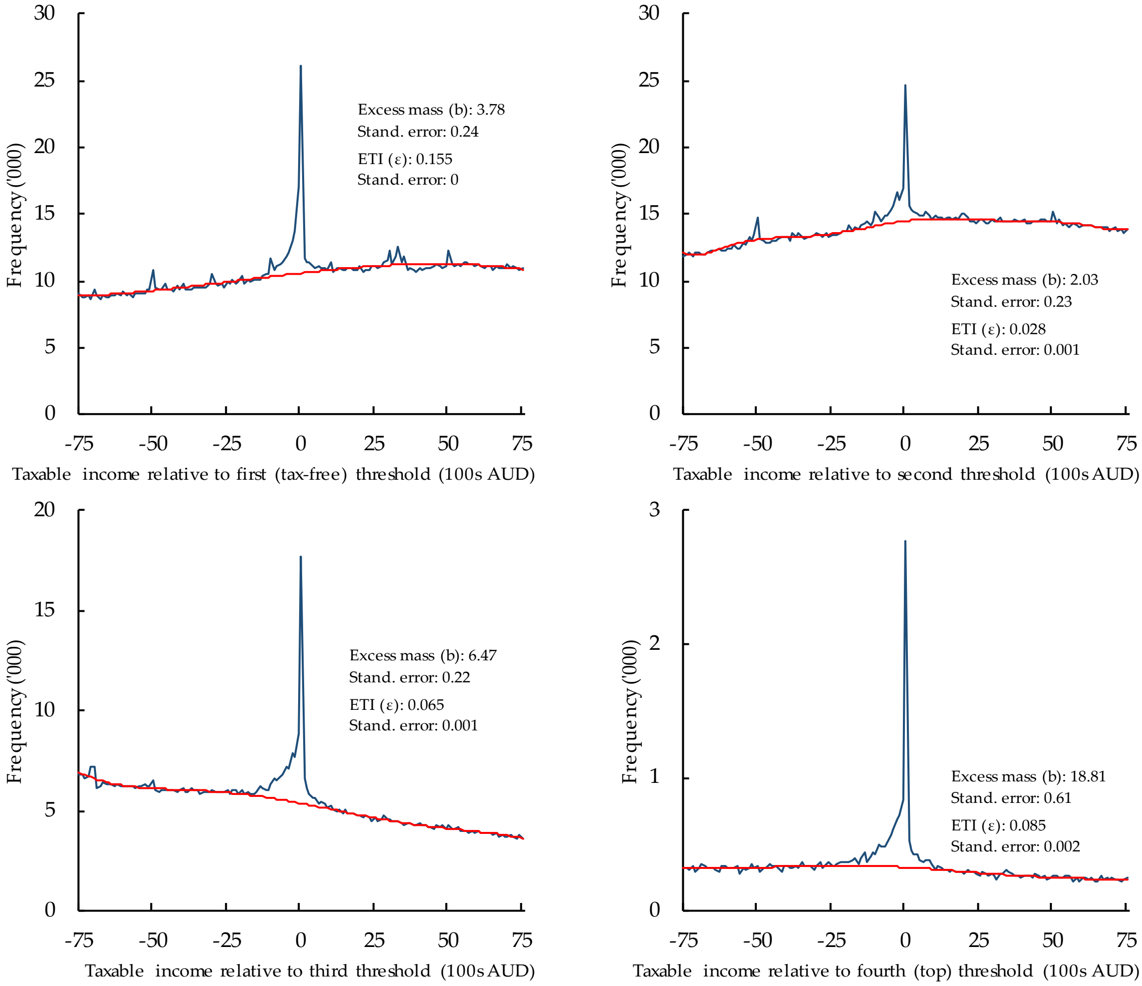


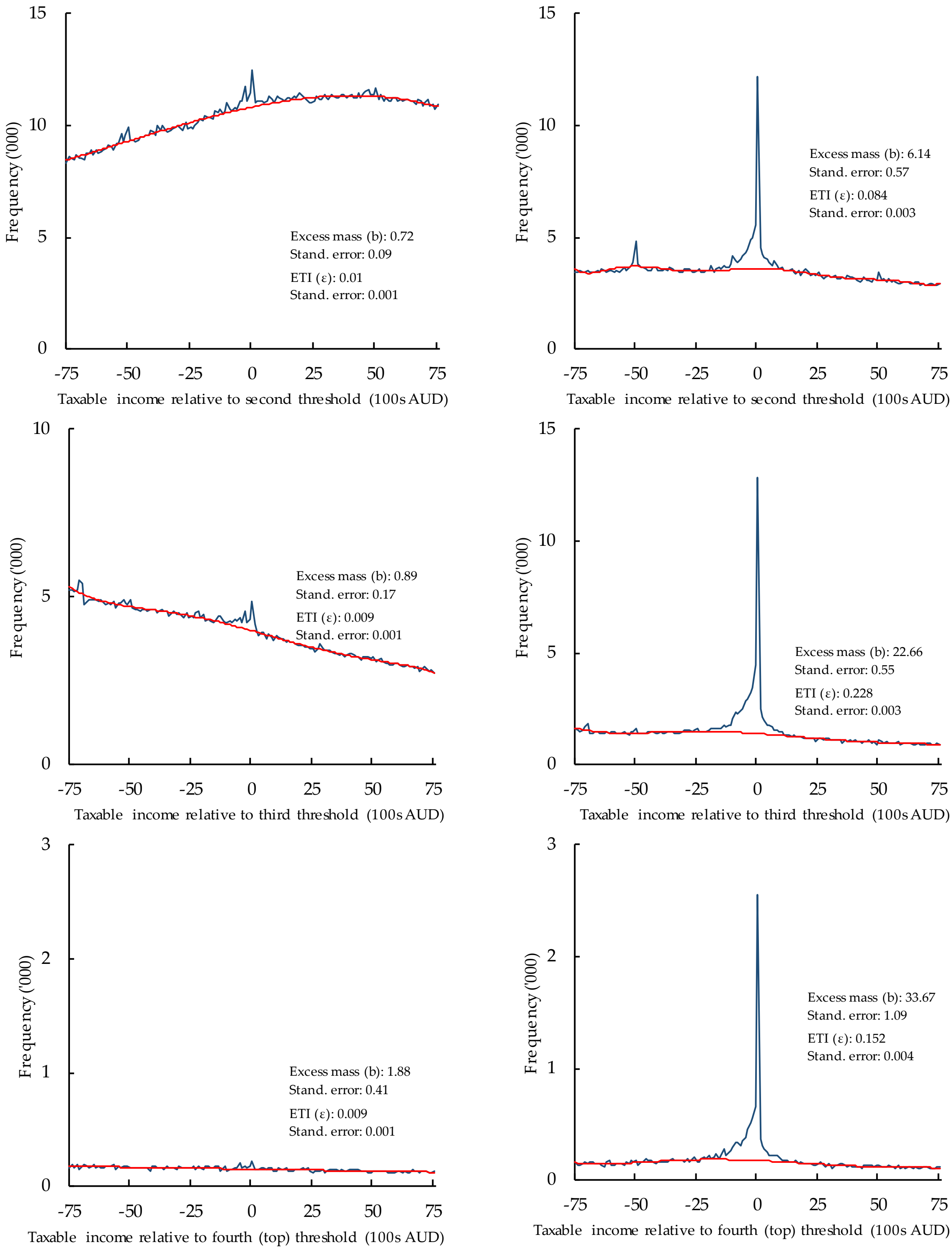
Figure 4: Distribution of taxable income around the main four kinks in 2010



Note: The x-axis denotes the normalized taxable income, so the kink is at zero. Standard errors are estimated using a nonparametric bootstrapping. See Appendix B for details.

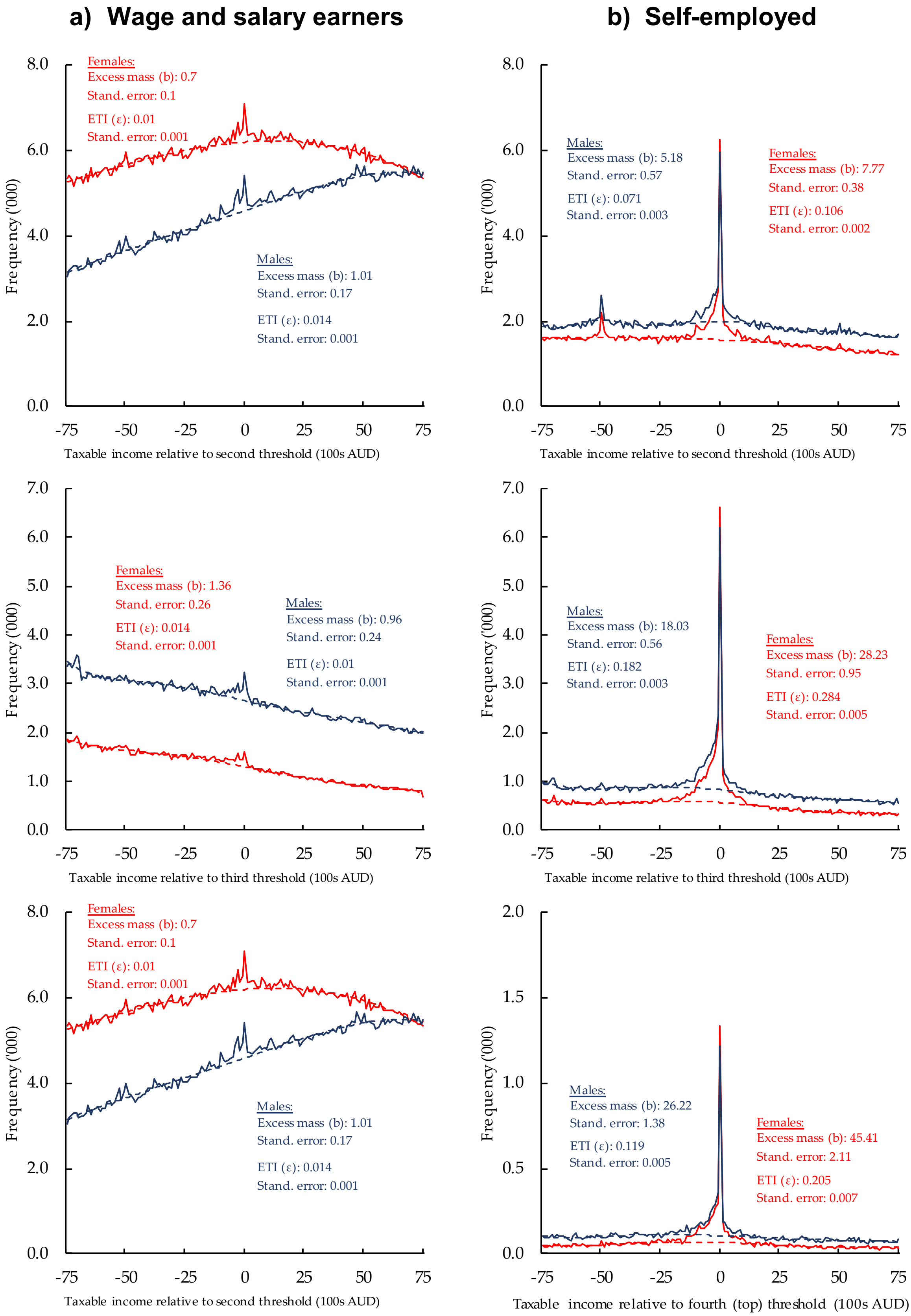
Figure 5: Distribution of taxable income at main kinks for wage and salary earners and self-employed individuals in 2010

a) Wage and salary earners **b) Self-employed**



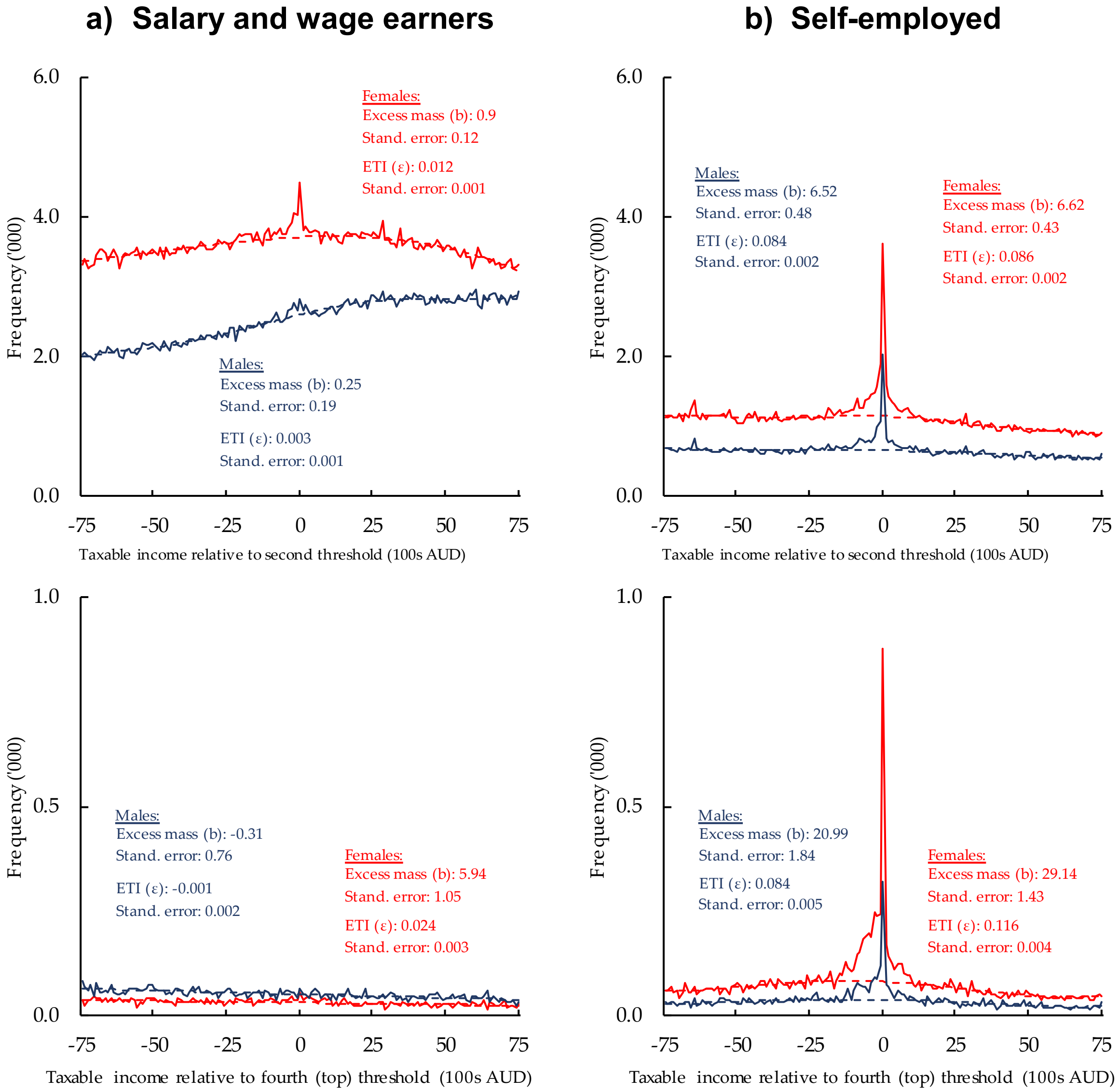
Note: See notes in Figure 4.

Figure 6: Distribution of taxable income by gender in 2010



Note: See notes in Figure 4.

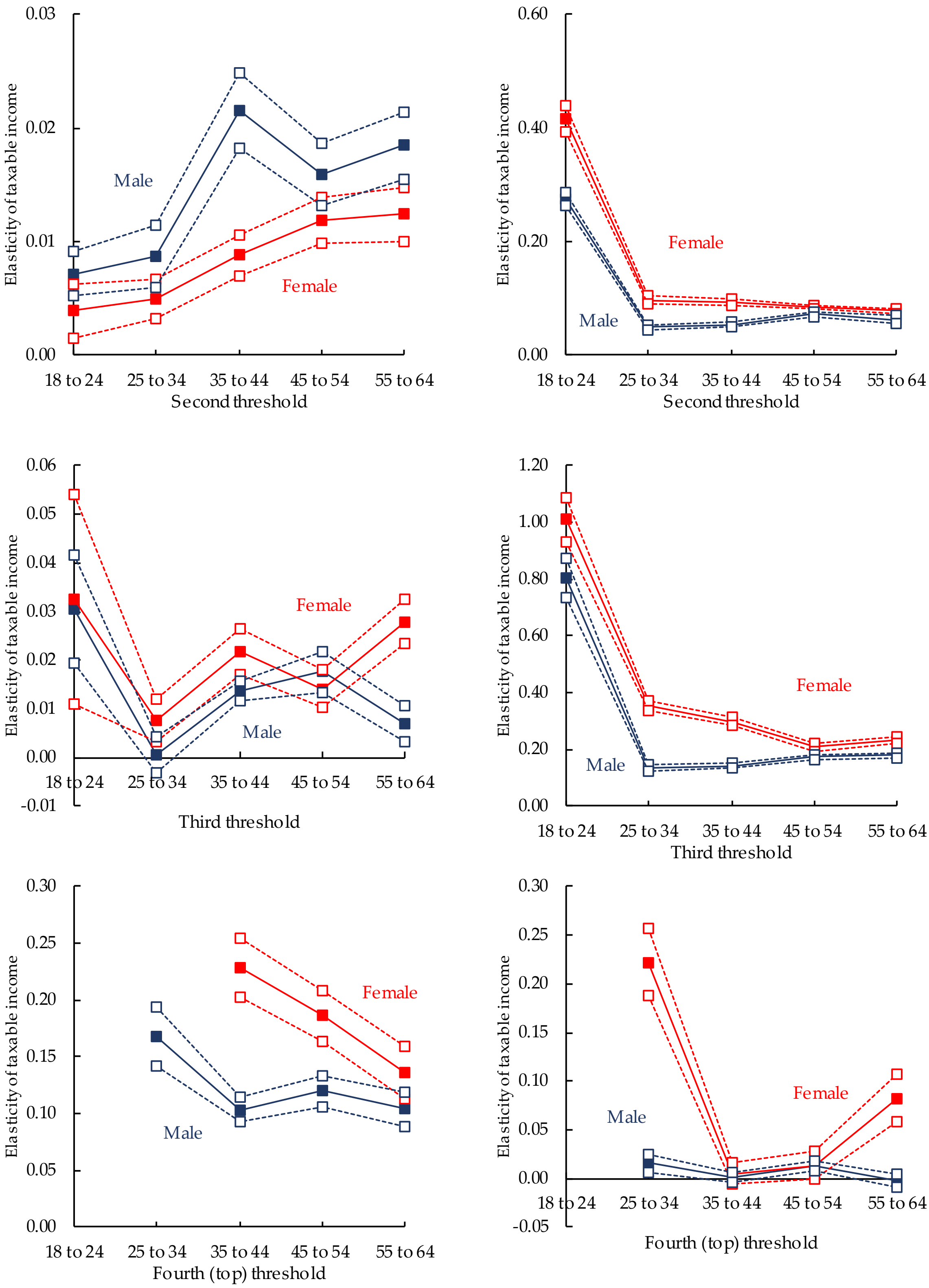
Figure 7: Distribution of taxable income for married women and single men in 2013



Note: See notes in Figure 4.

Figure 8: Estimated ETI by age groups in 2010

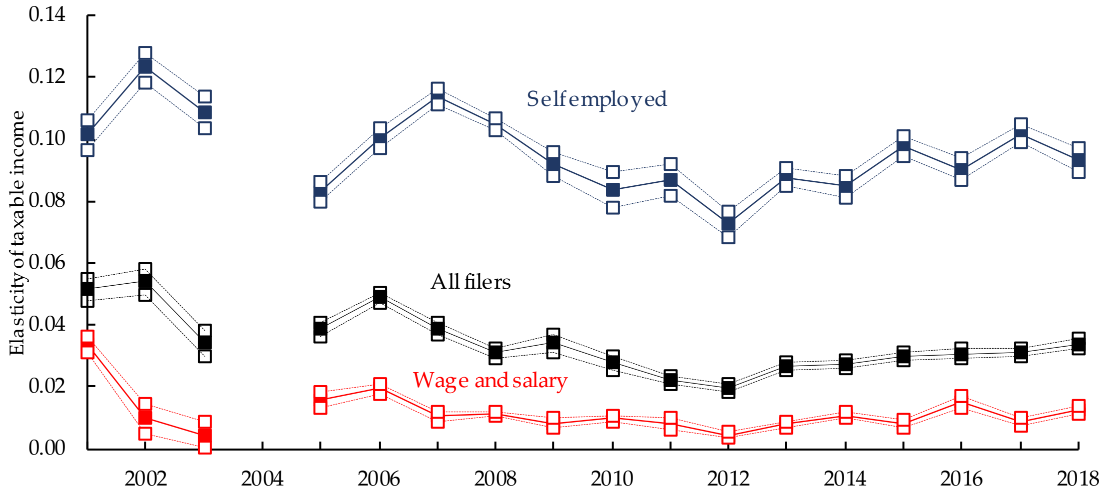
a) Salary and wage earners   b) Self-employed



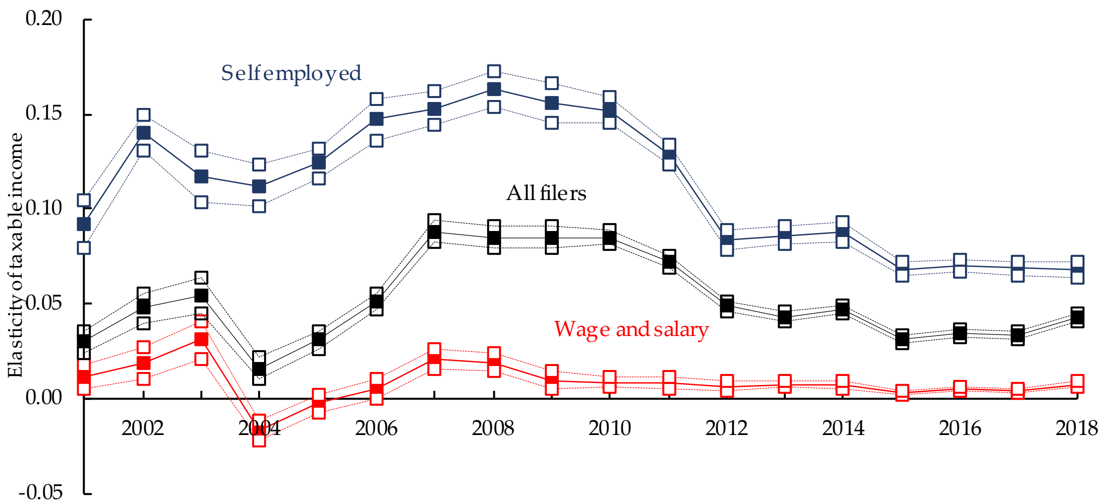
Note: The dashed lines represent the 95% confidence intervals.

