ESSAYS IN EMPIRICAL TAX POLICY

Taxpayer responsiveness to marginal tax rates: Bunching evidence from the Australian personal income tax system

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ACRONYMS

ATI    Adjusted Taxable Income
EITC   Earned Income Tax Credit
HECS   Higher Education Contributions Scheme
US     United States
**THESIS OUTLINE**

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Conclusions
We examine taxpayers’ responsiveness to marginal tax rates in Australia. Utilising the universe of taxpayer records from 2000 to 2014, we estimate the degree to which taxpayer’s bunch at kink points in the Australian personal tax system, and the associated elasticity of taxable income. Unlike previous studies, we find sharp bunching at all kink points in the Australian tax system. We estimate the associated observed elasticity of taxable income and find elasticities ranging from effectively zero for wage earners, to around 0.26 for self employed tax filers. Exploiting the detail and size of the dataset we find substantial heterogeneity in responses to changes in marginal tax rates over time and across a range of sub-groups, with higher elasticities for married females, females with children and younger tax filers.

1.1 INTRODUCTION

Taxes spark a range of behavioural responses as taxpayers attempt to minimise the burden they face. While much of the literature has focused on effect of taxes on labour supply, other behavioural responses - such as income shifting, effort and evasion - can be equally as important. The elasticity of taxable income provides a comprehensive measure of taxpayers’ behavioural responses to the tax system and is a key parameter to inform the optimal design of the tax system. Under certain conditions the elasticity of taxable income is a sufficient parameter for examining the efficiency cost of the tax system (Feldstein, 1999 & Chetty, 2009) and the optimality of the tax system (Saez, 2010).

In order to estimate the elasticity of taxable income rich administrative data is required. Since the pioneering work of Feldstein (1999) there have been a number of studies estimating the elasticity of taxable income, using a variety of approaches. Most of these studies have focused on the United States’ tax system, or individuals at the top tax threshold.

However, the elasticity of taxable income is not a structural parameter. It is endogenous to the tax system and can be controlled to some degree by policy makers. As such, estimates of the elasticity from one country may not reflect those in another. In this regard, the Australian tax system provides an interesting study. The general structure of the Australian tax system has been stable for some time providing tax-filers with the opportunity to understand and build knowledge of the system. Further, unlike most other countries personal income tax is solely levied by the general government, and therefore complex interactions between state and federal tax systems are avoided. While a tax-filers tax liability at for each threshold is based on the same comprehensive measure of income (that is, including both labour and capital income), minimising issues with regard to income classification that are generally present under dual or hybrid tax systems. The Australian system is also somewhat unique in that it
allows for a wide range of deductions, potentially making it easier for tax filers to target a particular level of income.

Traditional approaches to estimating the elasticity of taxable income have relied on panel or cross sectional data, exploiting variations in tax rates over time. These approaches have been plagued with a number of issues, including tax rate endogeneity, changes in the tax base (which often correspond with changes in tax rates) and mean reversion. Saez (2010); however, developed an approach to estimating the observed elasticity of taxable income that only relies on differences in marginal tax rates at a given threshold. The approach, which utilises the degree of taxpayer bunching around a tax threshold, allows for the observed elasticity of taxable income to be estimated utilising within year variations in the tax schedule, avoiding the issues of traditional approaches.

We follow the approach of Saez (2010) and examine bunching evidence in the Australian personal tax system and estimated the associated elasticity of taxable income. We utilise administrative data from the Australian Taxation Office which covers the full universe of taxpayers over the period 1999-2000 to 2013-14. The size of our dataset allows for us to undertake a detailed analysis of the behavioural responses to changes in marginal tax rates for various subgroups of the population. Further, the size of the dataset and the extended time series available allows us to examine the evolution of behavioural responses over time.

Unlike previous studies that have focused on other countries, we find evidence of significant bunching at all the main thresholds in the Australian system. Further, this finding applies for both wage and salary earners and self employed tax-filers. We find significant variation in the observed elasticity of taxable income across the different thresholds with estimated elasticity for all tax-filers ranging from 0.03 to 0.12. In line with previous studies, we find that the taxable income response to changes in marginal tax rates is significantly higher for self employed tax-filers compared to wage and salary earners. For example, we estimate the observed elasticity of taxable income for the self employed to be typically greater than 0.1, while the elasticity for wage and salary earners, while statistically significant, is effectively zero for all thresholds and across all years. Utilising the size and detail of this new dataset, we also examine bunching behaviour and the associated elasticity of taxable income for a range of sub-groups of the population. We find the observed elasticity of taxable income is typically higher for females, females who are married, females with children and younger tax filers.

We also examine trends in the observed elasticity of taxable income over the period 2000 to 2014. We find significant variation in the elasticity over time with changes typically corresponding to periods at, or following, changes in the tax rates or thresholds, or changes in other related tax policies. In particular, we find the observed elasticity of taxable income tends to fall following significant changes in the tax thresholds then increases over subsequent years, indicating potential frictions, including knowledge and ability to adjust income in the short run. We also find the observed elasticity of taxable income has declined since 2008, which corresponds to the time the Australian Taxation Office introduced pre-filling of returns and started to increase the use of data matching. This result suggests that in addition to the struc-


2 For the remainder of this Chapter we refer to the periods as 1999-2000 as 2000 and so forth.
ture of the tax system, the administration of the tax system is also an important driver of the elasticity of taxable income.

The rest of this chapter is structured as follows. First, we provide a brief overview of the literature focused on the taxpayer bunching approach to estimating the elasticity of taxable income. We then outline the general methodological approach and our empirical strategy, which is based on Saez (2010) and Chetty et al. (2011). Following this, we provide an outline of the Australian personal income tax system and an overview and summary of the new dataset used in our analysis. We then provide our empirical results, which include analysis for the entire population, an examination of differences between wage earners and the self-employed, results by gender and age, and conclude with analysis of how our estimated observed elasticities have varied over time. We finish with a summary of our main findings and highlight a number of areas for further research.

1.2 RELATED LITERATURE

Bunching analysis requires large high quality administrative datasets. While rich administrative tax data is collected in all developed economies, it is seldom made available for research purposes and as a result work in this area has been limited. To date, most analysis examining the elasticity of taxable income has focused on the United States and the Scandinavian countries for which data has been made available to researchers.3

Slemrod (1985), examining the prevalence of tax avoidance in the United States (US), was one of the first papers to use bunching analysis to study taxpayer behaviour. Using a small random sample of 1977 tax returns, Slemrod found a significant, but small, fraction of tax evaders within $10 of the top of the $50 brackets in the tax code, with an excess mass of between 0 and 3.5 per cent. He also found that taxpayers with more fungible income and deductions were more likely to evade tax. In another study, MaCurdy, Green, and Paarsch (1990) examine bunching in hours worked for males at various kink points in the United States tax code. Using data from the Panel Study of Income Dynamics for 1975, MaCurdy, Green, and Paarsch find no evidence of bunching.

A number of early papers also examined bunching as a result of thresholds created by means testing of social security payments. For example, Friedberg (2000), using the Current Population Survey data, finds bunching around the earnings test rules on elderly individuals in the United States. Friedberg estimates large income and substitution elasticities suggesting the earnings test generates a significant dead-weight loss.4 Blundell and Hoynes (2004) examine the effect of work requirements for certain benefits in the United Kingdom. They find evidence of bunching at the minimum hours work requirement for the UK family tax credit.

In the seminal work by Saez (2010), for which this paper is largely based, Saez develops a method of using bunching evidence to estimate the observed elasticity of taxable income. The approach suggested by Saez, relies only on within year variation in tax rates or the difference in marginal tax rates at a threshold, which is a feature observed in all progressive tax systems. Applying his methodology to a sample of administrative tax return data over the period 1960-

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3 In this section we provide a brief overview of bunching related studies. See Saez, Slemrod, and Giertz (2012) for a comprehensive review of the elasticity of taxable income literature.

4 Friedberg (2000) uses a regression based approach to estimate elasticities and finds an observed elasticity of 0.22 in 1978 and 0.32 in 1983.
2004, Saez analyses bunching around the various kink points in the US federal income tax system and at the kinks created by the Earned Income Tax Credit (EITC) where the credit is fully phased in and where the credit starts to be phased out.

Saez finds no evidence of bunching at either of the EITC kink points for wage earners and precisely estimates an observed elasticity of taxable income of zero. In contrast, he finds evidence of significant bunching for taxpayers with self-employment at the kink point created where the EITC is fully phased-in and an observed elasticity of around one. However, Saez suggests most of the response is likely to be a consequence of reporting behaviour rather than a real labour supply effect.5

In analysing the kink points in the federal income tax, which are probably more comparable to this study, Saez only finds evidence of bunching at the first kink point where the tax free threshold ends and a tax liability starts. The associated observed elasticity of taxable income is estimated to be around 0.2. Interestingly for the Australian context, Saez finds that part of the response is due to the availability of itemised deductions, with bunching less pronounced where taxable income is based on the standard deduction. Saez finds no evidence of bunching at any of the other higher kink points, even for the subsample of tax-filers with self-employment income, who are are likely to be more responsive.