Figure 9: Estimated ETI by employment type from 2000 to 2018

a) Second threshold

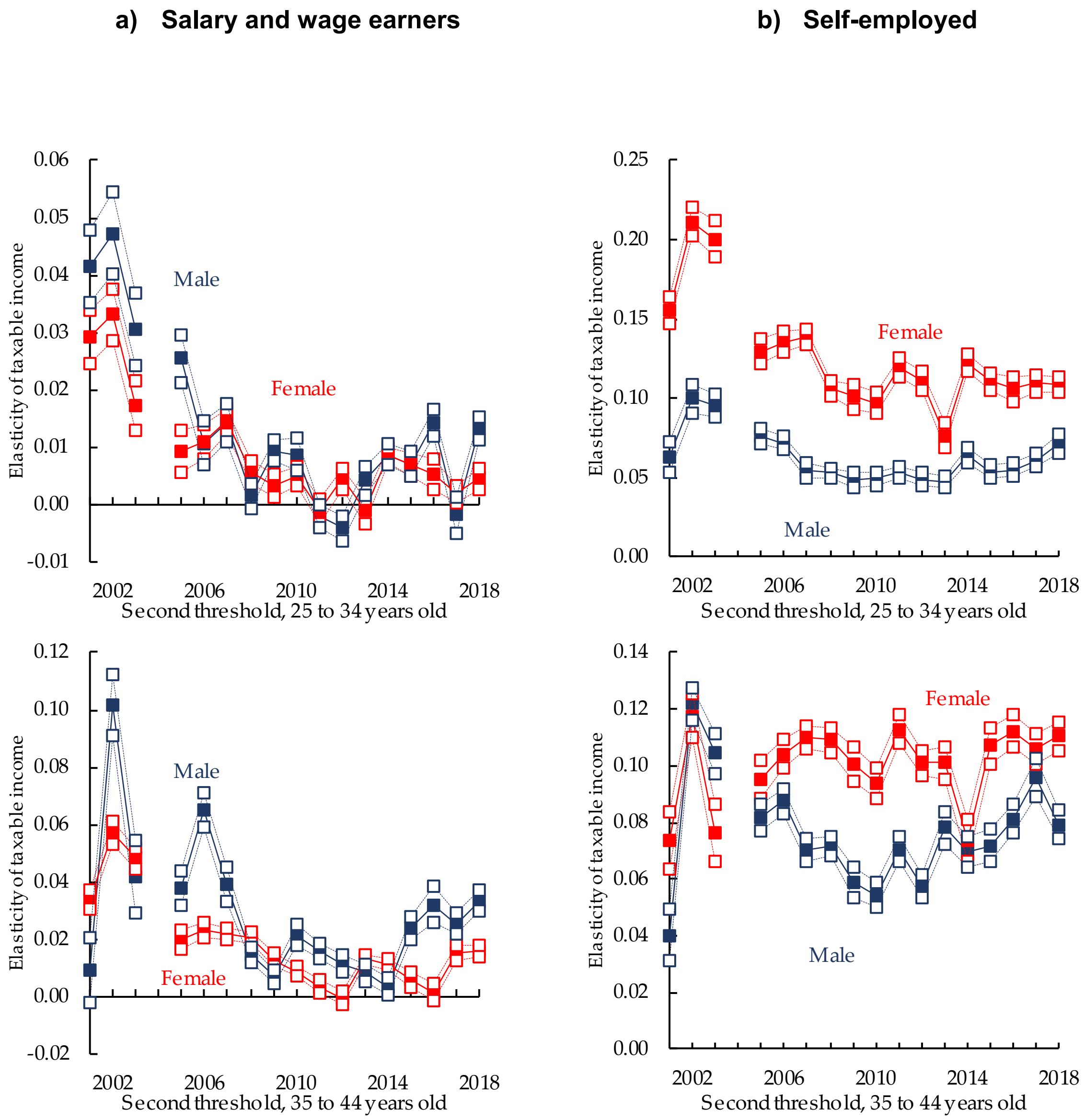


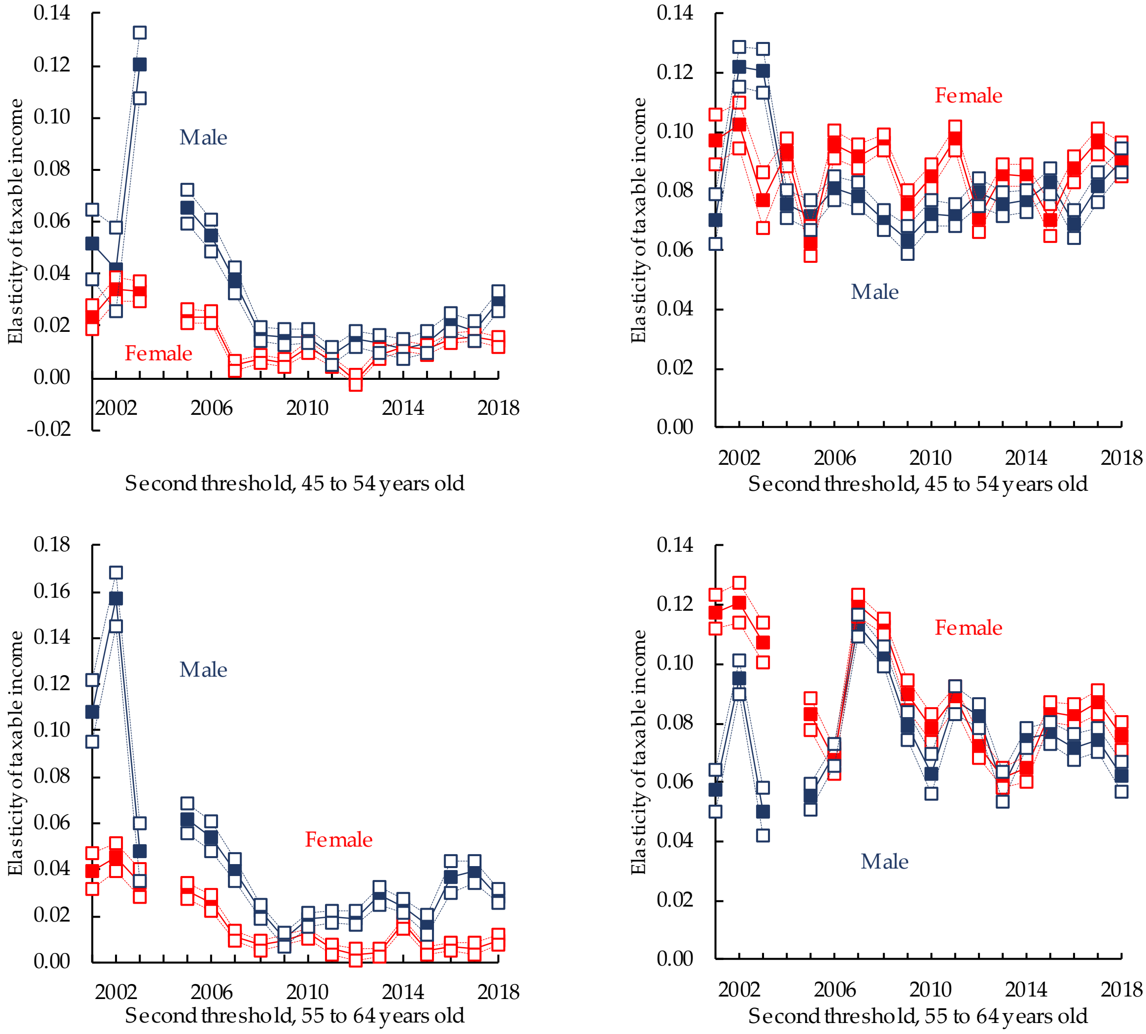
b) Top Threshold



Note: The dashed lines represent the 95% confidence intervals.

Figure 10: Estimated ETI at the second kink by age group from 2000 to 2018

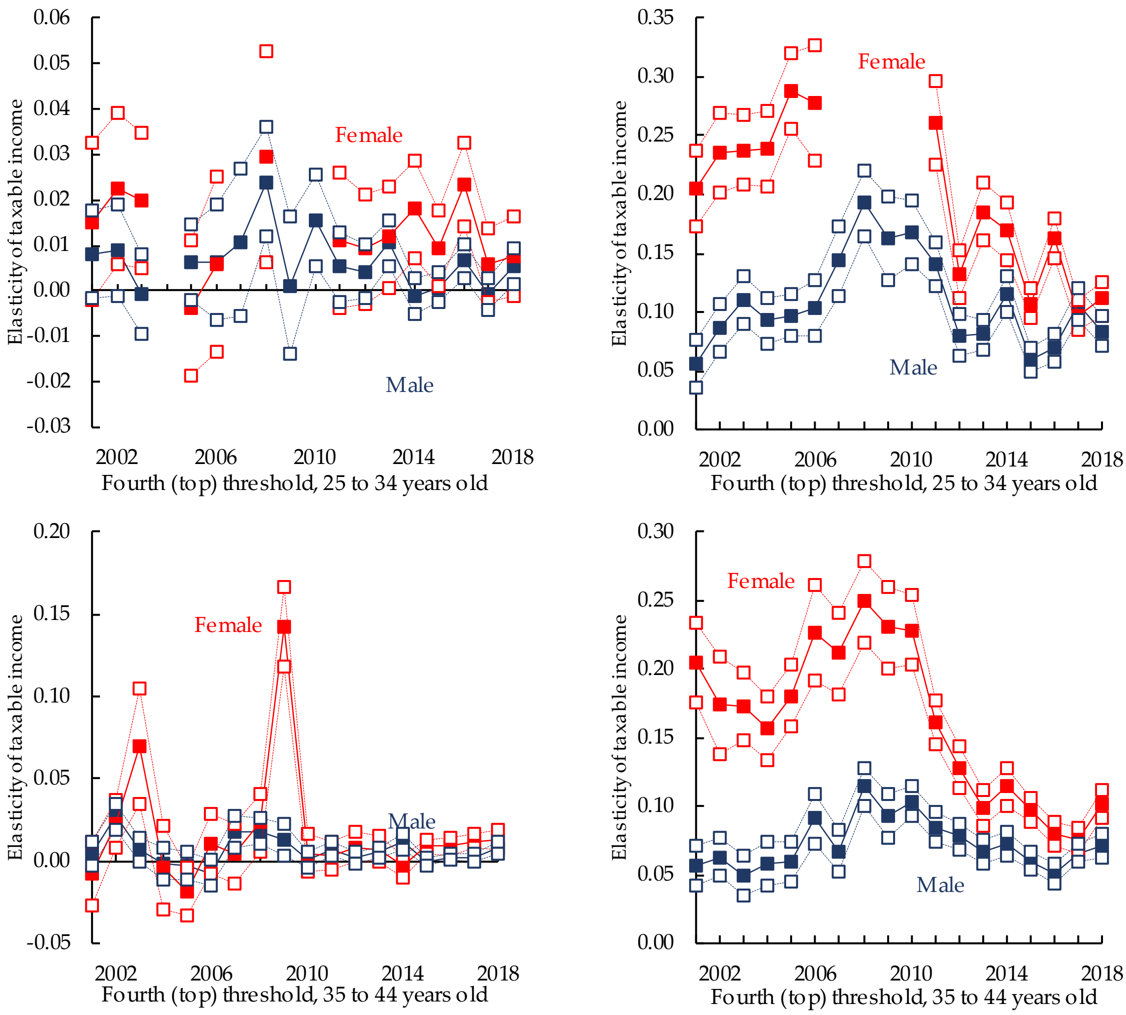


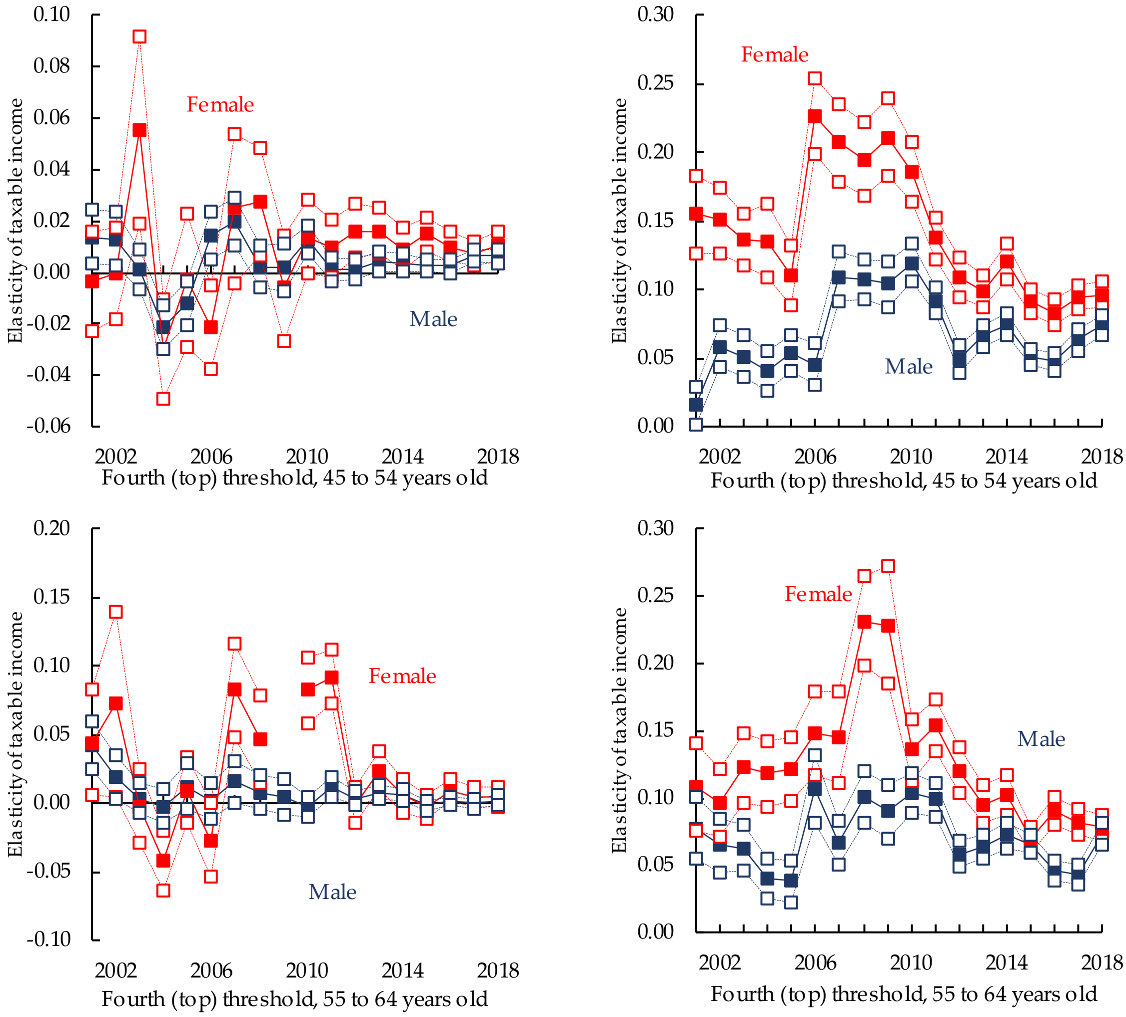


Note: The dashed lines represent the 95% confidence intervals. Estimates are not provided for 2004 due to interactions with other thresholds.

Figure 11: Estimated ETI at top kink by age group from 2000 to 2018

c) Salary and wage earners **d) Self-employed**





Note: The dashed lines represent the 95% confidence intervals.

Appendix

Appendix A. Detailed changes in personal income tax schedule from 2000 to 2018

Table A.1: Marginal tax rates and changes at kinks from 2000 to 2018

	Marginal tax rates (per cent)					Marginal change (per cent)			
	T0	T1	T2	T3	T4	T0 to T1	T1 to T2	T2 to T3	T3 to T4
1999-00	0.0	20.0	35.5	44.5	48.5	22.3	21.5	15.0	7.5
2000-01	0.0	17.0	31.5	43.5	48.5	18.6	19.2	19.3	9.3
2001-02	0.0	17.0	31.5	43.5	48.5	18.6	19.2	19.3	9.3
2002-03	0.0	17.0	31.5	43.5	48.5	18.6	19.2	19.3	9.3
2003-04	0.0	17.0	31.5	43.5	48.5	18.6	19.2	19.3	9.3
2004-05	0.0	17.0	31.5	43.5	48.5	18.6	19.2	19.3	9.3
2005-06	0.0	15.0	31.5	43.5	48.5	16.3	21.6	19.3	9.3
2006-07	0.0	15.0	31.5	41.5	46.5	16.3	21.6	15.8	8.9
2007-08	0.0	15.0	31.5	41.5	46.5	16.3	21.6	15.8	8.9
2008-09	0.0	15.0	31.5	41.5	46.5	16.3	21.6	15.8	8.9
2009-10	0.0	15.0	31.5	39.5	46.5	16.3	21.6	12.4	12.3
2010-11	0.0	15.0	31.5	38.5	46.5	16.3	21.6	10.8	13.9
2011-12	0.0	19.0	31.5	38.5	46.5	21.1	16.8	10.8	13.9
2012-13	0.0	19.0	34.0	38.5	46.5	21.1	20.5	7.1	13.9
2013-14	0.0	19.0	34.0	38.5	46.5	21.1	20.5	7.1	13.9
2014-15	0.0	19.0	34.5	39.0	47.0	21.1	21.2	7.1	14.1
2015-16	0.0	19.0	34.5	39.0	47.0	21.1	21.2	7.1	14.1
2016-17	0.0	19.0	34.5	39.0	47.0	21.1	21.2	7.1	14.1
2017-18	0.0	19.0	34.5	39.0	47.0	21.1	21.2	7.1	14.1

Notes: Rates for T1 to T4 include the Medicare Levy, which for resident individuals is essentially a general tax applying to taxable income. Excludes Low-Income Tax Offset phase-out and special purpose levies such as Flood Levy and Budget Repair Levy.

Appendix B. Bounds of the structural elasticity

The presence of adjustment costs would create a wedge between the estimated ETI and the true structural elasticity. We use the method of Chetty (2012) to estimate bounds for the true structural elasticity while remaining agnostic about the structure of the adjustment costs. The bounds are functions of the estimated ETI (ε), the size of the change in the marginal tax rate ($\log(\frac{\tau}{(1-\tau)})$), and the degree of the optimization friction (δ), which is defined as the utility cost of not responding to the tax change as a percentage of net-of-tax earnings. The lower (ε_L^S) and upper (ε_U^S) bounds of the structural elasticity are given by:

$$\varepsilon_L^S = \varepsilon + \frac{4\delta}{\left(\log\left(\frac{\tau}{(1-\tau)}\right)\right)^2}(1-\rho)$$

$$\varepsilon_U^S = \varepsilon + \frac{4\delta}{\left(\log\left(\frac{\tau}{(1-\tau)}\right)\right)^2}(1+\rho)$$

where:

$$\rho = \sqrt{1 + \frac{\varepsilon}{\delta}\frac{1}{2}\left(\log\left(\frac{\tau}{(1-\tau)}\right)\right)^2} \qquad \textbf{(9)}$$

As noted by Chetty (2012), larger changes in the tax rate are more informative of the true structural elasticity because the bounds shrink at a quadratic rate, with the change in the marginal tax rate, $\log(\frac{\tau}{(1-\tau)})$. While the changes in the tax rates in the Australian context are relatively modest, it is still instructive to present the bounds on the ETI for wage and salary earners.

Appendix C. Summary statistics, 2000 to 2018

Table C.1: Summary Statistics, 2018

	Full sample	Wage and salary	Self-employed
Taxable income	67,734.4	67,062.2	69,444.8
	(167,600.5)	(100,640.4)	(271,637.6)
Salary and wage income	57,139.3	67,339.5	31,185.9
	(63,319.9)	(58,131.5)	(68,369.5)
Total deductions	2,791.2	2,619.1	3,229.2
	(85,514.3)	(8,194.1)	(160,461.9)
Age	40.5	39.0	44.3
	(12.7)	(12.5)	(12.4)
Female	0.48	0.49	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.58	0.55	0.67
	(0.49)	(0.50)	(0.47)
Number of children	0.78	0.75	0.85
	(1.10)	(1.07)	(1.14)
Self-employed	0.28		
	(0.45)		
Observations	11,566,189	8,302,962	3,263,227

Note: Standard deviations are in parentheses.

Table C.2: Summary Statistics, 2017

	Full sample	Wage and salary	Self-employed
Taxable income	65,181.3	64,917.5	65,847.2
	(143,066.3)	(87,395.8)	(229,903.9)
Salary and wage income	55,049.0	65,227.3	29,354.5
	(61,946.8)	(57,099.9)	(66,123.3)
Total deductions	2,813.3	2,651.4	3,222.0
	(46,774.7)	(8,562.7)	(86,750.8)
Age	40.5	39.0	44.4
	(12.7)	(12.5)	(12.4)
Female	0.48	0.48	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.55	0.68
	(0.49)	(0.50)	(0.47)
Number of children	0.76	0.73	0.83
	(1.09)	(1.07)	(1.14)
Self-employed	0.28		
	(0.45)		
Observations	11,420,161	8,179,883	3,240,278

Note: Standard deviations are in parentheses.