The approach by Saez (2010) has gained considerable popularity in the public finance literature. One such important study is that by Chetty et al. (2011), who use the universe of Danish taxpayer records to examine the role of optimization frictions in explaining the difference between macro and micro labour supply elasticities. Chetty et al., find evidence of bunching by wage earners at the top kink of the Danish personal tax system, where there is a 30 per cent fall in the net of tax wage rate. However, their estimated elasticity of taxable income, while significant, is effectively zero. They suggest the low elasticity may be a result of optimisation frictions, and test this by exploiting a second ‘kink’ created by a limit on concessional retirement contributions. As only a small subset of taxpayers make contributions up to the limit, they examine whether the wages of these individuals (gross of the contributions) is bunched around the top kink or the pension kink. They find bunching around the top kink, but not at the pension kink, which they suggest is evidence of aggregate bunching, for example, as a result of firms’ wage offers, where firms target the marginal rates faced by the majority of their workers. Chetty et al. find no significant evidence of bunching at the second threshold for wage earners where the net of tax wage rate falls by only 11 per cent.

Chetty et al. also examine bunching by self employed tax filers. They find significant bunching at the top tax kink, with an implied elasticity of around 0.24. They also find that unlike wage earners, self employed tax filers with uncommon tax preferences are just as likely to bunch at the top threshold as those with common tax preferences, which they suggest is evidence of individual bunching.

Le Maire and Schjerning (2013), extend the model outlined in Saez (2010), and the analysis of Chetty et al. (2011) by developing a dynamic model, allowing them to differentiate between real responses, such as, a change in hours worked, and income shifting. While they find significant bunching by Danish self employed tax filers, they estimate that around 50 to 70 per

5 Weber (2014a), notes that one of the reasons Saez may have found no evidence of bunching at the second EITC kink is that the kink is a function of the broader Adjusted Taxable Income (ATI) rather than taxable income, and that the large bin size used by Saez introduces a downward bias. Correcting for these two issues, Weber finds evidence of significant bunching at the second kink for both wage earners and taxpayers with self employment income.
cent of this is due to income shifting, implying an observed elasticity in the range of 0.14 to 0.2.

Examining the large top kink in the Swedish personal tax system, where the net of tax income rate falls by up to 45.6 percent, Bastani and Selin (2014) find significant bunching for wage earners, however the observed elasticity of taxable income was again precisely estimated at zero with an upper bound of 0.39 under plausible assumptions around the size of optimization frictions. Bastani and Selin also examine whether the low observed elasticities may arise because of income effects, given the large increase in marginal tax rates at the top kink. Under a simulation exercise they find that income effects are unlikely to significantly bias their observed elasticity estimates.

The relatively low estimates for the observed elasticity and the evidence of optimization frictions found by Chetty et al. (2011) in the Danish tax system has been a focus of recent research. One possible source of optimization friction is taxpayers’ understanding of the tax system. In this regard, Chetty and Saez (2013), examine bunching around the kink points created by the EITC before and after informing randomly selected tax filers on the operation of the EITC and tailored advice on the impact of their marginal decisions. They find that providing information on the EITC was not very effective for changing behaviour.

In another study Chetty, Friedman, and Saez (2013), examine whether information frictions across neighbourhoods affect taxpayer responses to the EITC. They show how differences across regions in bunching at the kink point where the EITC is maximised can be used to identify knowledge about the EITC system. Using bunching by self-employed taxpayers by region as a proxy for local knowledge they firstly examine bunching by wage earners by region. They find that the EITC does effect labour supply decisions in high knowledge regions. They find an average elasticity of around 0.31 in the EITC phase-in region and an elasticity of around 0.14 in the phase-out region, with elasticities for the phase-out and phase in region of 0.84 and 0.29 in areas of the top decile for EITC knowledge.

Research examining taxpayer bunching behaviour outside of the US and the Scandinavian countries has been somewhat more limited.

Kleven and Waseem (2013) examine taxpayers responses to notches in the Pakistani personal tax system. Unlike kinks, notches create a discontinuity in the budget constraint, which, in the absence of optimisation frictions, would lead taxpayers to bunch on the low tax side of the threshold.6 Kleven and Waseem (2013) find both large and sharp bunching at the notches, however, they also find around 90 per cent of wage earners and between 50-80 per cent of self-employed tax filers report incomes to the right of the kink in dominated regions. Utilising their estimated observed elasticities and share of people in the dominated region, Kleven and Waseem (2013) estimate structural elasticities in the order of 0.05 and lower.