Table C.3: Summary statistics, 2016

	Full sample	Wage and salary	Self-employed
Taxable income	64,717.1	64,348.1	65,649.2
	(166,655.5)	(82,876.5)	(283,880.2)
Salary and wage income	54,611.3	64,656.2	29,233.9
	(65,519.5)	(60,469.0)	(70,720.6)
Total deductions	2,835.3	2,699.5	3,178.3
	(15,655.2)	(8,848.2)	(25,813.0)
Age	40.6	39.0	44.6
	(12.7)	(12.5)	(12.3)
Female	0.47	0.48	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.56	0.69
	(0.49)	(0.50)	(0.46)
Number of children	0.76	0.73	0.82
	(1.09)	(1.07)	(1.14)
Self-employed	0.28		
	(0.45)		
Observations	11,211,162	8,031,929	3,179,233

Note: Standard deviations are in parentheses.

Table C.4: Summary statistics, 2015

	Full sample	Wage and salary	Self-employed
Taxable income	63,611.3	62,199.1	64,469.4
	(153,401.3)	(83,772.5)	(358,615.4)
Salary and wage income	53,582.9	62,393.5	27,810.5
	(61,175.1)	(54,543.7)	(71,221.6)
Total deductions	2,864.9	2,633.5	3,075.4
	(18,402.0)	(7,021.3)	(26,419.8)
Age	40.6	39.0	45.2
	(12.7)	(12.4)	(12.1)
Female	0.47	0.47	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.60	0.57	0.71
	(0.49)	(0.50)	(0.46)
Number of children	0.75	0.72	0.81
	(1.09)	(1.06)	(1.14)
Self-employed	0.28		
	(0.45)		
Observations	11,016,204	7,852,308	3,009,275

Note: Standard deviations are in parentheses.

Table C.5: Summary Statistics, 2014

	Full sample	Wage and salary	Self-employed
Taxable income	62,828.1	62,199.1	64,469.4
	(201,755.8)	(83,772.5)	(358,615.4)
Salary and wage income	52,812.0	62,393.5	27,810.5
	(61,609.2)	(54,543.7)	(71,221.6)
Total deductions	2,755.9	2,633.5	3,075.4
	(15,134.9)	(7,021.3)	(26,419.8)
Age	40.7	39.0	45.2
	(12.6)	(12.4)	(12.1)
Female	0.47	0.47	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.61	0.57	0.71
	(0.49)	(0.50)	(0.46)
Number of children	0.74	0.72	0.81
	(1.08)	(1.06)	(1.14)
Self-employed	0.28		
	(0.45)		
Observations	10,861,583	7,852,308	3,009,275

Note: Standard deviations are in parentheses.

Table C.6: Summary statistics, 2013

	Full sample	Wage and salary	Self-employed
Taxable income	61,071.5	60,615.7	62,232.9
	(109,726.1)	(63,683.9)	(179,956.1)
Salary and wage income	51,752.5	61,015.0	28,148.6
	(57,645.0)	(52,073.7)	(64,069.4)
Total deductions	2,678.3	2,552.9	2,997.8
	(14,600.2)	(8,224.1)	(24,163.6)
Age	40.7	38.9	45.2
	(12.6)	(12.4)	(11.9)
Female	0.47	0.47	0.45
	(0.50)	(0.50)	(0.50)
Has a spouse	0.61	0.57	0.71
	(0.49)	(0.50)	(0.45)
Number of children	0.79	0.76	0.86
	(1.10)	(1.08)	(1.16)
Self-employed	0.28		
	(0.45)		
Observations	10,731,417	7,707,058	3,024,359

Note: Standard deviations are in parentheses.

Table C.7: Summary Statistics, 2012

	Full sample	Wage and salary	Self-employed
Taxable income	58,474.9	57,983.4	59,696.5
	(95,580.2)	(57,757.1)	(153,464.0)
Salary and wage income	49,600.2	58,562.8	27,319.8
	(54,609.5)	(48,737.6)	(61,600.8)
Total deductions	2,783.0	2,531.4	3,408.7
	(17,373.4)	(6,428.1)	(30,804.4)
Age	40.6	38.7	45.2
	(12.7)	(12.5)	(11.9)
Female	0.47	0.47	0.45
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.55	0.70
	(0.49)	(0.50)	(0.46)
Number of children	1.00	0.92	1.23
	(1.16)	(1.13)	(1.21)
Self-employed	0.29		
	(0.45)		
Observations	10,650,980	7,595,577	3,055,403

Note: Standard deviations are in parentheses.

Table C.8: Summary Statistics, 2011

	Full sample	Wage and salary	Self-employed
Taxable income	55,440.2	55,021.3	56,394.4
	(125,134.7)	(64,142.3)	(204,814.7)
Salary and wage income	46,706.4	55,636.7	26,368.3
	(54,927.1)	(48,789.1)	(62,221.7)
Total deductions	2,718.4	2,435.7	3,362.2
	(34,219.4)	(7,710.8)	(60,842.1)
Age	40.5	38.6	44.9
	(12.6)	(12.5)	(11.9)
Female	0.47	0.47	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.55	0.69
	(0.49)	(0.50)	(0.46)
Number of children	1.03	0.93	1.27
	(1.17)	(1.13)	(1.22)
Self-employed	0.31		
	(0.46)		
Observations	10,594,959	7,362,252	3,232,707

Note: Standard deviations are in parentheses.

Table C.9: Summary statistics, 2010

	Full sample	Wage and salary	Self-employed
Taxable income	52,039.4	52,094.6	51,917.3
	(150,076.4)	(106,674.8)	(217,228.4)
Salary and wage income	43,991.6	52,597.6	24,942.6
	(50,976.6)	(44,442.3)	(58,752.7)
Total deductions	2,638.3	2,348.9	3,278.9
	(28,353.3)	(7,497.1)	(49,581.3)
Age	40.4	38.5	44.8
	(12.6)	(12.5)	(11.8)
Female	0.47	0.47	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.55	0.69
	(0.49)	(0.50)	(0.46)
Number of children	1.02	0.92	1.25
	(1.17)	(1.13)	(1.22)
Self-employed	0.31		
	(0.46)		
Observations	10,397,721	7,162,021	3,235,700

Note: Standard deviations are in parentheses.

Table C.10: Summary Statistics, 2009

	Full sample	Wage and salary	Self-employed
Taxable income	50,114.2	50,141.6	50,053.5
	(104,442.8)	(55,758.8)	(167,813.8)
Salary and wage income	42,525.6	50,694.2	24,455.5
	(54,766.9)	(48,110.0)	(63,563.0)
Total deductions	2,844.8	2,289.8	4,072.6
	(177,502.0)	(8,157.7)	(317,892.9)
Age	40.3	38.2	44.8
	(12.6)	(12.4)	(11.7)
Female	0.47	0.47	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.54	0.69
	(0.49)	(0.50)	(0.46)
Number of children	1.02	0.93	1.24
	(1.17)	(1.14)	(1.22)
Self-employed	0.31		
	(0.46)		
Observations	10,291,758	7,087,756	3,204,002

Note: Standard deviations are in parentheses.

Table C.11: Summary statistics, 2008

	Full sample	Wage and salary	Self-employed
Taxable income	49,238.9	47,900.9	52,154.1
	(210,027.7)	(150,708.6)	(301,199.0)
Salary and wage income	40,982.2	48,377.4	24,870.3
	(116,555.5)	(132,862.1)	(65,918.2)
Total deductions	2,906.8	2,203.0	4,440.3
	(20,574.3)	(7,694.4)	(34,830.1)
Age	40.1	37.9	44.8
	(12.6)	(12.4)	(11.8)
Female	0.46	0.47	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.59	0.54	0.70
	(0.49)	(0.50)	(0.46)
Number of children	1.14	1.08	1.25
	(1.18)	(1.16)	(1.21)
Self-employed	0.31		
	(0.46)		
Observations	10,159,311	6,963,279	3,196,032

Note: Standard deviations are in parentheses.

Table C.12: Summary statistics, 2007

	Full sample	Wage and salary	Self-employed
Taxable income	47,203.6	46,039.7	49,622.8
	(340,728.5)	(55,245.7)	(592,480.9)
Salary and wage income	38,619.8	46,295.9	22,666.0
	(50,834.3)	(40,448.8)	(64,633.3)
Total deductions	2,954.6	2,107.4	4,715.6
	(21,581.6)	(5,960.8)	(36,815.2)
Age	40.2	38.1	44.6
	(12.5)	(12.3)	(11.8)
Female	0.47	0.47	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.60	0.55	0.70
	(0.49)	(0.50)	(0.46)
Number of children	1.16	1.11	1.25
	(1.18)	(1.16)	(1.21)
Self-employed	0.32		
	(0.47)		
Observations	9,748,250	6,581,553	3,166,697

Note: Standard deviations are in parentheses.

Table C.13: Summary statistics, 2006

	Full sample	Wage and salary	Self-employed
Taxable income	44,150.9	44,203.8	44,043.2
	(81,812.9)	(45,918.3)	(126,543.8)
Salary and wage income	36,785.4	44,487.5	21,128.9
	(44,878.5)	(36,473.9)	(55,120.3)
Total deductions	2,435.1	1,998.6	3,322.2
	(14,224.7)	(5,066.8)	(23,670.5)
Age	40.2	38.1	44.4
	(12.4)	(12.2)	(11.7)
Female	0.46	0.46	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.60	0.55	0.70
	(0.49)	(0.50)	(0.46)
Number of children	1.14	1.09	1.23
	(1.18)	(1.16)	(1.21)
Self-employed	0.33		
	(0.47)		
Observations	9,420,884	6,314,522	3,106,362

Note: Standard deviations are in parentheses.

Table C.14: Summary statistics, 2005

	Full sample	Wage and salary	Self-employed
Taxable income	42,068.5	42,455.4	41,289.3
	(75,851.6)	(41,425.3)	(117,821.2)
Salary and wage income	35,232.6	42,762.4	20,071.4
	(41,226.0)	(34,612.7)	(48,635.5)
Total deductions	2,118.8	1,881.0	2,597.6
	(12,066.6)	(5,302.1)	(19,540.4)
Age	40.0	38.0	44.1
	(12.3)	(12.1)	(11.7)
Female	0.46	0.46	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.61	0.56	0.71
	(0.49)	(0.50)	(0.46)
Number of children	1.08	1.05	1.14
	(1.17)	(1.15)	(1.21)
Self-employed	0.33		
	(0.47)		
Observations	9,165,926	6,124,293	3,041,633

Note: Standard deviations are in parentheses.

Table C.15: Summary statistics, 2004

	Full sample	Wage and salary	Self-employed
Taxable income	40,140.8	40,862.9	38,697.8
	(65,167.8)	(36,298.0)	(100,489.4)
Salary and wage income	33,663.8	41,037.6	18,926.8
	(36,475.8)	(31,720.7)	(40,653.8)
Total deductions	1,944.4	1,775.2	2,282.5
	(12,618.1)	(5,898.7)	(20,191.9)
Age	39.9	37.9	43.9
	(12.2)	(11.9)	(11.7)
Female	0.46	0.46	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.61	0.56	0.70
	(0.49)	(0.50)	(0.46)
Number of children	1.07	1.05	1.11
	(1.17)	(1.15)	(1.21)
Self-employed	0.33		
	(0.47)		
Observations	8,908,119	5,937,326	2,970,793

Note: Standard deviations are in parentheses.

Table C.16: Summary statistics, 2003

	Full sample	Wage and salary	Self-employed
Taxable income	38,533.3	39,469.4	36,658.9
	(57,341.3)	(34,689.6)	(86,351.9)
Salary and wage income	32,504.9	39,556.1	18,387.0
	(38,596.9)	(30,603.3)	(47,941.6)
Total deductions	1,808.9	1,671.3	2,084.3
	(9,229.5)	(4,493.4)	(14,669.6)
Age	39.8	37.8	43.9
	(12.1)	(11.8)	(11.7)
Female	0.46	0.46	0.47
	(0.50)	(0.50)	(0.50)
Has a spouse	0.61	0.56	0.70
	(0.49)	(0.50)	(0.46)
Number of children	0.98	0.95	1.05
	(1.16)	(1.14)	(1.20)
Self-employed	0.33		
	(0.47)		
Observations	8,579,767	5,721,939	2,857,828

Note: Standard deviations are in parentheses.

Table C.17: Summary statistics, 2002

	Full sample	Wage and salary	Self-employed
Taxable income	37,541.4	38,335.3	35,913.5
	(89,145.0)	(33,321.5)	(148,198.0)
Salary and wage income	31,754.7	38,302.1	18,328.0
	(33,796.5)	(29,564.3)	(37,735.1)
Total deductions	1,750.4	1,605.3	2,048.0
	(9,832.8)	(6,077.9)	(14,800.9)
Age	39.8	37.7	44.0
	(12.1)	(11.7)	(11.6)
Female	0.46	0.46	0.46
	(0.50)	(0.50)	(0.50)
Has a spouse	0.61	0.56	0.70
	(0.49)	(0.50)	(0.46)
Number of children	0.99	0.97	1.02
	(1.16)	(1.15)	(1.20)
Self-employed	0.33		
	(0.47)		
Observations	8,303,076	5,581,395	2,721,681

Note: Standard deviations are in parentheses.

Table C.18: Summary statistics, 2001

	Full sample	Wage and salary	Self-employed
Taxable income	36,948.9	37,264.4	36,301.3
	(119,048.9)	(41,972.8)	(199,113.1)
Salary and wage income	31,064.4	37,121.7	18,631.4
	(36,268.2)	(34,375.8)	(36,876.7)
Total deductions	1,626.5	1,464.5	1,959.0
	(17,045.9)	(5,015.6)	(28,899.1)
Age	39.6	37.4	44.2
	(12.0)	(11.7)	(11.4)
Female	0.45	0.46	0.44
	(0.50)	(0.50)	(0.50)
Has a spouse	0.60	0.55	0.71
	(0.49)	(0.50)	(0.45)
Number of children	1.01	1.01	1.03
	(1.17)	(1.15)	(1.20)
Self-employed	0.33		
	(0.47)		
Observations	8,153,707	5,482,591	2,671,116

Note: Standard deviations are in parentheses.

Table C.19: Summary statistics, 2000

	Full sample	Wage and salary	Self-employed
Taxable income	35,791.4	36,033.3	35,286.1
	(112,722.7)	(33,780.0)	(192,020.9)
Salary and wage income	29,679.0	35,730.7	17,034.0
	(31,231.9)	(27,227.3)	(35,045.4)
Total deductions	1,462.0	1,329.5	1,739.1
	(8,515.5)	(4,331.6)	(13,591.0)
Age	39.3	37.2	43.7
	(12.0)	(11.6)	(11.5)
Female	0.45	0.46	0.43
	(0.50)	(0.50)	(0.49)
Has a spouse	0.59	0.55	0.69
	(0.49)	(0.50)	(0.46)
Number of children	1.09	1.09	1.11
	(1.18)	(1.16)	(1.22)
Self-employed	0.32		
	(0.47)		
Observations	8,018,459	5,423,089	2,595,370

Note: Standard deviations are in parentheses.