Research in Australia has been more limited, in part due to limited data availability. Chapman and Leigh (2009) build on the bunching analysis of Saez (2010) to examine the effect of notches created by the first loan repayment threshold under Australia’s Higher Education Contributions Scheme (HECS).7 Chapman and Leigh (2009), find small but significant evidence of bunching at the first repayment threshold over the period 2001-2004, suggesting the high

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6 Chapter 5 examines bunching behaviour around the notch created by Australia’s higher education income contingent loan system and the associated elasticity of taxable income.
7 The HECS is an income contingent loan from the Australian Government for tuition fees. The loan repayments are conditional on the borrower’s income.
effective tax rates created by the HECS system have only a small impact on behaviour. Chapman and Leigh, however, do not estimate the degree of bunching or the associated elasticity of taxable income.

More recently, Stavrunova and Yerokhin (2014) and Kang et al. (2015) examine take-up of private health insurance around the notch created by the Medicare Levy Surcharge. Both studies show, graphically, significant bunching around the threshold for singles with no children, however, again they do not provide estimates for the degree of bunching or the income responses.

1.3 METHODOLOGY

Taxpayers can respond to the tax system in a number of ways. Feldstein (1995) proposed the elasticity of taxable income as a way of capturing the combined affect of the various responses to changes in marginal tax rates. The elasticity of taxable income is simply defined as the response of taxable income, $z$, to variations in the net-of-tax rate $(1 - \tau)$.

$$\varepsilon(z) = \frac{\Delta z}{z} / \frac{\Delta \tau}{(1 - \tau)}$$  \hspace{1cm} (1.1)

We use the bunching methodology proposed by Saez (2010) and Chetty et al. (2011) to analyse the degree of bunching and the elasticity of taxable income at kink points in the Australian personal income tax system. To outline the model, it is useful to begin with the standard two good labour supply model under which an individual maximises a deterministic utility function, $U(c, z)$, where $c$ is disposable income (or consumption) and enters the utility function with a positive effect and $z$ is taxable income, which enters the utility function with a negative effect, reflecting earning income requires some effort and that tax avoidance has a real resource cost.

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

Now let’s assume that a reform is introduced such that the tax rate applying to all income above some point $z^*$ is $\tau_2 > \tau_1$, and 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 taxpayers below the kink their tax liability will remain unchanged: $T(z) = \tau_1 z$. Under this tax reform, each taxpayers’ budget constraint will be convex. For taxpayers above the kink point, $z^*$, they will want to reduce their taxable income because the tax rate above the kink is now higher (for example, this would include more leisure, consumption and evasion). 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 the one they faced before the reform, and they were previously happy to earn taxable income at this rate.

8 The Medicare Levy Surcharge applies to taxpayers with income above a threshold that do not hold private health insurance. The surcharge applies to total income, thus resulting in a notch.

9 This section follows closely Saez (2010) and Bastani and Selin (2014).
Assuming, for simplicity, all individuals have the same elasticity, all individuals above (to the right of) 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 and in the absence of any optimization frictions, this reform would result in a mass of tax filers (\( B \)) who bunch precisely at the kink point. As shown by Bastani and Selin, 2014, using the first mean value theorem for integrals \( B \) is given by:

\[
B = \int_{z^*}^{z^* + \delta z^*} h_0(z) \, dz = h_0(\zeta) \delta z
\]  

(1.2)

for some \( \zeta \in [z^*, z^* + \delta z] \). As shown by Saez (2010), this sharp bunching or mass at the kink point can be used to directly identify the elasticity of taxable income.

Again following Bastani and Selin (2014), substituting equation 1.2 into 1.1 and rearranging gives:

\[
\bar{\varepsilon}(z^*) = \frac{B(\delta z)}{h^* h_0(\zeta) \frac{\delta z}{(1 - \tau)}}
\]

(1.3)

In the case of a small increase in the tax rate for incomes above \( z^* \), (that is where \( \delta \tau = d\tau \) and \( \delta z = dz \), \( \zeta \to z^* \) the elasticity of taxable income is given by:

\[
\lim_{\delta \tau, \delta z \to 0} \frac{\varepsilon(z^*)}{\varepsilon(z^*)} = \frac{B(\delta z)}{z^* h_0(z^*) \log\left(\frac{\tau}{(1 - \tau)}\right)}
\]

(1.4)

As we focus on the behaviour or individuals 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. As such, there are no income effects and \( \varepsilon \) is therefore the compensated elasticity of taxable income. From equation 1.4 we can also see the elasticity of taxable income, \( \varepsilon \), around the kink point is directly proportional to the number of taxpayers who bunch there, or the relative excess mass, \( b \), which is defined as:

\[
b = \frac{B(\delta z)}{h_0(z^*)}
\]

(1.5)

It is worth noting that the discussion above implicitly assumes that taxpayers can bunch precisely at the threshold \( z^* \). In practice, due to optimisation frictions this is unlikely to be the case and instead bunching is likely to be imperfect and diffuse around the threshold.

1.4 EMPIRICAL APPROACH

In terms of estimating equation 1.4, we directly observe both the tax rate \( \tau \) and the kink point \( z^* \), but cannot observe the excess mass, \( b \), of tax filers around the kink point. Ideally we
would measure the excess mass 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 unfortunately we cannot observe the counterfactual. Our challenge is therefore to construct a counterfactual distribution, $\hat{h}_0$, that does not include the effect of the kink.

It is useful to separate the density into three regions. The first region we will define the small bunching window $[z^* - \delta_L, z^* + \delta_H]$. This is the region where imperfect bunching occurs and has an estimated mean density $\hat{h}^*$ and a cumulative density $H^*$. The other two regions are used to estimate the counterfactual density and lie to the right and left of the small bunching window, together they represent the wide bunching window. These regions are given by: $[z_L : z^* - \delta_L - \delta_L, z^* - \delta_L]$ which is to the left of the of the small bunching window and has a mean density of $h_L$ and cumulative density of $H_L$; and $[z_H : z^* + \delta_H, z^* + \delta_H + \delta_B]$ which is to the right of the small bunching window and has a mean density $h_L$ and a cumulative density of $H_L$.

Saez (2010) uses the number of taxpayers in the two regions that lie either side of the bunching window ($H_L$ and $H_H$) to infer the counterfactual distribution around the kink. Implicitly this assumes that the counterfactual density $\hat{h}(z^*)$ is linear; however, where $\hat{h}(z^*)$ is concave excess bunching will be understated, and where $\hat{h}(z^*)$ is convex excess bunching will be overstated.

To address this concern Chetty et al. (2011) suggest estimating the counterfactual distribution using non-parametric methods. They estimate $h_0(z)$ by fitting a polynomial to the income distribution, omitting the small bunching region around the kink, $[z^* - \delta_L, z^* + \delta_H]$. Using the actual density to the right of kink, in the region $[z^* + \delta_H, z^* + \delta_H + \delta_B]$, to estimate the counterfactual density can be problematic. Chetty et al. suggest the counterfactual density to the right of the small bunching window will be biased downwards and should be adjusted so that the area under the counterfactual density equals the area under the actual density. They argue that because individuals around the kink have moved from the right of the region $[z^* + \delta_H, z^* + \delta_H + \delta_B]$, the observed density in this area will be lower than the counterfactual in the absence of the tax reform. Weber (2014b) suggests that if taxpayers above the kink reduce their taxable income by a certain percentage (as assumed in the model) the density above $z^*$ would effectively shift to the left (compressing the density) and therefore the estimated counterfactual in this area would be overstated.

Weber (2014b) suggests that not controlling for this results in the estimates being a lower bound. However, whether the counterfactual region is (more than) replaced by taxpayers who in the absence of the tax would have had incomes greater than $z^* + \delta_H + \delta_B$, is unclear and would depend on the shape of the density and the extent of income effects. For this paper, we follow Weber and do not make the adjustment suggested by Chetty et al. (2011); however, the adjustment does not materially effect our results.

Unlike Weber (2014b) we do, however, follow Chetty et al. (2011) and estimate the counterfactual by fitting a polynomial to the income distribution. A critical identifying assumption

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11 Weber (2014b) examines bunching around the Earned Income Tax Credit phase out in the United States also uses this approach due to the close proximity of other kinks in the US tax system.
12 The further away a taxpayer is from the kink before the reform, the larger the change in average tax rate and therefore possible income effects will become more important.
13 Summary results available on request.
under this approach is that the counterfactual distribution, that is the distribution in the absence of the tax reform, is smooth (has no peak) at the kink point.

To estimate the counterfactual distribution we fit a polynomial distribution to the actual distribution, excluding observations over the bunching region, \([z_L, z_H]\). Chetty et al. (2011) suggest using a seventh order polynomial to estimate the counterfactual distribution. There is little basis for this assumption and instead 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 AIC. \(^{14}\) The procedure we take to estimate the counterfactual distribution following Chetty et al. (2011) is as follows.

First, we group individuals into small earnings bins \((Z_j)\) of $100, indexed by \(j\), which are centred around the kink point. The index \(j\) represents the distance between the mid-point of the bin and the kink point (measured in $100AUD). For example, the second bin to the left of the kink point is \(Z_{-2}\) and the mid-point of the bin is $200 below the threshold.