Appendix D. Distribution of taxable income, 2000 to 2018

Figure D.1: Distribution of taxable income in 2018

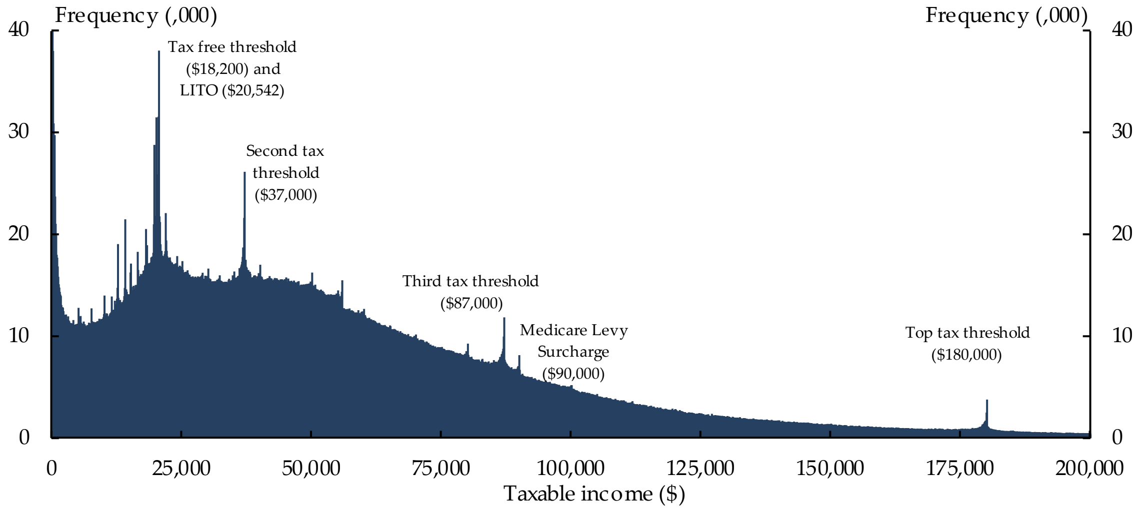


Figure D.2: Distribution of taxable income in 2017

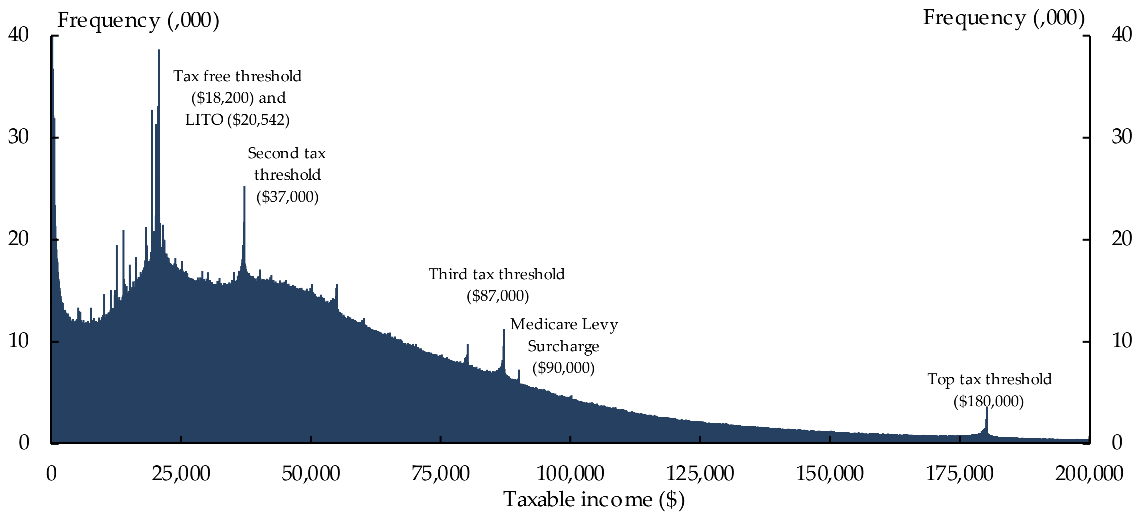


Figure D.3: Distribution of taxable income in 2016

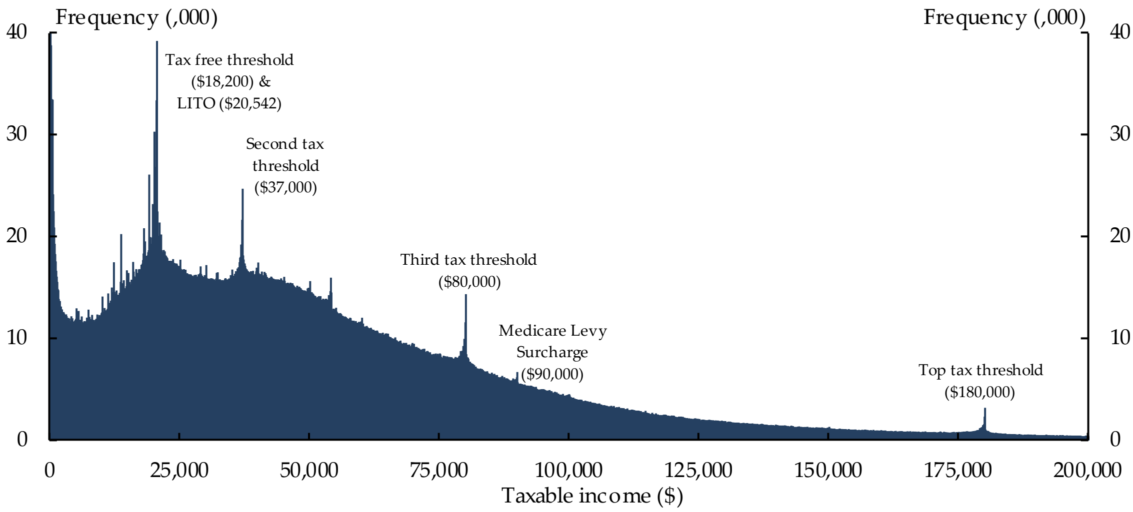


Figure D.4: Distribution of taxable income in 2015

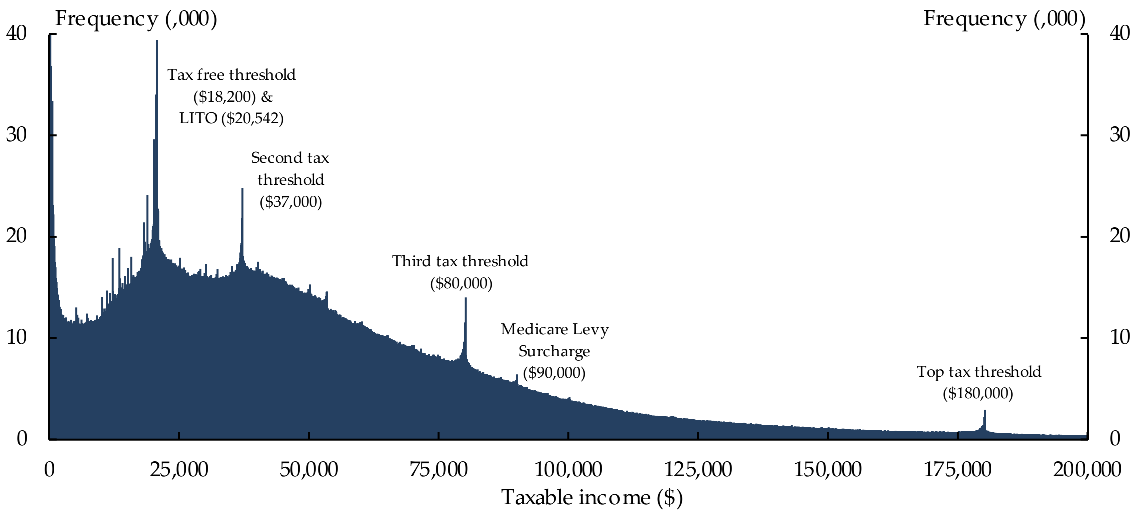


Figure D.5: Distribution of taxable income in 2014

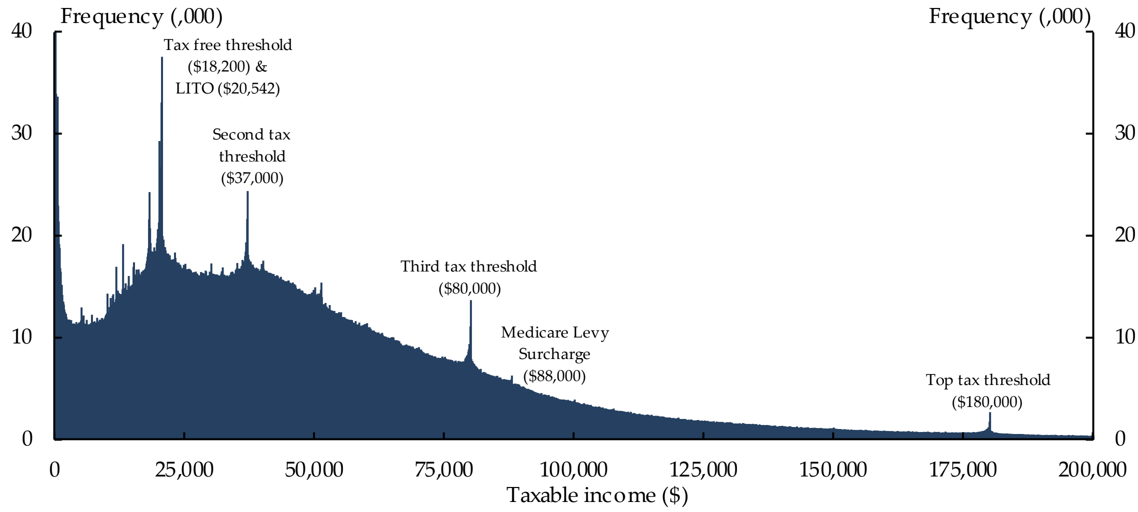


Figure D.6: Distribution of taxable income in 2013

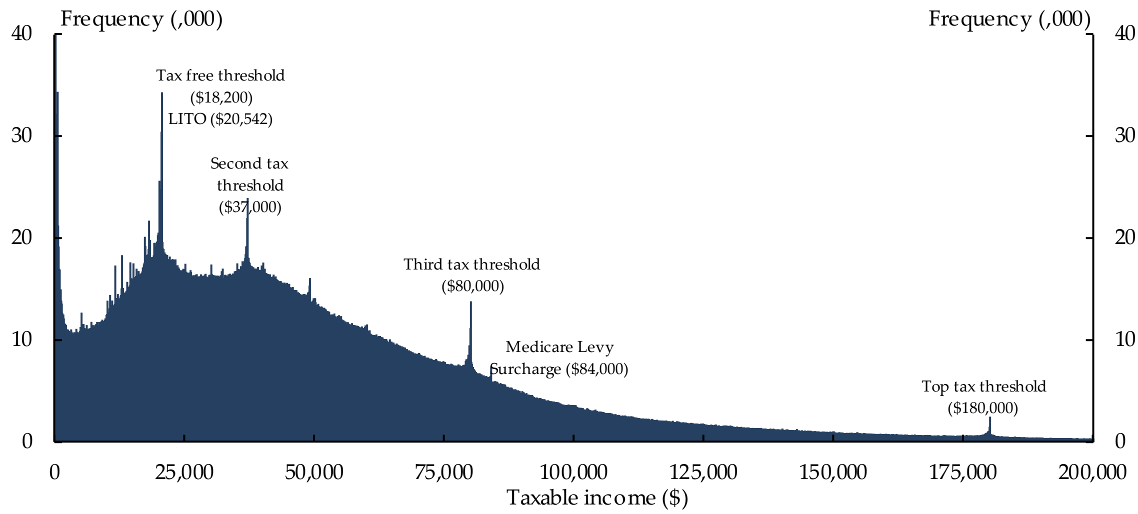


Figure D.7: Distribution of taxable income in 2012

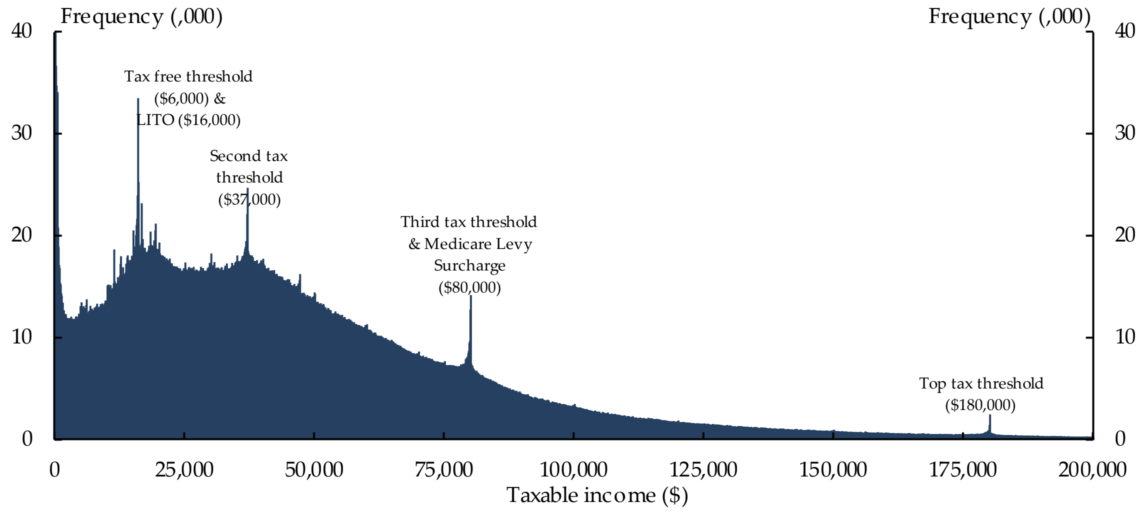


Figure D.8: Distribution of taxable income in 2011

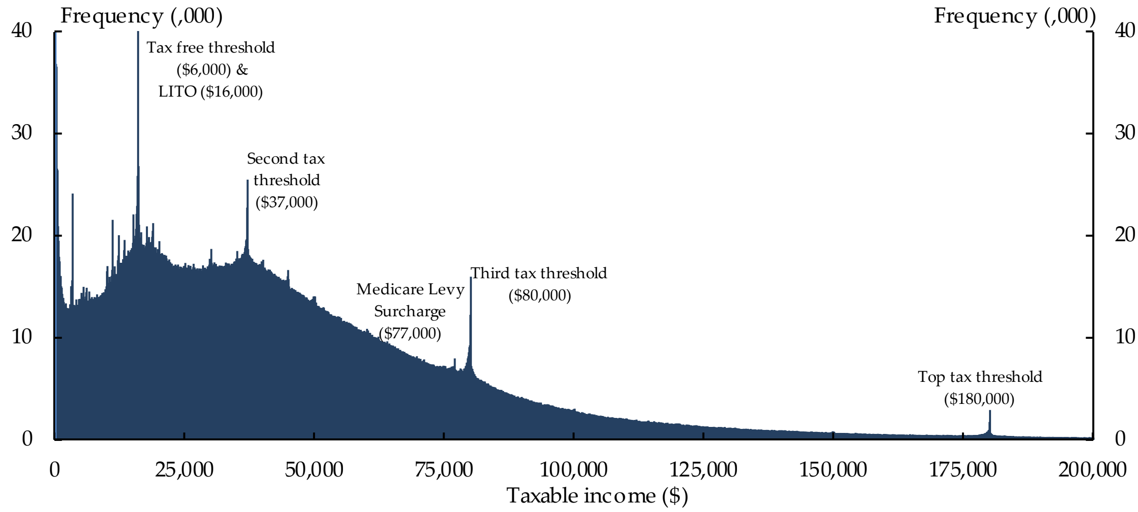


Figure D.9: Distribution of taxable income in 2010

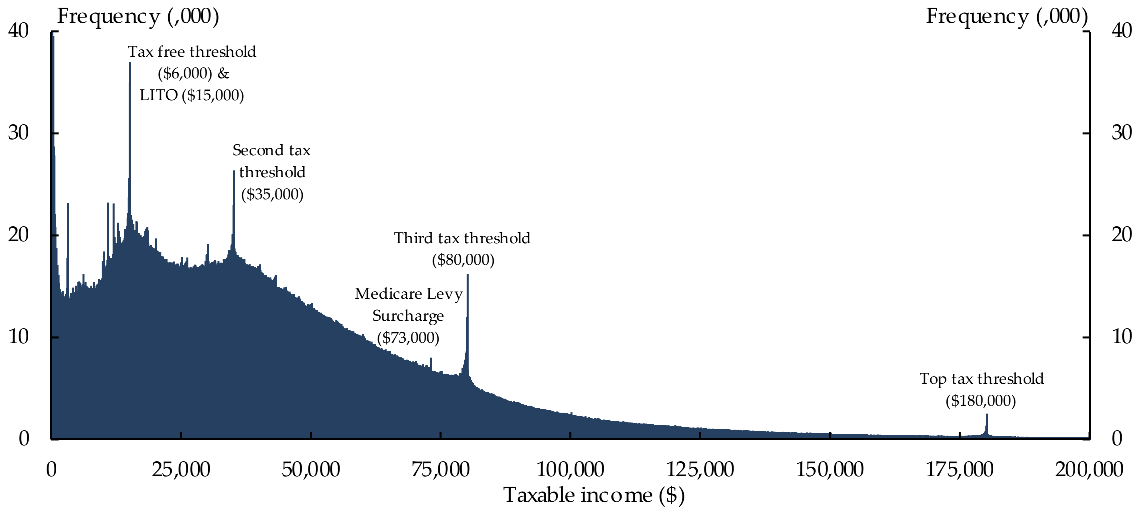


Figure D.10: Distribution of taxable income in 2009

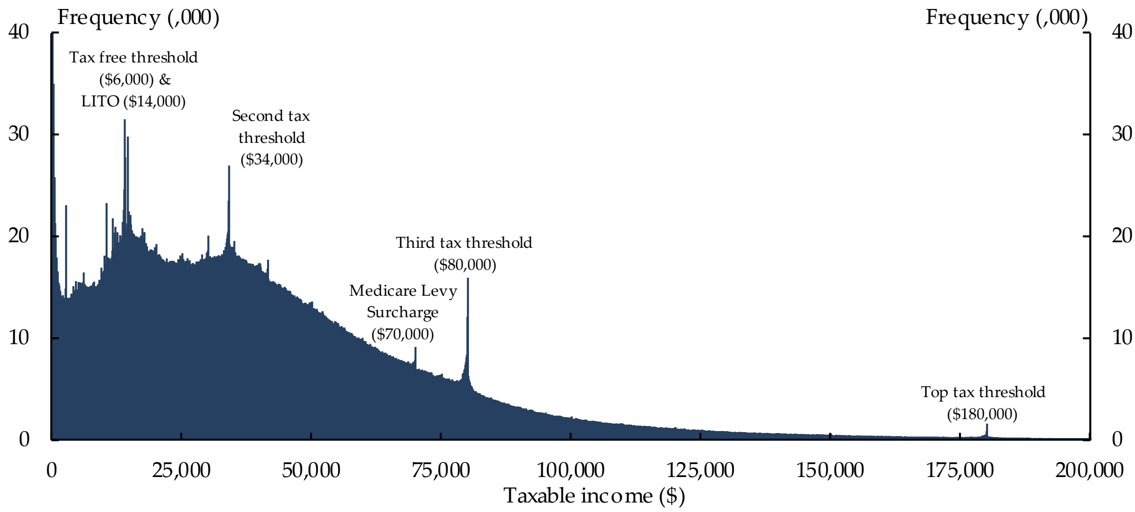


Figure D.11: Distribution of taxable income in 2008

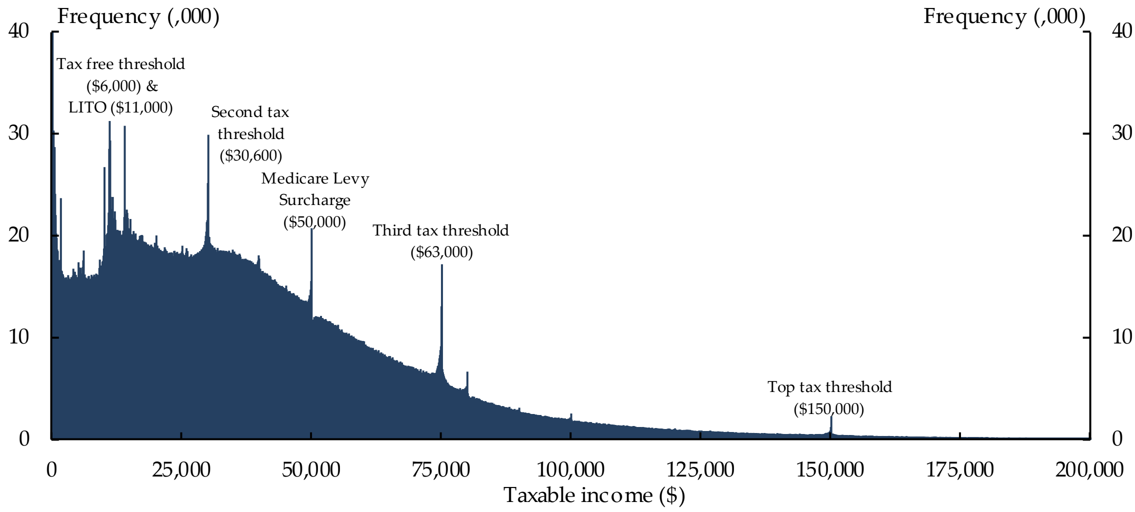


Figure D.12: Distribution of taxable income in 2007

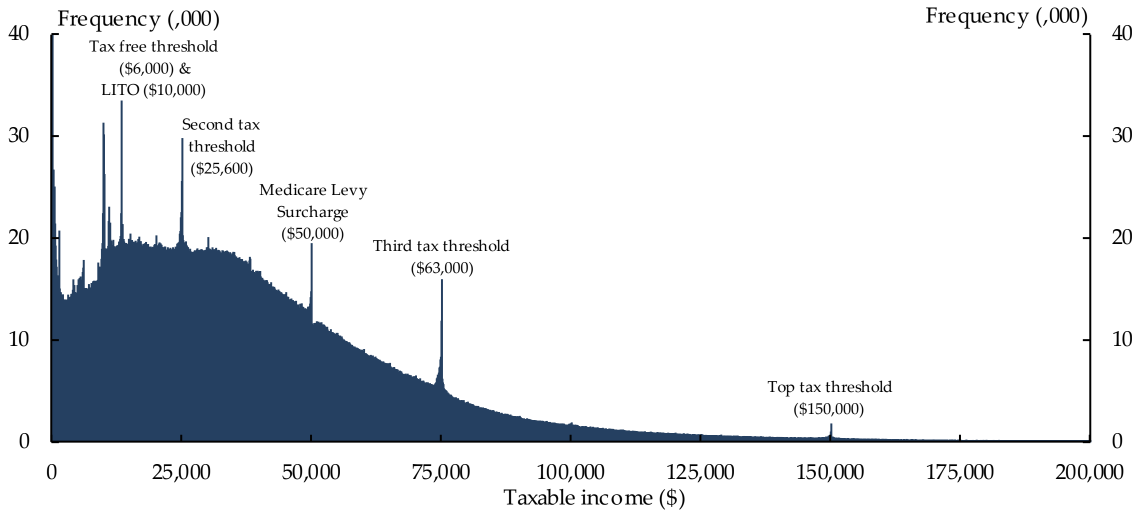


Figure D.13: Distribution of taxable income in 2006

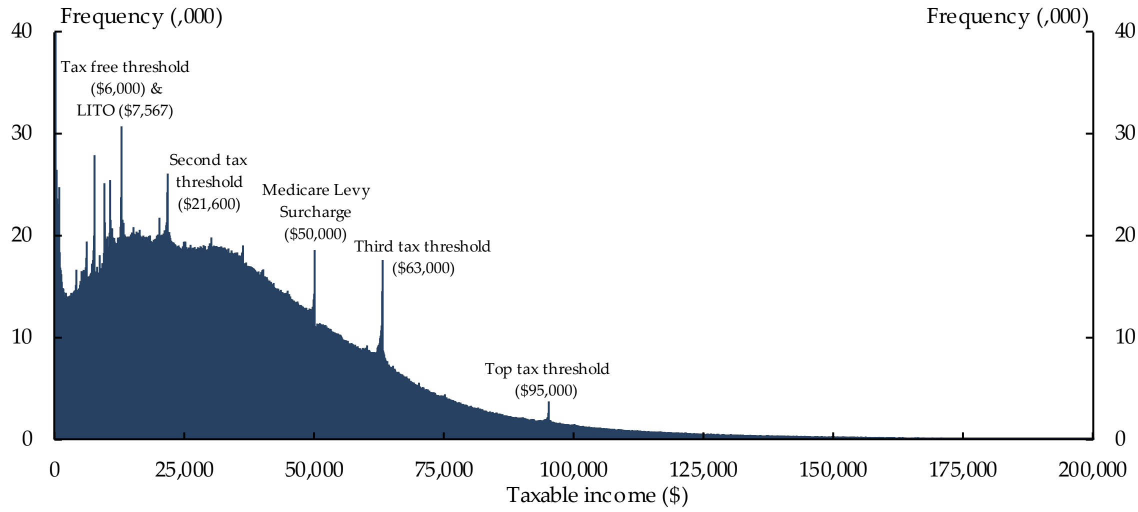


Figure D.14: Distribution of taxable income in 2005

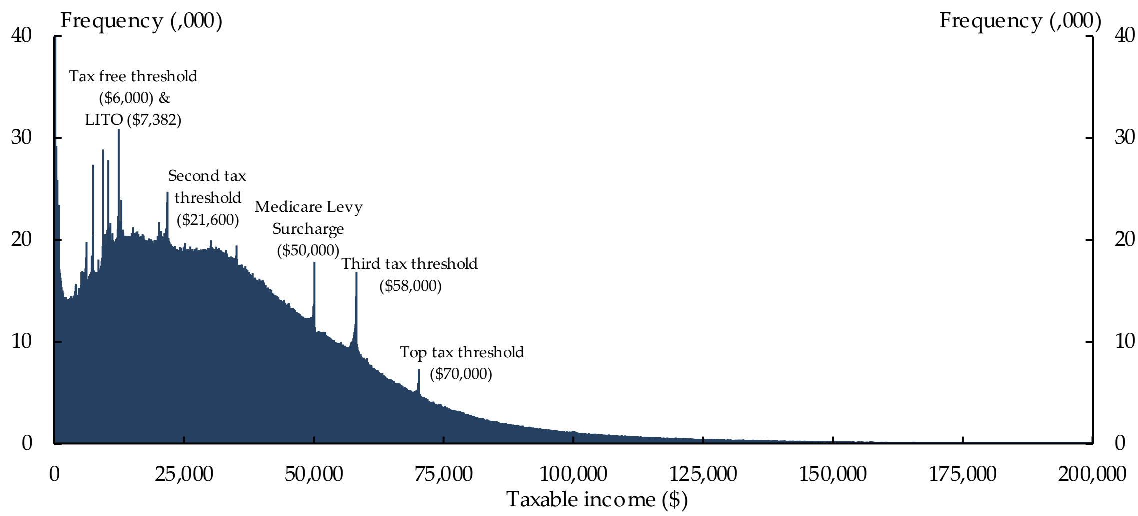


Figure D.15: Distribution of taxable income in 2004

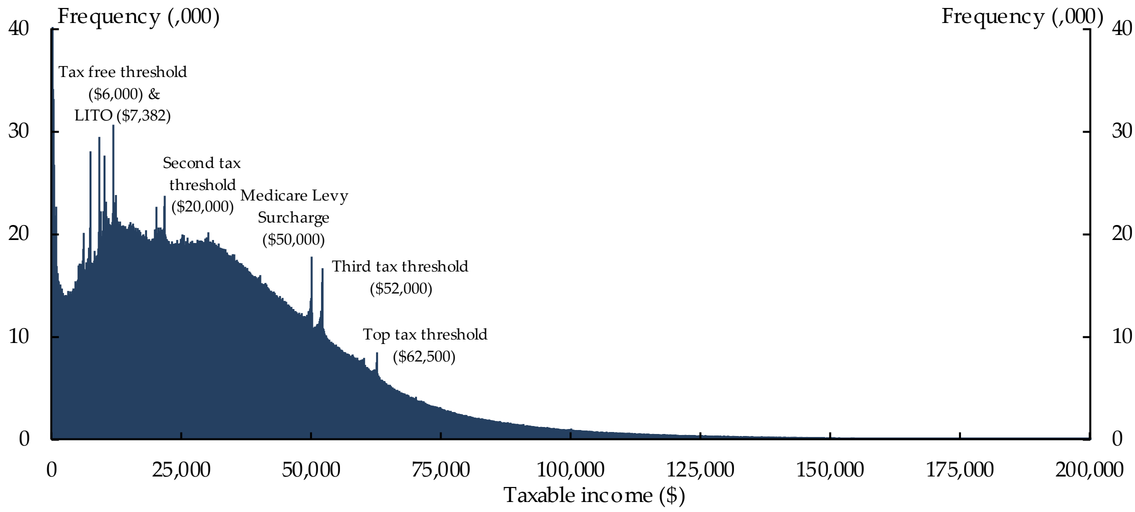


Figure D.16: Distribution of taxable income in 2003

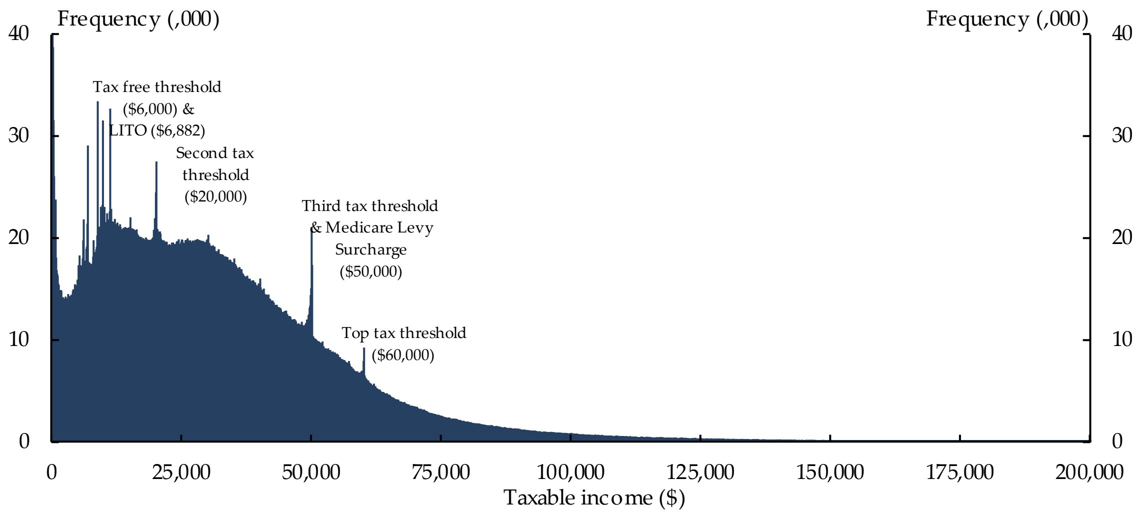


Figure D.17: Distribution of taxable income in 2002

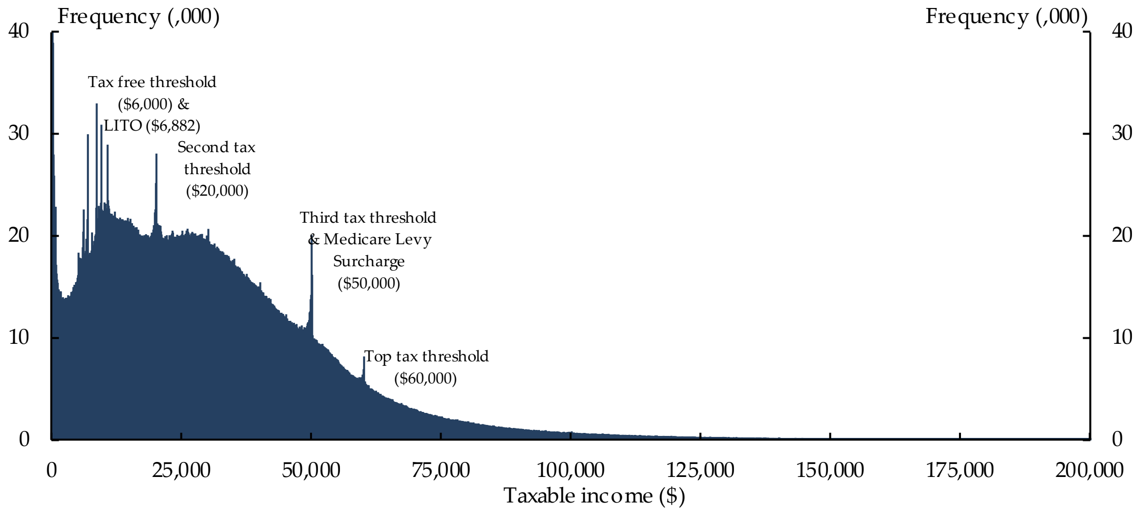


Figure D.18: Distribution of taxable income in 2001

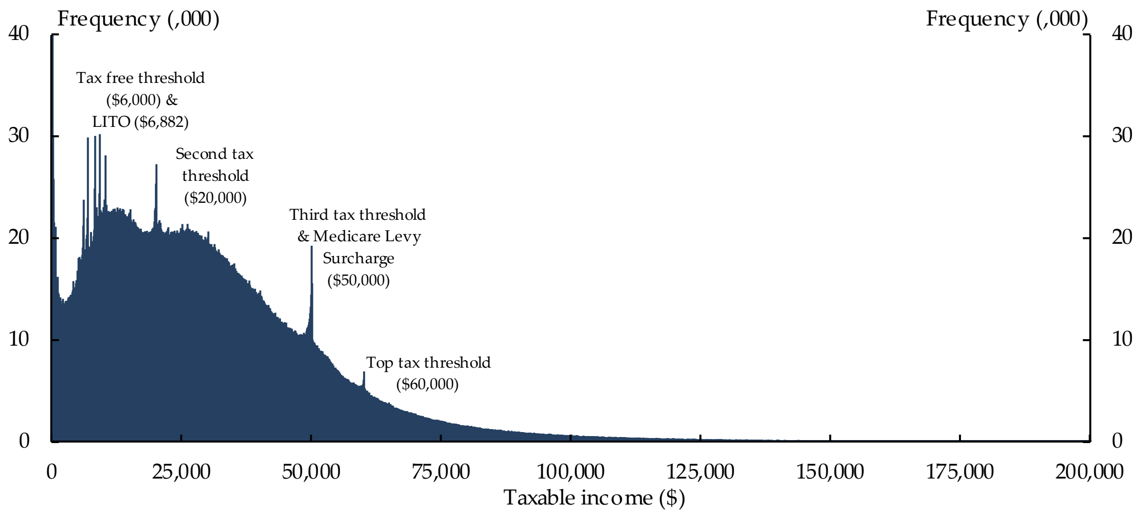
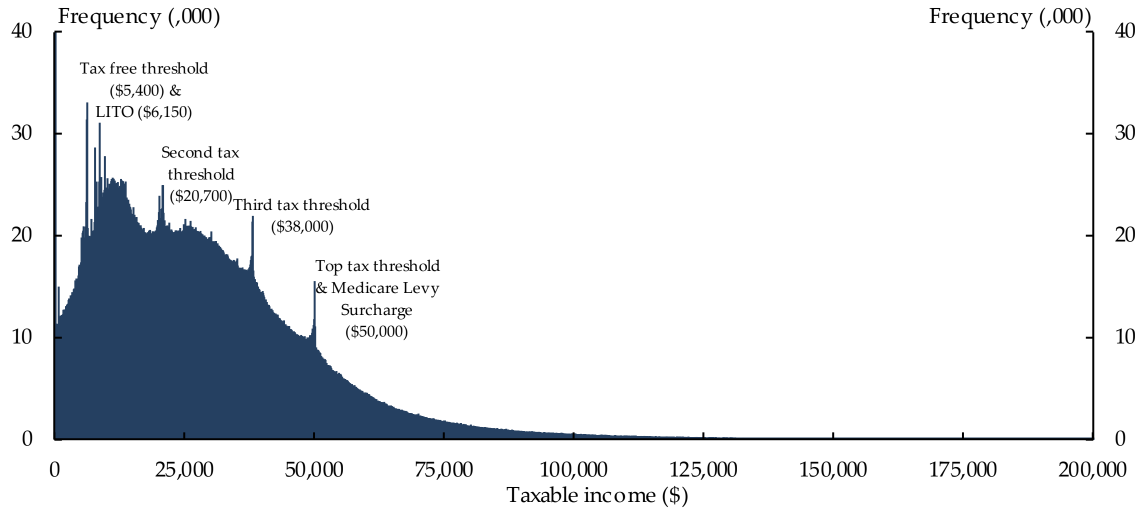
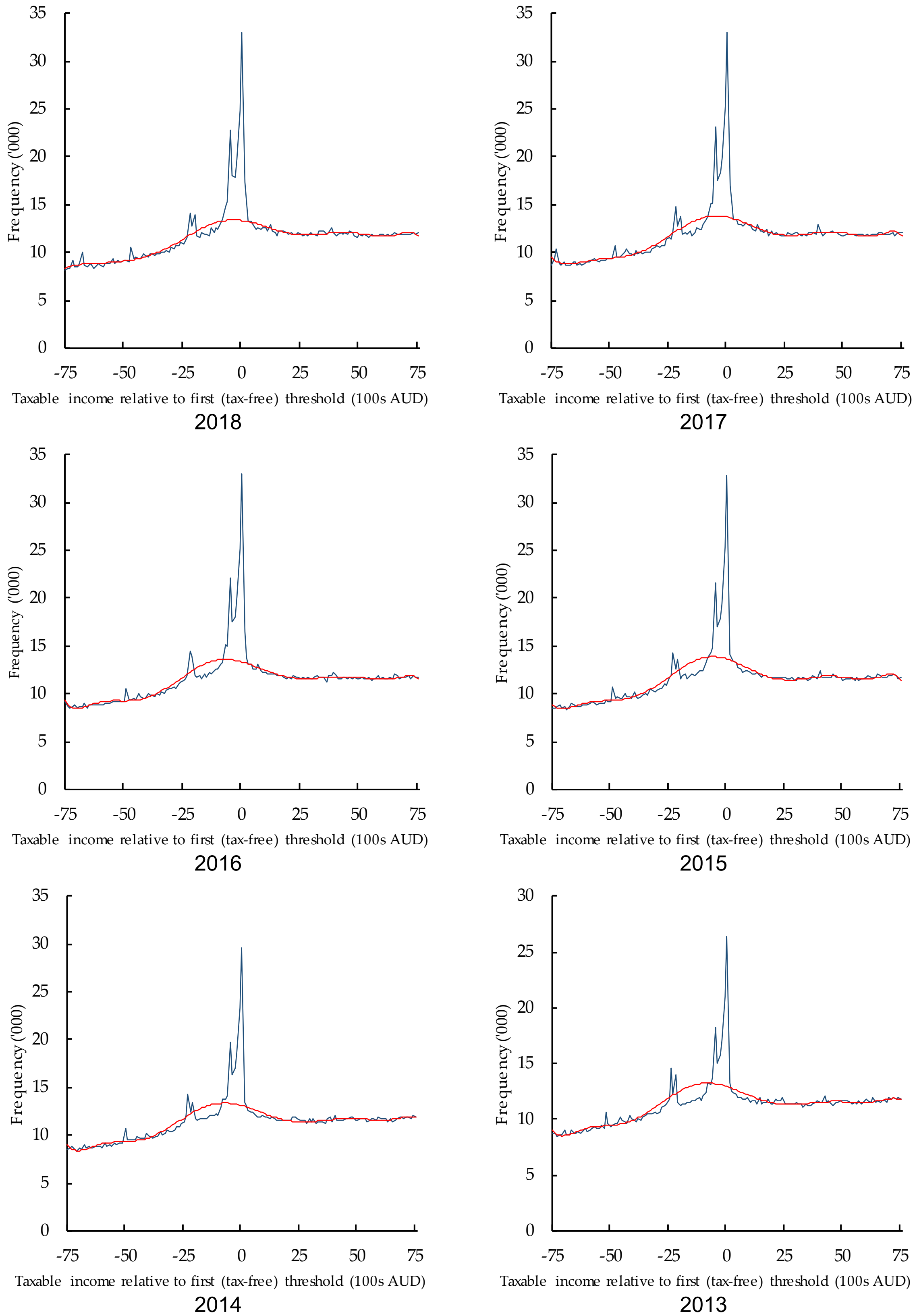


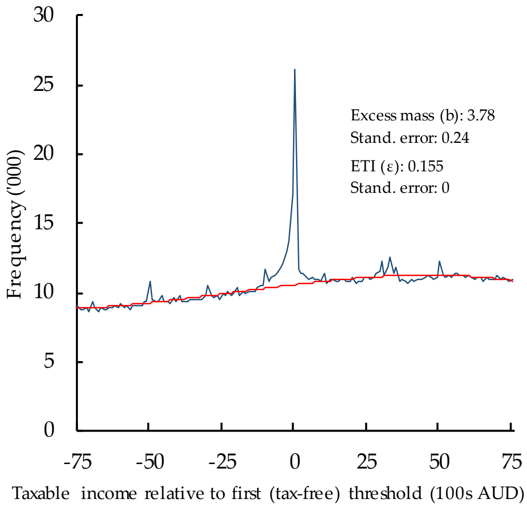
Figure D.19: Distribution of taxable income in 2000



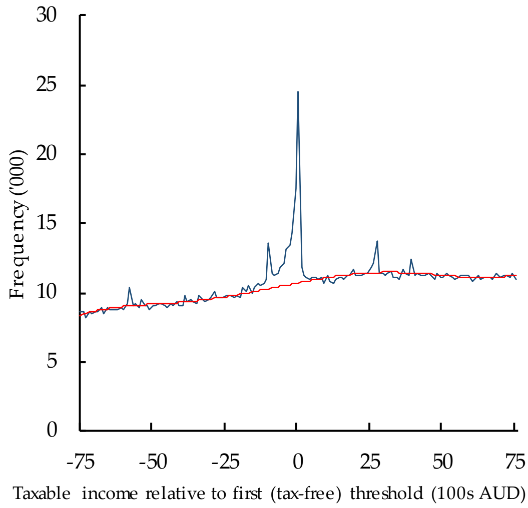
Appendix E. Bunching at thresholds

Figure E.1: Bunching and Elasticity of ETI – first (tax-free) threshold

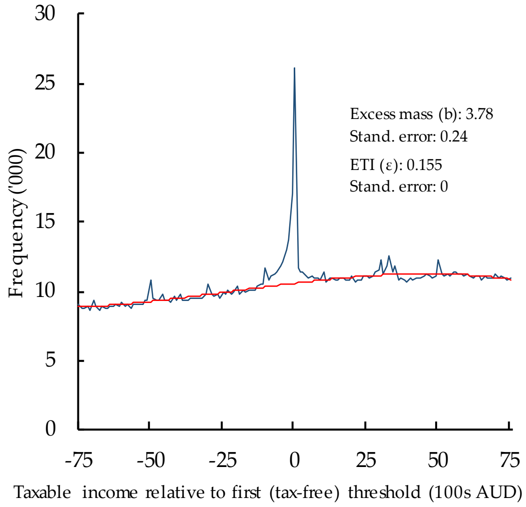




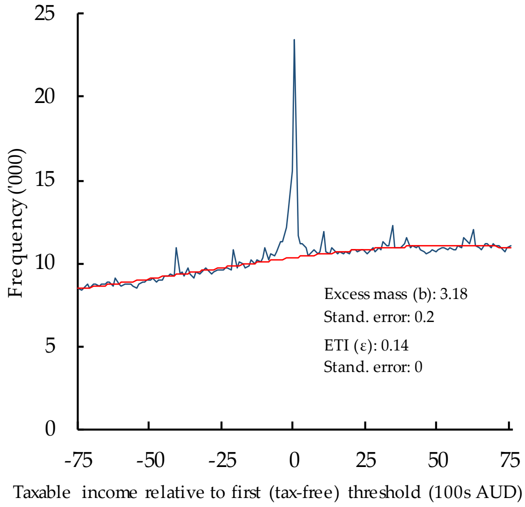
2012



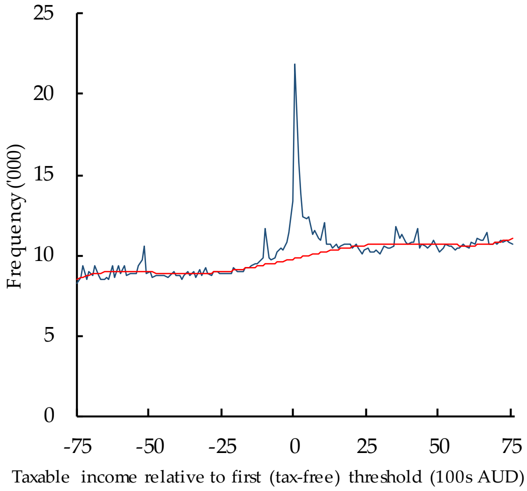
2011



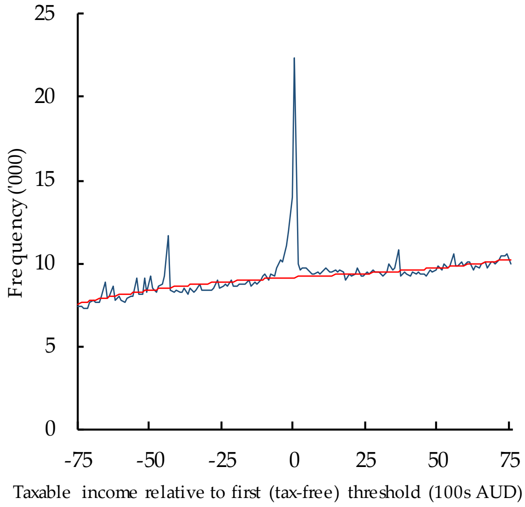
2010



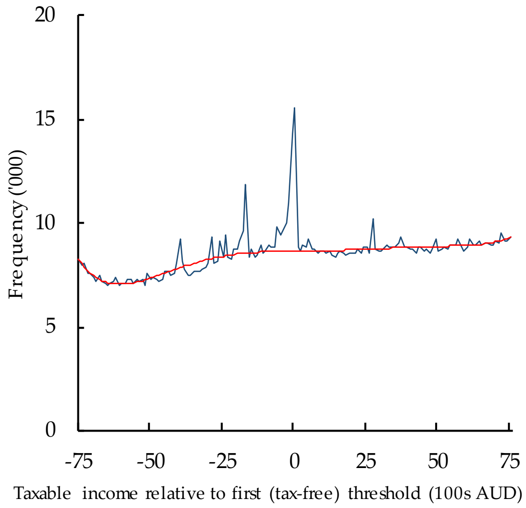
2009



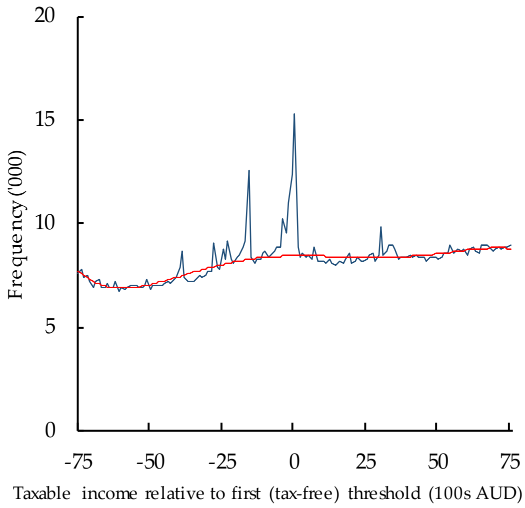
2008



2007



2006



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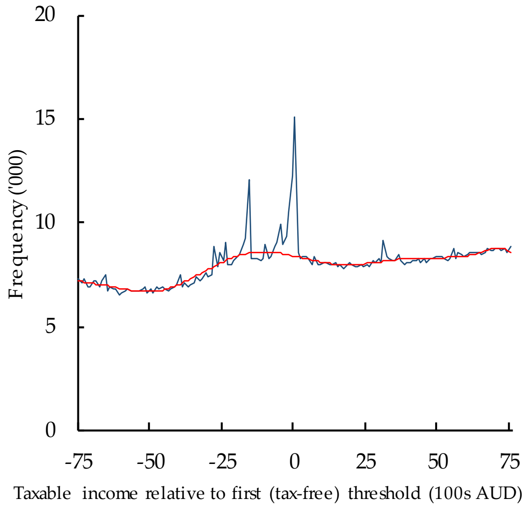

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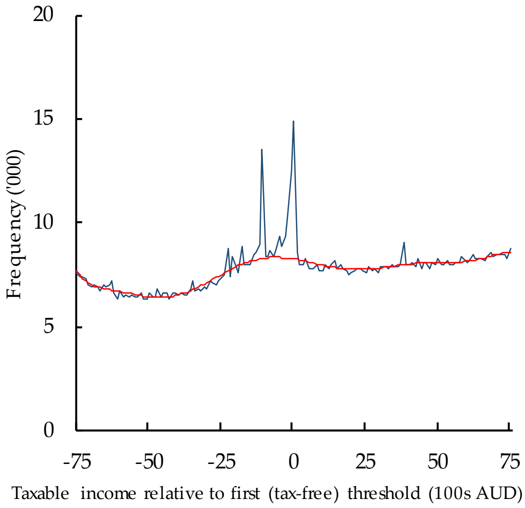

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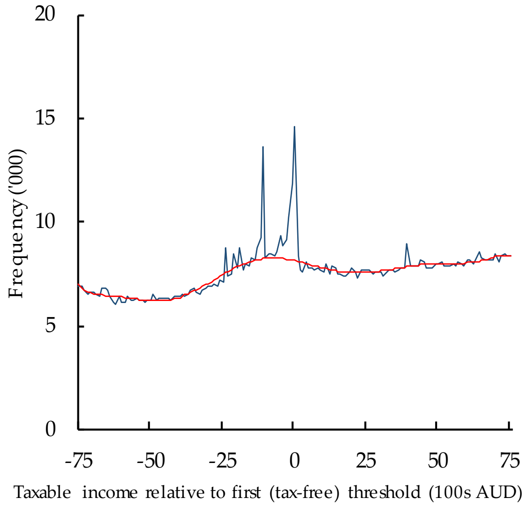

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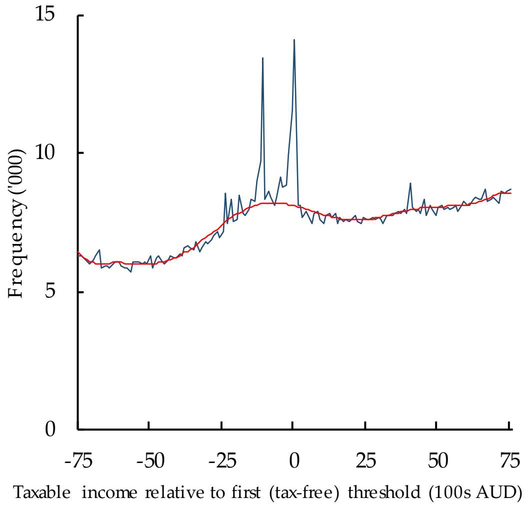