Next we identify and check the wide bunching window. We do this by plotting and inspecting the histogram \(Z_j\). The wide bunching window is used to estimate the counterfactual distribution. In inspecting the wide bunching window, as noted it is important that it is smooth (has no other peaks outside of kink point). Essentially we are looking for an income range that does not include significant bunching for another kinks or notches in the tax-transfer system. In addition, we also require a window that contains enough bins (observations) to allow us to estimate the counterfactual distribution when the ‘small bunching window’ (determined next) is excluded. \(^{15}\)

The final step is determining the small bunching window, \([z_L, z_H]\). This is again determined by visual inspection of the histogram \(Z_j\). Previous bunching studies have assumed that the small bunching window is symmetric, however this need not be the case and this assumption may bias estimates of the excess mass and observed elasticity. For example, overstating the size of the bunching window on one side of the density would tend to bias estimates of the excess mass and observed elasticity downwards. 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:

\[
c_j = \sum_{i=0}^{p} \psi_i(z_j) + \sum_{i=z_L}^{z_H} \gamma_i \mathbb{1}[z_j = i] + \eta_j
\]

(1.6)

Where, \(c_j\) is the number of individuals in bin \(Z_j\), \(z_j\) is the mid-point of the earnings level of bin \(j\) and \(p\) is the order of the polynomial. We then estimate the counterfactual distribution using predicted values from equation 1.6 and omitting the dummy variables used over the small bunching window: \(\hat{c}_j = \sum_{i=0}^{p} \hat{\psi}_i(z_j)\). The excess number of individuals who bunch

\(^{14}\) citetchetty:2011 note that some of their results were sensitive to the choice of polynomial.

\(^{15}\) In all case unless otherwise indicated the large bunching window is \([Z_{-75}, Z_{75}]\).
around the kink point is then calculated as the difference between the actual and predicted densities around the small bunching window:

$$\hat{B} = \sum_{i=Z}^{Z} (c_i - \hat{c}_i)$$  \hfill (1.7)

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

$$\hat{b} = \frac{\hat{B}}{\sum_{i=Z}^{Z} (\hat{c}_i / (z_H - z_L + 1))}$$  \hfill (1.8)

Consistent with others, we estimate standard errors using nonparametric bootstrap. Under this approach, we generate a large number of earnings distributions (and associated estimates for each variable) by randomly resampling the residuals $\eta_j$ from 1.6. The standard error of each variable is the standard deviation in the distribution of estimates of the variable.

1.5 INSTITUTIONAL SETTINGS AND DATA

1.5.1 Australian tax system

Australia’s personal income tax system is levied exclusively by the central government, and is the single largest tax base, accounting for around 45 per cent of total central government receipts.

Unlike the tax systems in countries analysed in previous bunching studies, Australia’s personal income tax system is individual based and comprehensive; in that it includes all sources of worldwide income (both labour and capital).\(^{16}\) Therefore, in contrast to countries with dual income tax systems, where capital and labour income are treated separately, the incentive to convert income from one form to another to avoid higher marginal rates is somewhat reduced. Income includes, wage earnings, self-employment income, transfer payments, dividends, interest income, capital gains, rental income, while most forms of in-kind income (or fringe benefits) are also subject to taxation.

The Australian tax system also allows expenses incurred in earning income to be deducted including, work related travel and clothing expenses; interest expenses and depreciation of capital. Deductions are also available for charitable donations and effectively for certain retirement savings contributions, and some in-kind income.\(^{17}\) The Australian taxation system also has limited quarantining of expenses for example, unlike some countries, interest expenses on borrowings can be used to offset labour or other forms of income. One exception to this

\(^{16}\) While Australia operates a individual based personal income tax system, there are a few elements based on household or partner’s income, such as the Medicare levy surcharge.

\(^{17}\) Superannuation contributions can be made out of pre-tax or post tax income. Contributions made out of pre-tax income, result in a similar treatment as if the contribution was deductible for tax purposes, a key difference is that contributions made out of pre-tax income are taxed at a flat rate of 15 per cent. Income earned in a superannuation fund is typically taxed at 15 per cent. Some forms of in-kind income are non-reportable and therefore effectively exempt from tax (these benefits are typically expenses that would be otherwise deductible).
is that capital losses (that is, losses on the sale of an asset) are quarantined, and can only be used against capital gains.

Over the period studied (2000 to 2014) the basic tax schedule remained relatively simple with five brackets. Figure 1 presents the basic tax schedule in 2010 Australian dollars while the tax rates are presented in Table 1. In 2010, there was a tax free threshold set at $6,000; however, a tax offset for low income earners provided an effective tax free threshold of $15,000. The second bracket applied to incomes up to $37,000, with a marginal tax rate of 15 per cent, resulting in net of tax income falling by around 16 per cent at the beginning of this bracket. The tax rate in the third bracket is 31.5 per cent resulting in net of tax income falling by around 19 per cent and covers income up to $80,000. The forth bracket applies up to $180,000 in income, with a marginal tax rate of 39.5 per cent with net of tax income falling by around 12 per cent. The top bracket, which applies to incomes above $180,000, has a tax rate of 46.5 per cent, resulting in a net of tax income also falling by around 12 per cent where the top bracket begins.