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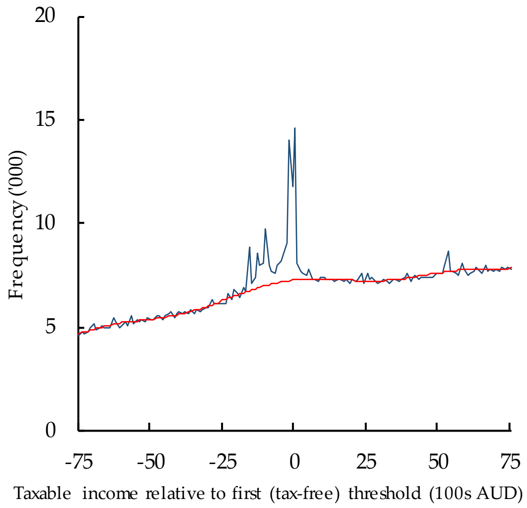
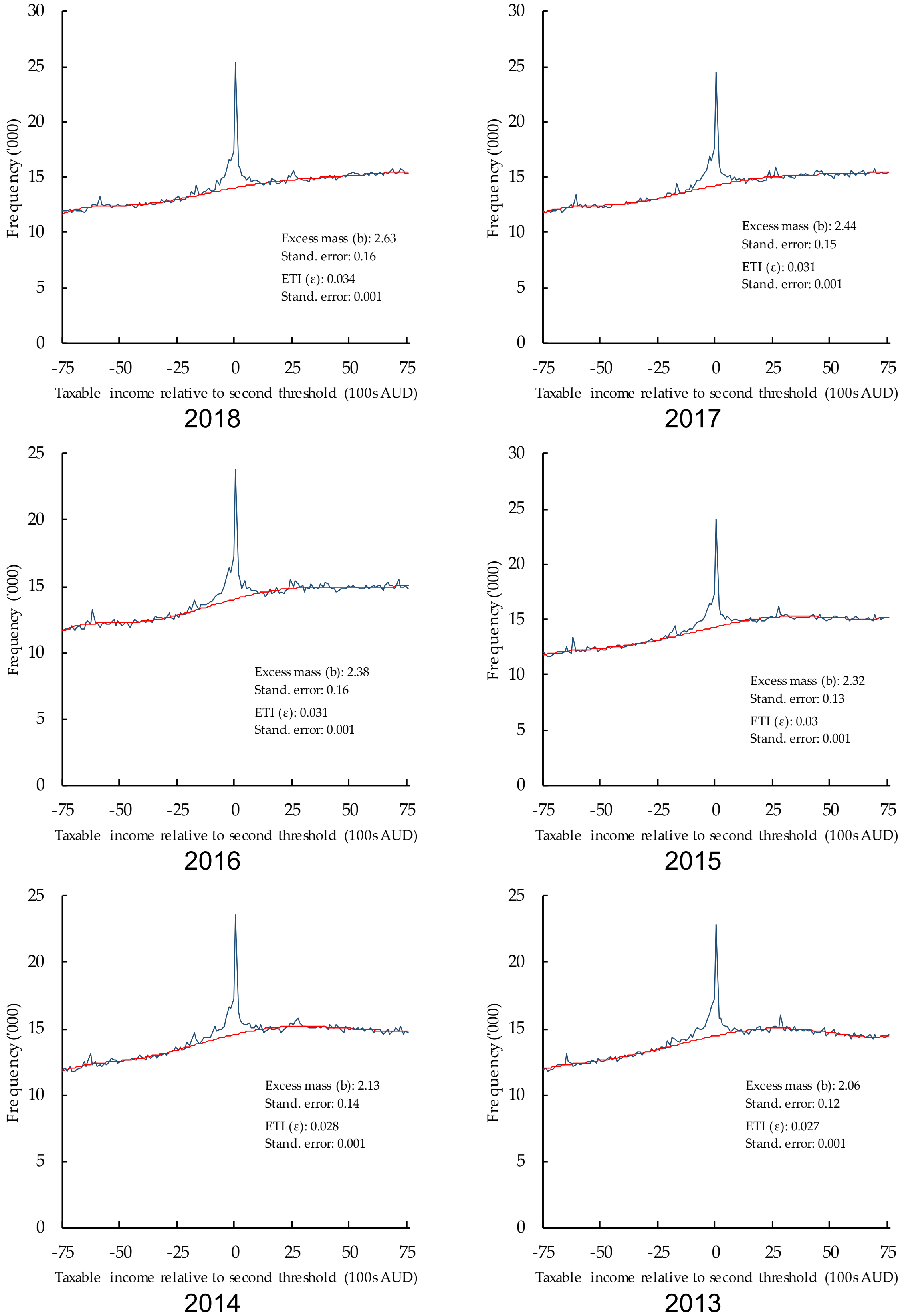
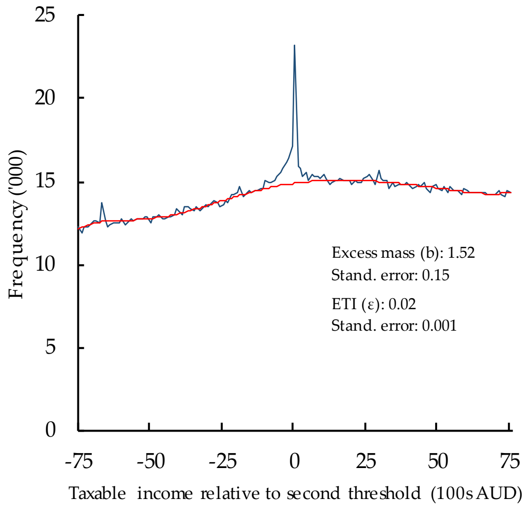


2000

Note: The x-axis denotes the normalized taxable income, so the kink is at zero. Standard errors are estimated using a nonparametric bootstrapping. See Appendix B for details. Estimates for the bunching and ETI are not presented for years where the distribution across the large bunching window (excluding the small bunching window) is not smooth (that is, where the income range includes additional notches or kinks).

Figure E.2: Bunching and ETI at the second kink from 2000 to 2018





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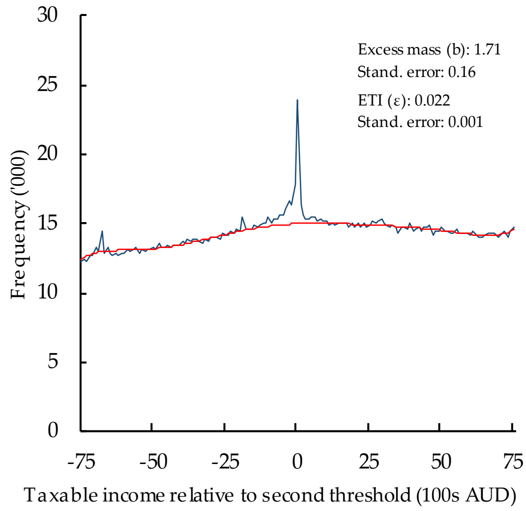

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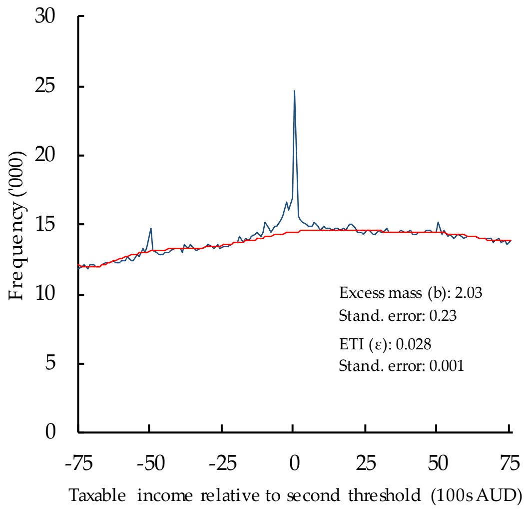

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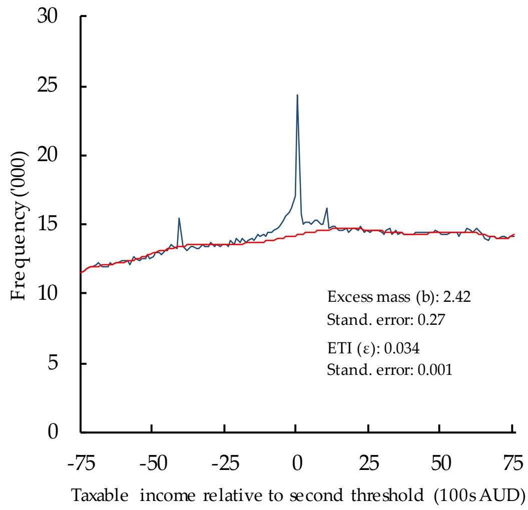

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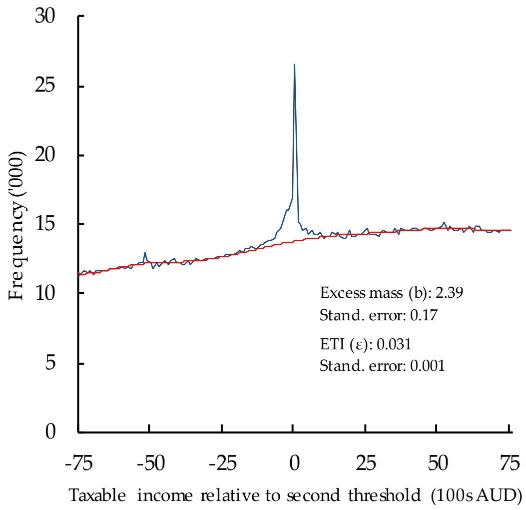

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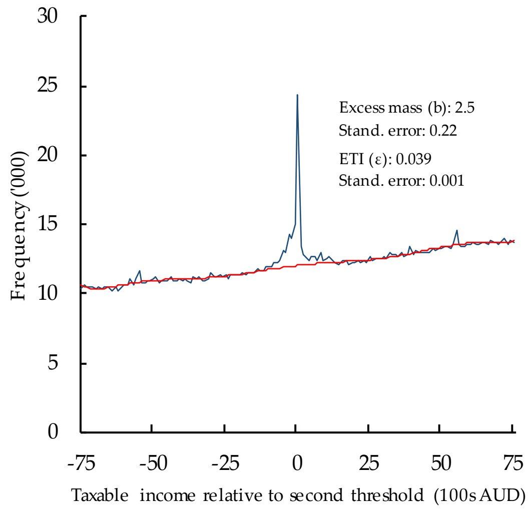

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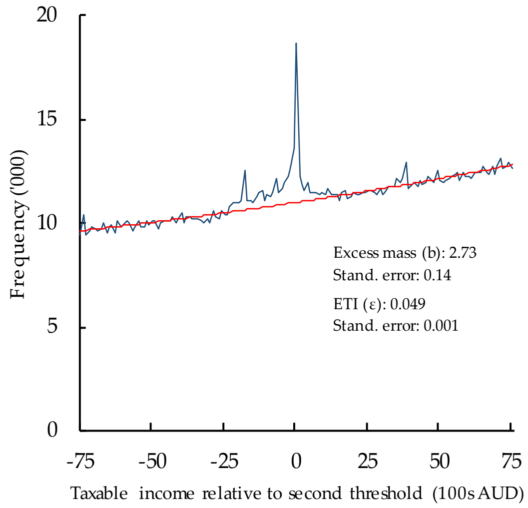

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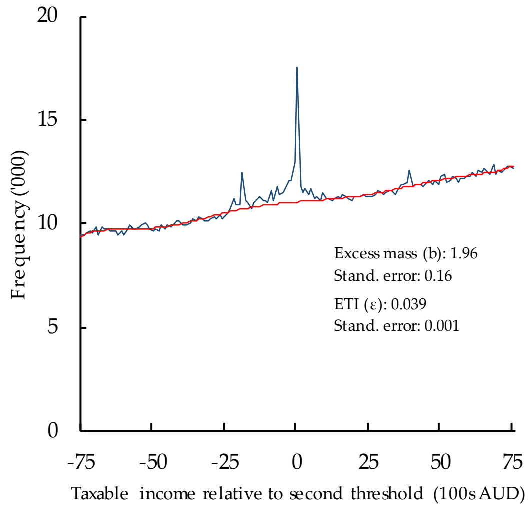

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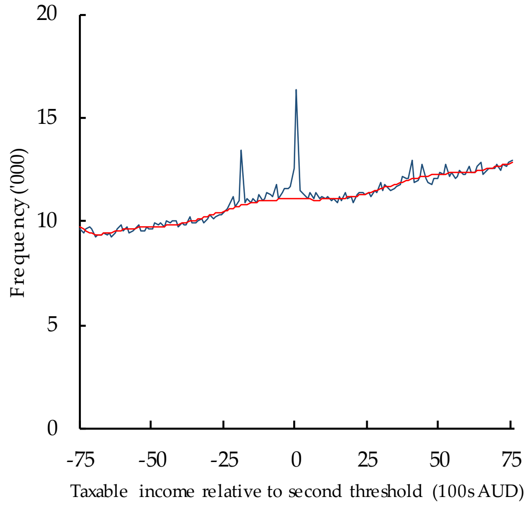

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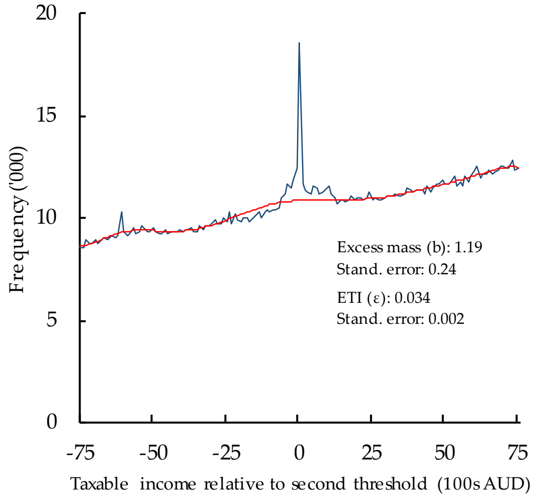

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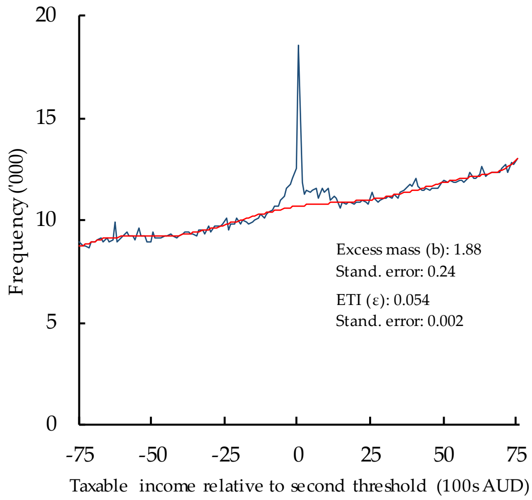

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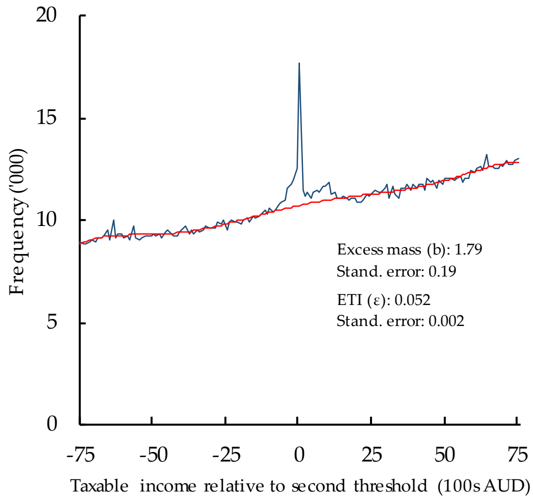

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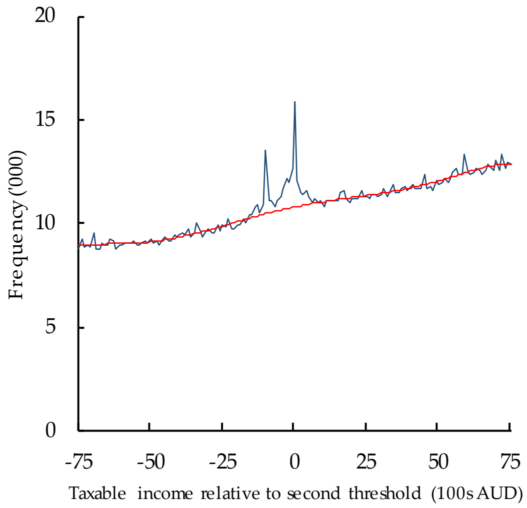
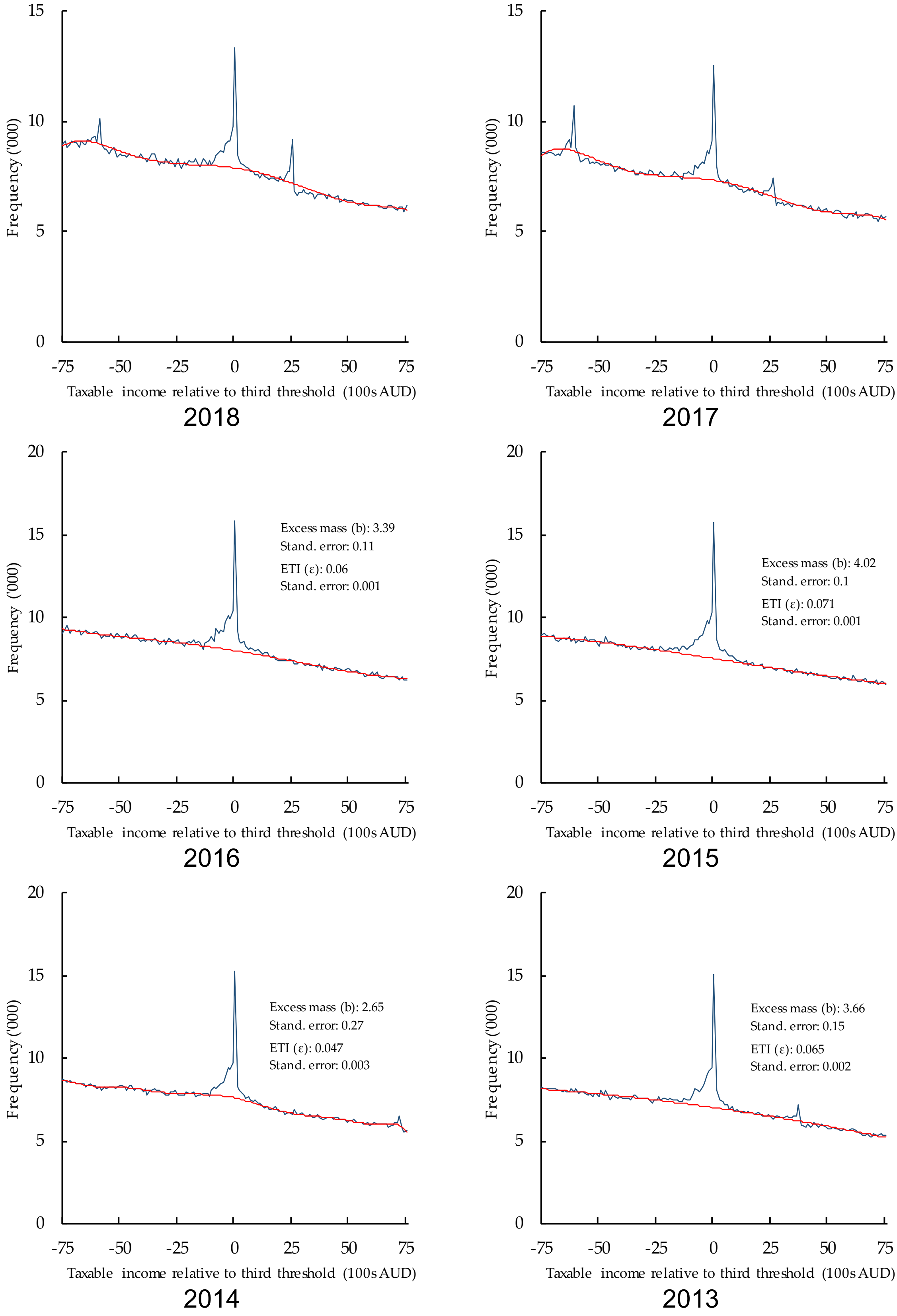
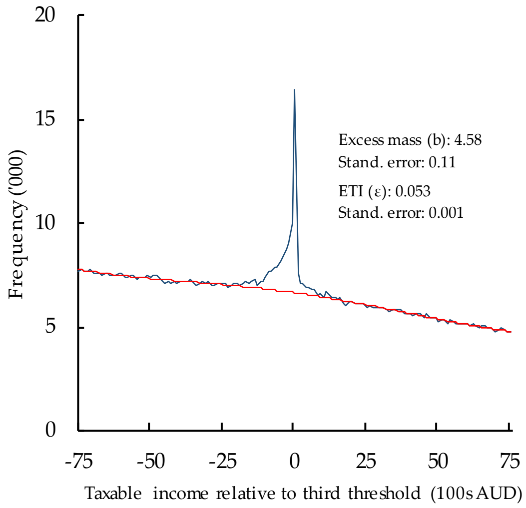


2000

Note: Estimates for the bunching and ETI are not presented for years where the distribution across the large bunching window (excluding the small bunching window) is not smooth (that is, where the income range includes additional notches or kinks).

Figure E.3: Bunching and ETI at the third kink from 2000 to 2018





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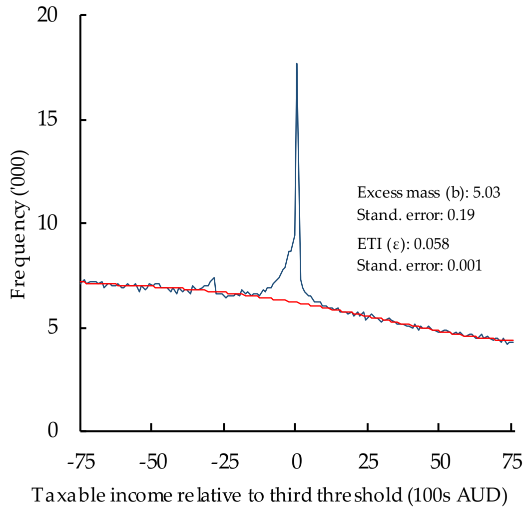

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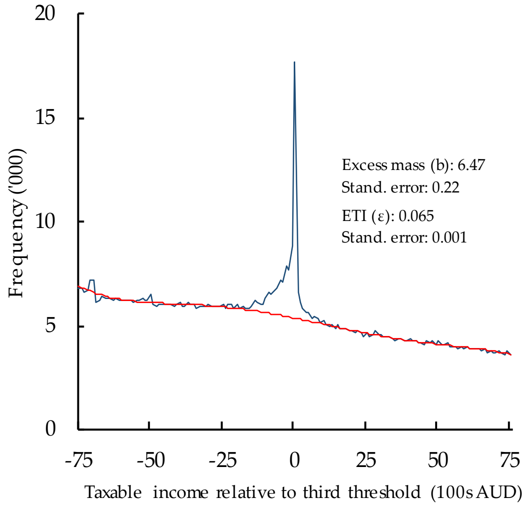

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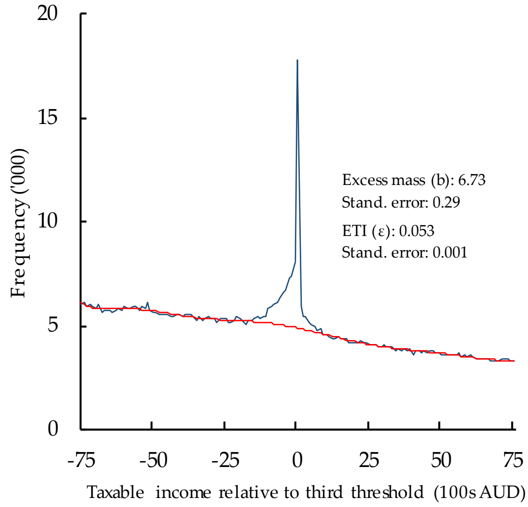

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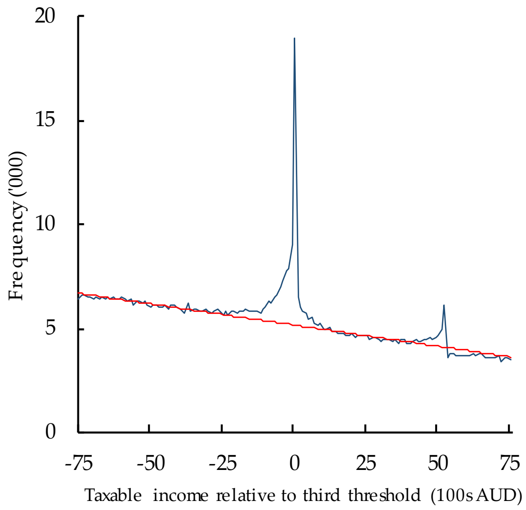

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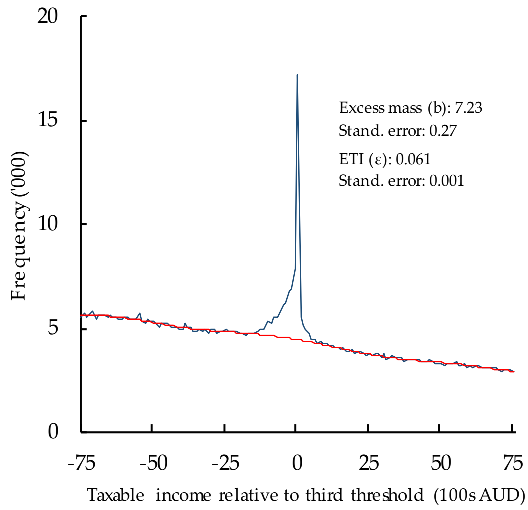

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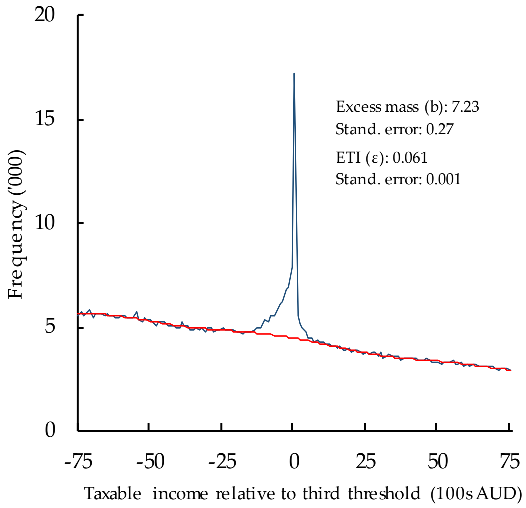

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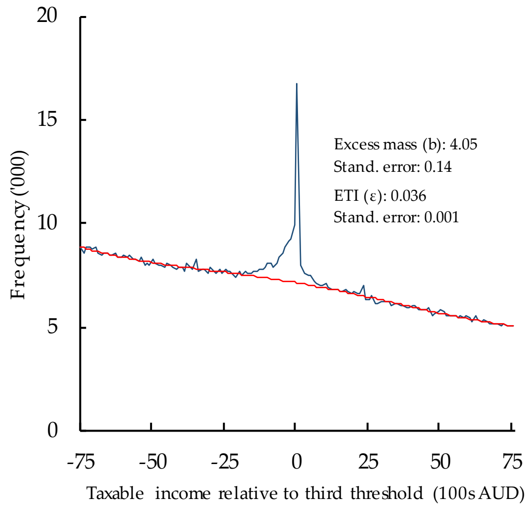

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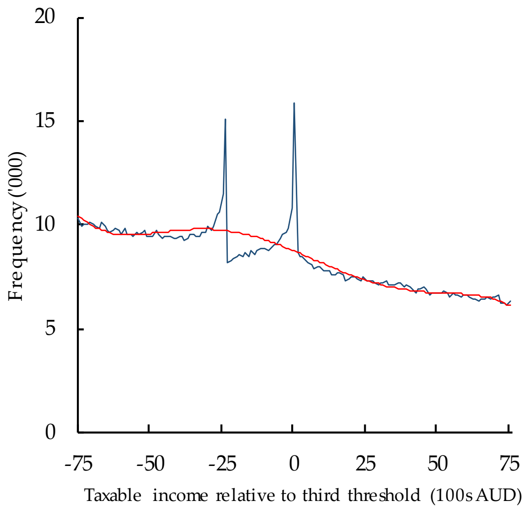

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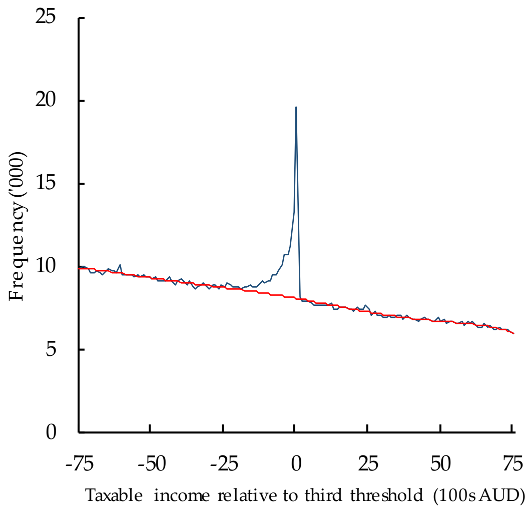

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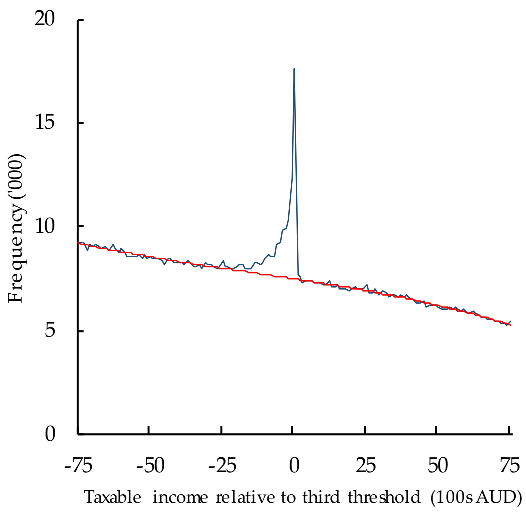

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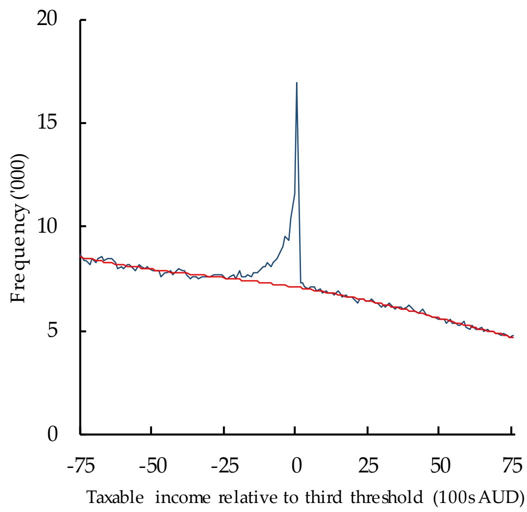

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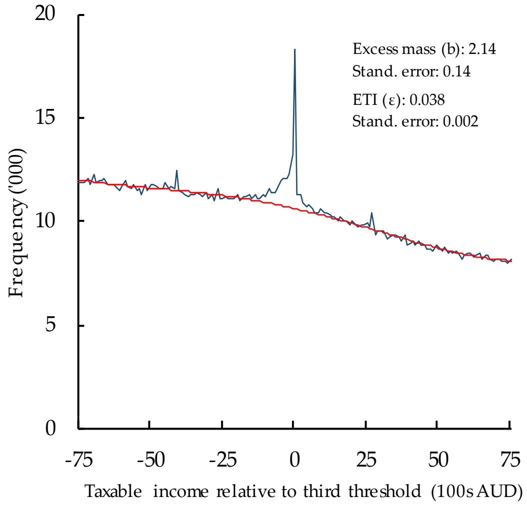
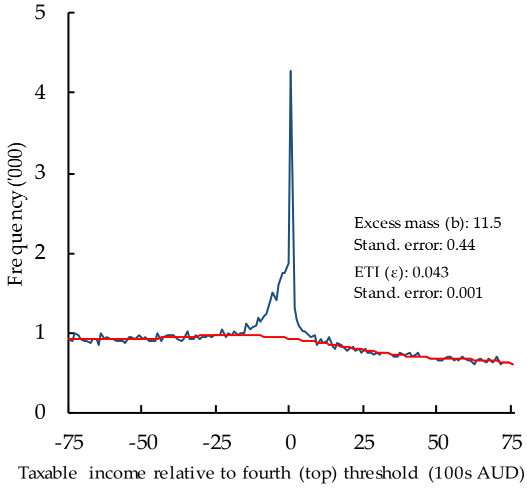


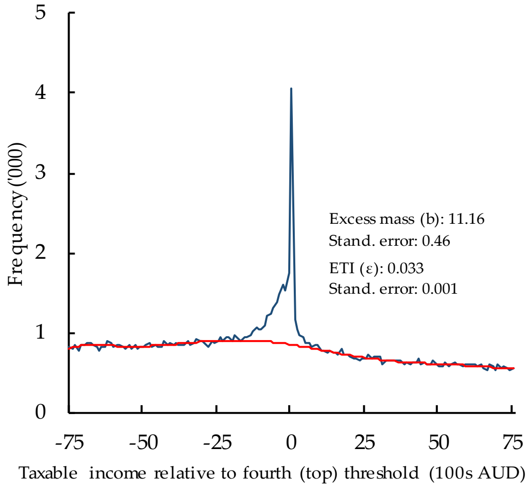
2000

Note: Estimates for the bunching and ETI are not presented for years where the distribution across the large bunching window (excluding the small bunching window) is not smooth (that is, where the income range includes additional notches or kinks).

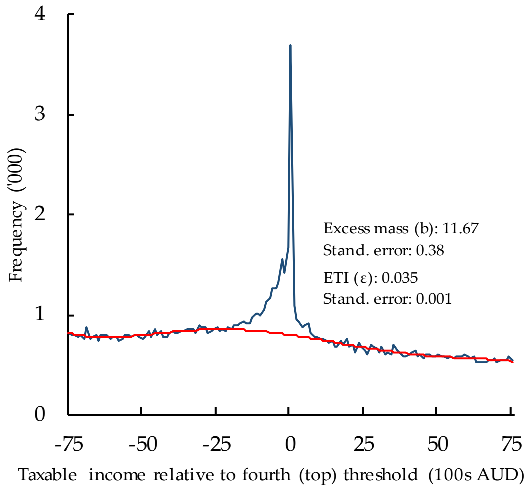
Figure E.4: Bunching and ETI at the top kink from 2000 to 2018



2018



2017



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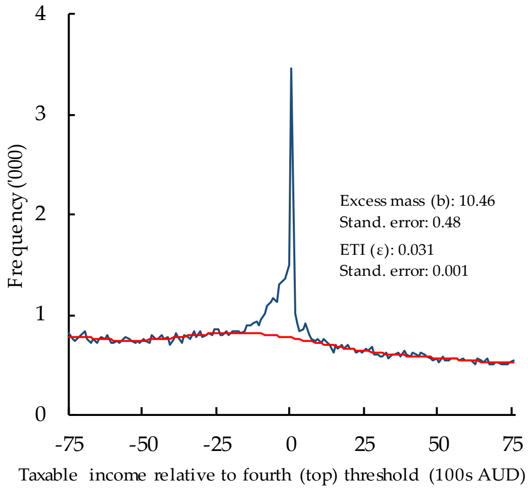

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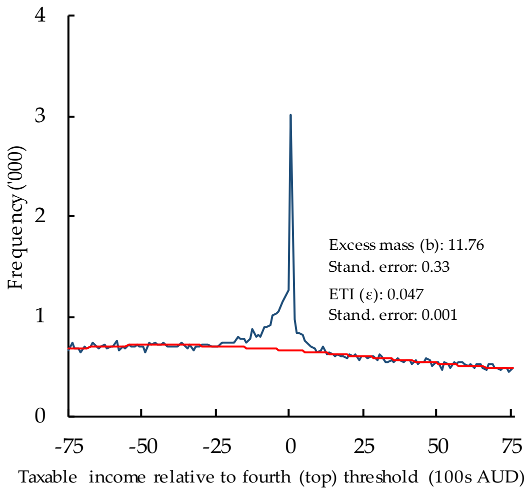

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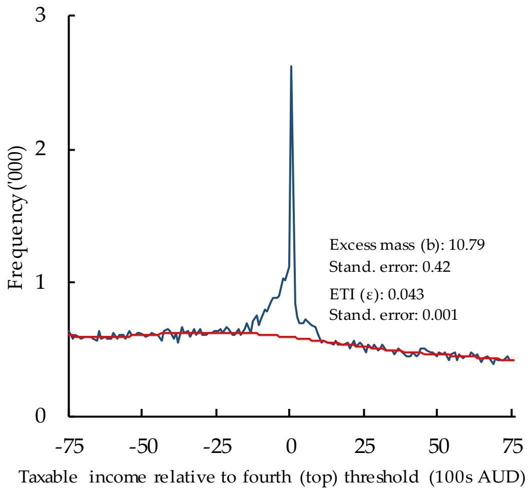

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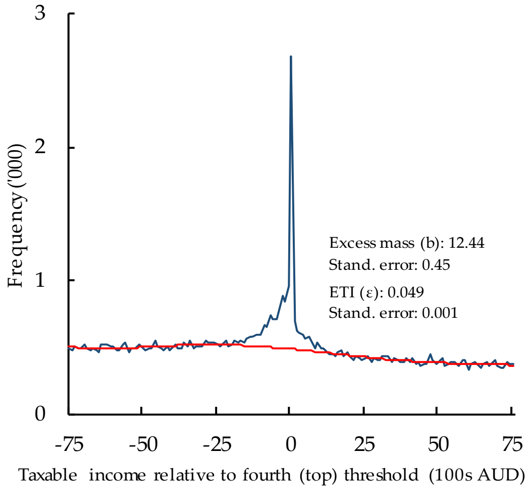

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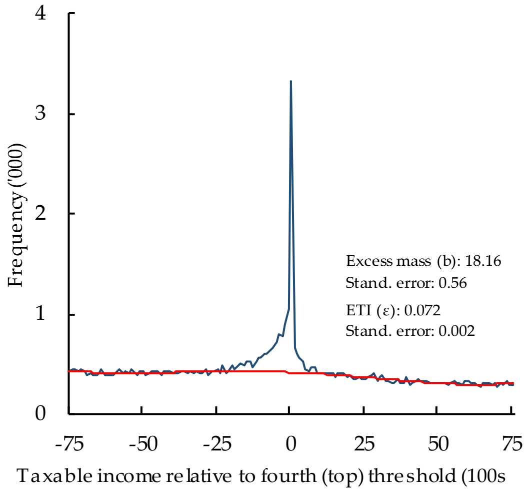

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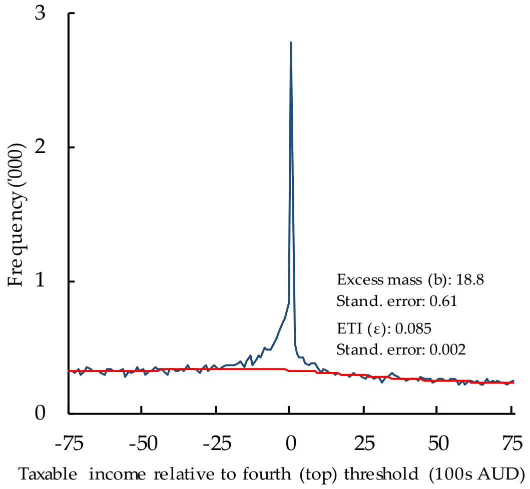

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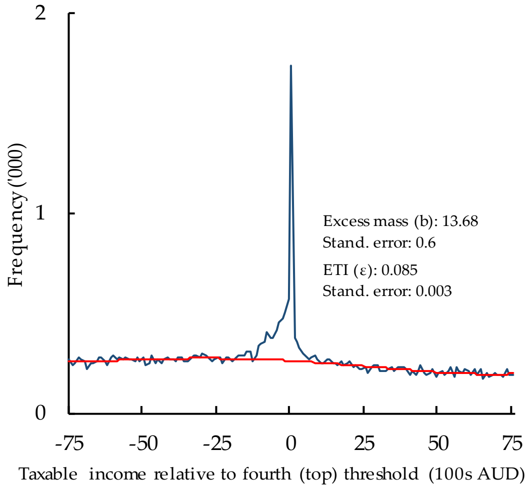

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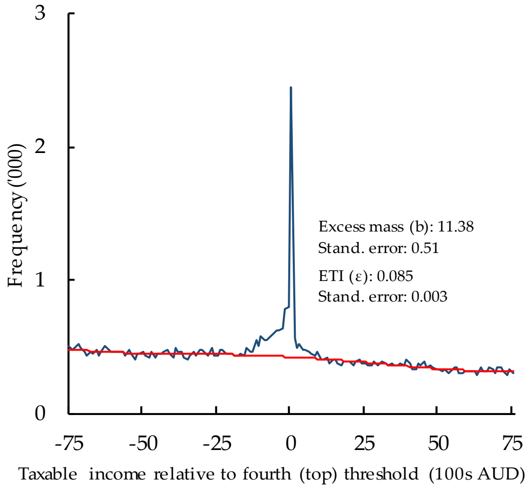

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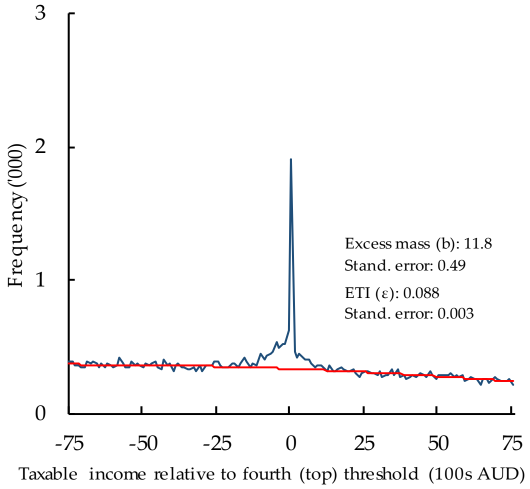

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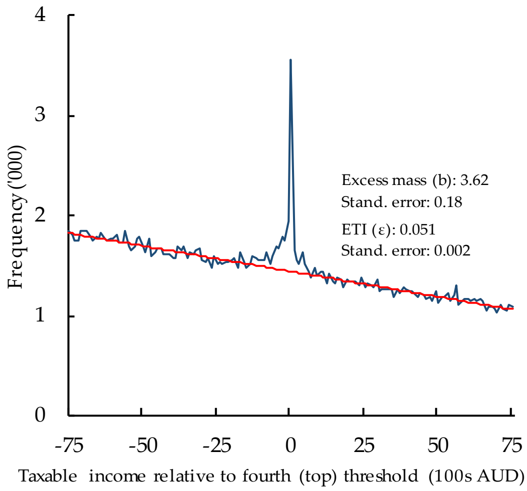

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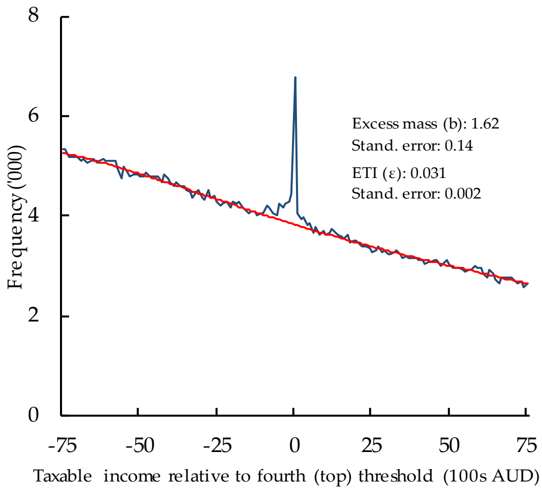

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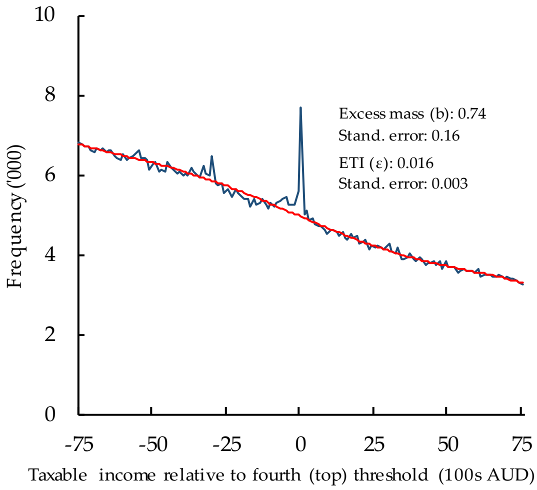