![Figure 1: Income tax thresholds (real 2010 AUD), 2000 to 2014](image)

Over the period 2000 to 2014 there have been a number of changes to the tax thresholds and rates (Figure 1 and Table 1). Most notably, at the time the Goods and Service Tax was introduced in 2000 the first threshold was reduced from $20,700 to $20,000, while the rate applying to income above the threshold was also reduced from 35.5 per cent to 31.5 per cent (including the Medicare Levy). In addition, the second and top thresholds were increased from $38,000 and $50,000 to $50,000 and $60,000 respectively. Rates and thresholds remained unadjusted until 2004, when the first threshold was increased to $21,600, the second threshold was increased to $52,000 and the top threshold was increased to $62,500. The period from 2004 until 2011 saw continual changes to the thresholds, but most notably in the top threshold which increased from $62,500 in 2004 to $180,000 by 2009.

It is also worth noting that actual effective tax rates can differ to statutory rates. In Australia this can often arise as a result of the phase out of certain tax offsets or as a result of other levies that are not explicitly included in the tax schedule. We account for these by including

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18 The average AUS/US exchange rate in 2010 was around AUD$1=USD$0.92
We utilise administrative data from the Australian Taxation Office which includes all Australian taxpayers that lodged a tax return over the period 2000 to 2014. In total the dataset contains over 160 million observations.

The dataset is very detailed including some individual and household demographic information which is collected on the tax return. This includes gender, age, and to a degree marital status.\(^{21}\)

1.5.2 Data

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The dataset is very detailed including some individual and household demographic information which is collected on the tax return. This includes gender, age, and to a degree marital status.\(^{21}\)

<table>
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<tr>
<th>Marginal tax rates (per cent)</th>
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Table 1: Marginal tax rates and percentage change in after tax rate

Note: Rates for T2 to T5 include the Medicare levy, which is essentially a general tax applying to taxable income.

the Medicare Levy, the phase out rate of Low Income Tax Offset, and the Flood Levy in our effective tax rates.\(^{19}\)

In terms of the related taxes, unlike most OECD countries, Australia does not levy social security contributions. The states, however, levy proportional payroll taxes which are based on a firm’s wage bill and are often dependent on the number of employees. These payroll taxes have been fairly constant over the period examined. Australia introduced a 10 per cent value added tax, the Goods and Services Tax, on 1 July 2000. The rate and base of the Goods and Services Tax have been constant since its introduction, with the rate, expressed as a percentage of consumption is around 5 per cent.\(^{20}\)

\(^{19}\) The Flood Levy applied in 2012 only and was set at a rate of 0.5 per cent for each dollar earned between $50,000 and $100,000 and 1 per cent for each dollar above $100,000.

\(^{20}\) The effective Goods and Services Tax Rate is lower than the statutory rate of 10 per cent due to a number of exemptions including consumption on food, education and health services and the input taxation of financial services.

\(^{21}\) Over the period 2005 to 2012, the marital status label on the tax return was not compulsory and as such, the reliability of this data is limited over this period.
We impose the following restrictions on the estimation population. First, we focus on Australian resident tax-filers who are living in Australia. Second, we restrict attention to individuals of working age (between 20-65 years old). Third, individuals who report receiving a government pension or allowance are excluded as the current dataset does not allow us to account for the withdrawal rates on these payments. The benefit withdrawal rates should have a similar behavioural response to an equivalent marginal tax rate. These restrictions leave us with just over 143 million observations across all years.

A number of studies have found that tax-filers with self employment income are more responsive to the tax system (for example, Saez, 2010, Chetty et al., 2011, Kleven and Waseem, 2013 and Bastani and Selin, 2014). The Australian tax system and tax returns do not allow for tax-filers with self employment income to be readily identified. As such, we construct a proxy variable to indicate whether a tax-filer may be self employed based on the type of income they receive. We consider a tax-filer to be self employed if they report business income (or losses), trust or partnership income or have dividends greater than 10 per cent of their income.

Table 2 provides descriptive statistics for the population in 2010. In 2010, the average taxable income of the population was around $52,000, and around 30 percent of tax-filers were classified as being ‘self employed’. Taxable income between the self employed and wage earners was similar, however, average deductions were higher for the self employed ($3,300) than wage and salary earners ($2,600). The average age of tax-filers was around 41, with those identified as being self employed typically older (average age of around 45 years old) compared to wage earners (average age of around 39 year old). The self employed are also more likely to be married and have more children, which likely corresponds to them also being older on average.