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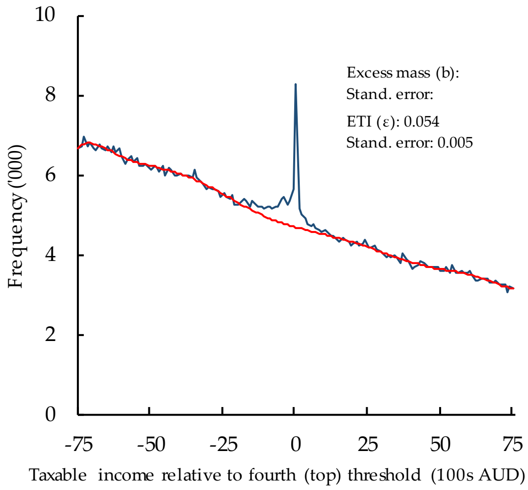

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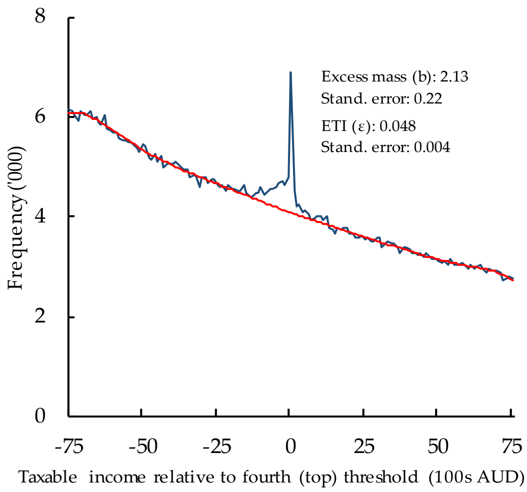

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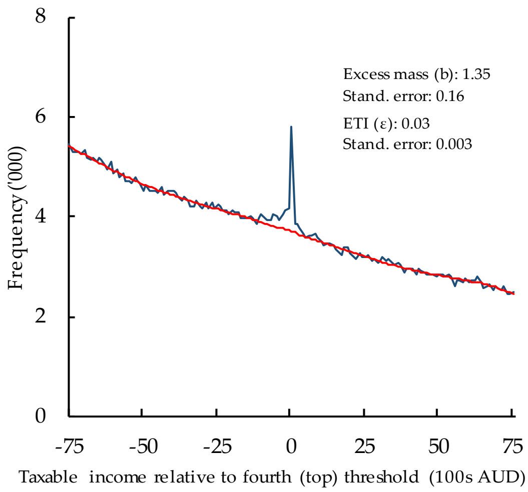

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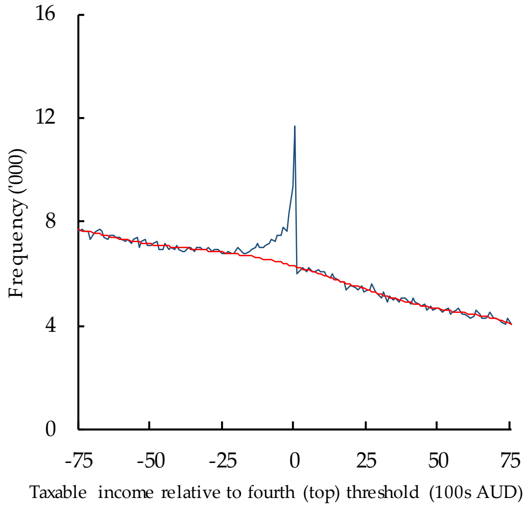


2000

Note: Estimates for the bunching and ETI are not presented for years where the distribution across the large bunching window (excluding the small bunching window) is not smooth (that is, where the income range includes additional notches or kinks).

Appendix F. Self-employment – definition and sensitivity analysis

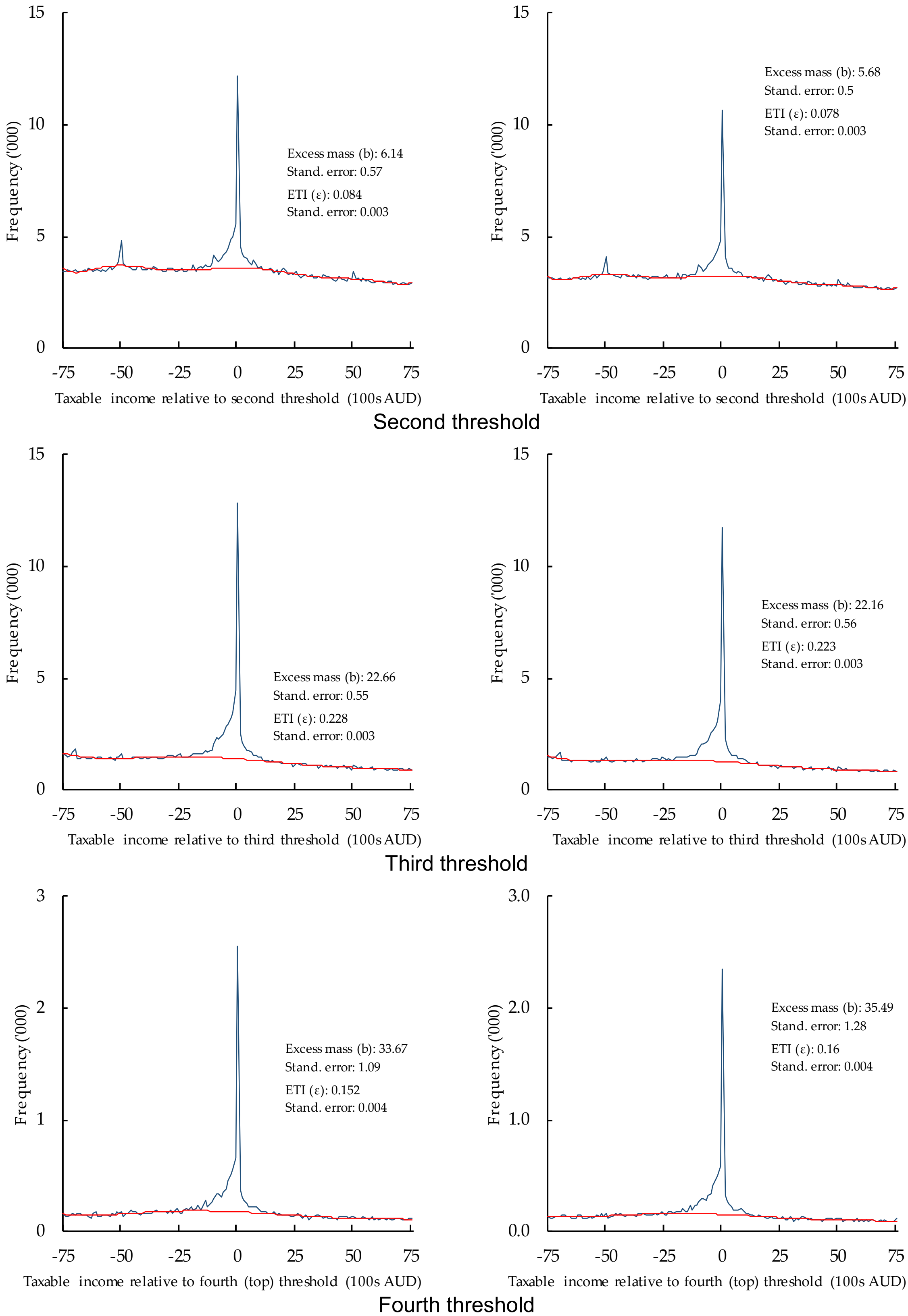
The Australian tax system and tax returns do not allow for individuals with self-employment income to be readily identified. As such, we construct a proxy variable to indicate whether a taxpayer may be self-employed based on the type of income they receive. We consider a taxpayer to be self-employed if they report business income (or losses), net trust or partnership income, or have dividends greater than 20% of their wages and salary income (we relax this latter constraint in Figure F.1).

Table F.1: Variables used for trust

pt_is_pship_dist_npp	Trust & Partnership (non-primary production (PP)): distribution from partnerships
pt_is_trust_dist_npp	Trust & Partnership (non-PP): distribution from trusts
pt_is_landcare_exp_npp	Trust & Partnership (non-PP): Landcare operation expenses
pt_is_other_ded_npp	Trust & Partnership (non-PP): other deductions relating to the distribution
pt_is_frank_dist_trust_npp	Trust & Partnership (non-PP): franked distributions from trusts
pt_is_pship_dist_pp	Trust & Partnership (PP): distribution from partnerships
pt_is_trust_dist_pp	Trust & Partnership (PP): distribution from trusts
pt_is_landcare_water_pp	Trust & Partnership (PP): Landcare operations and depreciation of water facility
pt_is_other_ded_pp	Trust & Partnership (PP): other deductions relating to the distribution
is_pt_net_dist_npp	Trust & Partnership (non-PP): net non-primary production amount
is_pt_net_dist_pp	Trust & Partnership (PP): net non-primary production amount
is_psi_net	Net personal service income
is_bus_pp	Business: net primary production income or loss
is_bus_npp	Business: net non-primary production income or loss
is_def_loss_pp	Deferred non-commercial business losses from primary production
is_def_loss_npp	Deferred non-commercial business losses from non-primary production
is_def_loss_pp_npp	Deferred non-commercial losses: total losses
is_fmd_net_deposits	Net income equalization deposits / net farm management deposits
dividends (sum of i_div_unfrank i_div_frank i_frank_cr)	i_div_unfrank – Income from dividends: unfranked amount i_div_frank – Income from dividends: franked amount i_frank_cr – Income from dividends: franking credit

Figure E.1: Estimated bunching with different definitions of self-employment

a) Self-employed (base case) **b) Self-employed (no dividend restriction)**



Appendix G. Robustness check

G.1: Bunching and estimation window

Table G.1 presents estimates of the bunching and ETI under different assumptions for the width of the small and large bunching windows used to estimate the counterfactual distribution.

Unsurprisingly, a wider small bunching window does not have a material impact on the bunching and ETI. We also find that changes to the sizeable bunching window do not materially affect our estimates. However, a narrower small bunching window, which is more likely to result in individuals who are bunching being excluded from the bunching region, has a material impact on the estimates. This highlights the importance of close visual inspection of the bunching region.

Table G.1: Robustness check, bunching and estimation window, fourth (top) threshold, 2010

	Excess mass (b)	Elasticity (ε)
Base case	18.8	0.085
	(0.61)	(0.002)
Small bunching window - increased (-25, 15)	20.9	0.095
	(0.79)	(0.003)
Small bunching window - reduced (-15, 5)	12.6	0.057
	(0.56)	(0.002)
Large bunching window - increased (-80, 80)	18.3	0.083
	(0.70)	(0.002)
Large bunching window - reduced (-70, 70)	18.4	0.083
	(0.65)	(0.002)

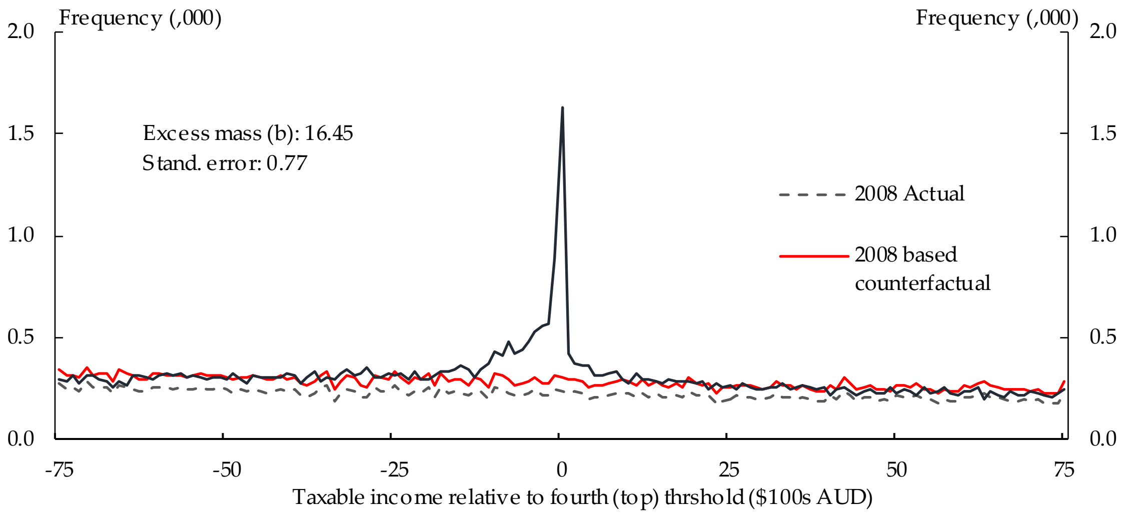
Note: In the base case, the small bunching window is (-20, 15), and the wide bunching window is (-75, 75).

G.2: Counterfactual distribution

Here we provide a robustness check of the estimated counterfactual distribution for bunching around the top (fourth) threshold in 2009, the year the threshold was moved to $180,000 (up from $150,000 in 2008).

Instead of estimating the counterfactual, we use the actual distribution from 2008 before the threshold moved), scaled based on the right-hand side of the distribution (excluding the bunching region). The bunching under this approach is around 16.45, with a standard error of 0.77. This compares to our estimate using equation 6 of 13.66, with a standard error of 0.59.

Figure G.1: Robustness check – using 2008 actual as the counterfactual for 2009



Appendix H: Bunching at the Medicare Levy Surcharge (MLS)

The Medicare Levy Surcharge (MLS) applies to all income if the taxpayer's income exceeds the threshold and the taxpayer does not hold appropriate private health insurance. While the MLS threshold is not explicitly examined in this paper, it is helpful to highlight a few observations. For much of the period, the Medicare Levy Surcharge threshold for singles was set at the same level as the top or third personal income tax thresholds.[1] The first period in our sample where the Medicare Levy Surcharge differed from the personal tax threshold was 2005. This year there was a noticeable spike at the Medicare Levy Surcharge threshold ($50,000) and a larger spike at the second personal tax threshold ($52,000). However, as both thresholds increased over time, the spike at the Medicare Levy Surcharge threshold became less prominent. This likely reflects the cost of the surcharge around the threshold becoming increasingly greater than the cost of private health insurance (and as such, there is less incentive not to take private health insurance and bunch below the threshold) and because of the continual broadening of the definition of Surcharge income, which has moved further away from taxable income.[2]

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[1] While the thresholds have often been set at the same income level, the income definition for the Medicare Levy Surcharge differs from taxable income and includes superannuation contributions, and reportable fringe benefits, while some losses are added back.
[2] For example, in 2009, Medicare Levy Surcharge income was expanded to include concessional superannuation contributions and to add back investment losses.

Appendix I: Analysis using the 10% random sample of tax data

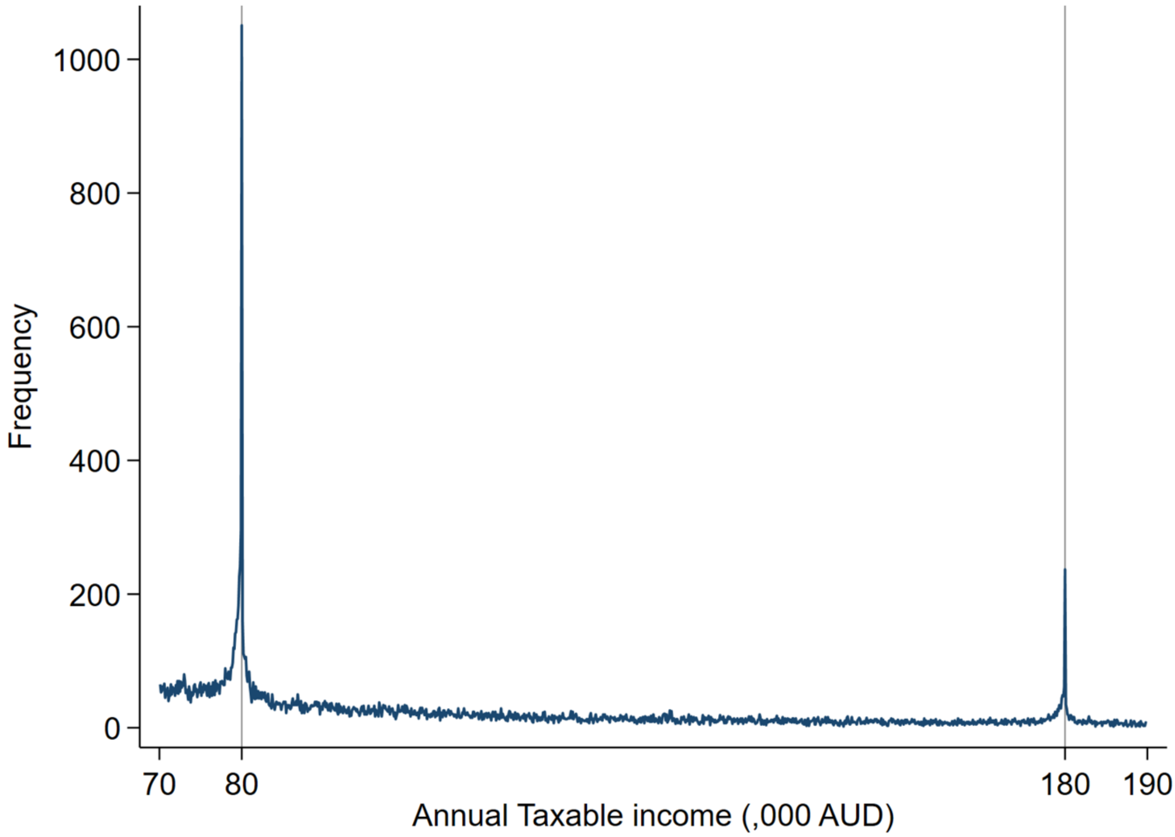
Table I.1: Summary statistics of self-employed individuals with trust income who bunch around the third and top kink in 2010

	Third kink bunchers	Top kink bunchers
Self-employed	0.24 (0.42)	0.58 (0.49)
Has trust income	0.20 (0.40)	0.46 (0.49)
Self-employed and have trust income	0.13 (0.34)	0.40 (0.49)
Taxable income (mean)	79,634.6 (2,748.6)	179,775.7 (2,560.97)
Gross taxable income (mean)	76,754.3 (22,612.1)	142,387.0 (75,301.1)
Trust income (mean)	6,774.6 (22,560.7)	45,996.5 (72,862.2)
Total deductions (mean)	3,894.3 (11,077.4)	8,607.7 (25,286.8)
Observations	59,144	4,033

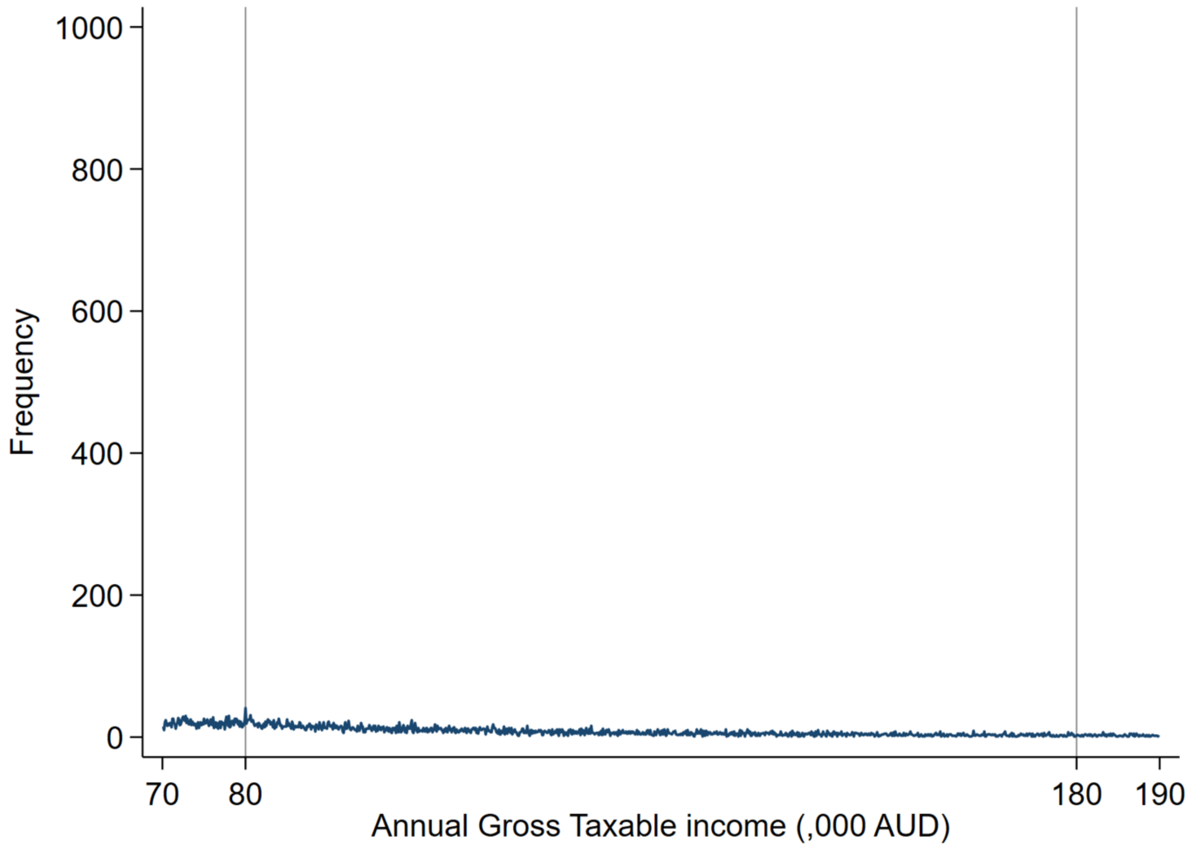
Note: The sample includes working-age individuals with taxable income between $70,000 and $190,000 in 2010. The third ($80,000) and top ($180,000) kink bunchers are defined as individuals within a $5,000 window around the kinks. The standard deviations are presented in parentheses.

Figure I.1: Distribution of taxable income and gross taxable income around the third and top kinks for self-employed individuals with trust income in 2010

a) Taxable income



b) Gross taxable income



Note: Gross taxable income is defined as taxable income including deductions and excluding the trust income. There is no bunching at the kinks on the distribution of gross taxable income, suggesting that bunching individuals use deductions and trust income to manipulate their taxable income.