The primary advantage of using administrative data is its accuracy, or more specifically that it should be less prone to measurement error. Compared to survey data, administrative data is also less likely to have non-responses or rounding and other approximations.

A further advantage of our dataset, compared to that used in other similar studies, is that because of the size of the dataset we can provide estimates for each individual year, and do not have to rely on aggregating multiple years of data. Aggregating over multiple years, can create a number of issues. First, it may create a problem where the same individual is observed more than once, but the bunching behaviour was triggered only once, for example, where tax-filers receive future income that would otherwise be above the threshold, in the form of better conditions of concessionally taxed in-kind benefits. This behaviour would result in the excess mass and therefore elasticity of taxable income being overstated. Second, there are inherent difficulties in combining tax-filers across years when the thresholds have not been maintained in real terms or where the tax rates have changed over time, for example where there are significant changes in the net of tax rate, or where the kink point moves to a point which applies to different types of tax-filers.

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22 Australia has a separate schedule for non-resident taxpayers, while special arrangements apply to Australians earning labour income overseas.
23 The inclusion of the dividend criteria is to account for tax-filers with a controlling interest in an unlisted company. We also construct a number of alternative proxies to identify individuals with self-employment income to test the robustness of our results. The alternative proxies provide qualitatively similar results.
24 Descriptive statistic for all years are available on request.
25 We thank Thomas Abhayaratna for pointing this issue out.
26 For example, Chetty et al. (2011) find that the elasticity of taxable income rises with the tax rate.
1.6 Empirical Analysis

To begin it is useful to examine the full distribution of taxable income. Figure 2 presents the taxable income distribution for 2010, for taxable incomes between $0 and $200,000. Data is collapsed into $100 bins in nominal dollars. Figure 2 clearly shows a strong indication of bunching at all the main thresholds. This pattern is observed across all years.

The dataset is not however, without limitations. The main limitations of our dataset is that it does not include individuals who are exempt from lodging, due to low income, or not complying with their lodgement obligations. The dataset also does not provide enough information to determine eligibility for social security payments. As these payments are typically means tested in Australia, the actual effective tax rate faced by the taxpayer (marginal tax rate and withdrawal rate of benefits) may be understated in our analysis, while taxpayers may also respond to social security thresholds that are near the tax threshold we focus our attention on. As noted previously we attempt to correct for this in some cases by excluding filers who report receiving government pensions or allowances, however not all payments are reportable.27

27 The most significant payment that is not reportable is the Family Tax Benefit, which is a series of means tested benefits that are available to households with children of certain ages.

28 Figures for all other years are available on request.

29 Throughout the analysis we use a constant binsize of $100. For the main analysis we use a constant real binsize of $100 based to 2010 (with the Consumer Price Index used as the indexation factor).
First, there is a significant spike in taxable income in the first bin which includes tax-filers with zero (or negative) taxable income. The next noticeable spike is at the upper limit of the tax free threshold ($6,000). Bunching here is somewhat counter-intuitive, and may reflect imperfect knowledge about the tax system. This is because in Australia, for all the years examined, a Low Income Tax Offset was available which effectively increased the tax free threshold for low income taxpayers. For example, in 2010, the Low Income Tax Offset could be used to offset up to $1,350 in tax, resulting in an effective tax free threshold of $15,000 (refunded at the end of the year), which is the next location we see significant bunching by tax-filers.

After the effective tax free threshold, the remaining spikes in the distribution reflect the thresholds where the marginal tax rates increase (and the notch created at the Medicare Levy Surcharge threshold for single tax-filers). While the Medicare Levy Surcharge threshold is not explicitly examined in this paper, it is useful to highlight a few observations. For much of the period the Medicare Levy Surcharge threshold for singles was set at the same level of the top or second personal income tax threshold. The first period in our sample where the Medicare Levy Surcharge differed from the personal tax threshold was in 2005. In this year there is a noticeable spike in the at the Medicare Levy Surcharge threshold ($50,000) and again a larger spike at 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 to not take private

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30 In the Australian tax system taxpayers with negative taxable income (loss) are deemed to have zero taxable income.
31 As noted earlier Stavruchova 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. Abhayaratna, Breunig and Johnson (forthcoming), examine the effect of the threshold more broadly, including the taxable income response.
32 The Medicare Levy Surcharge applies to all income, if the tax-filers income exceeds the threshold and the filer does not hold appropriate private health insurance.
33 While the thresholds have often been set at the same income level, income for the Medicare Levy Surcharge is different to taxable income, and includes superannuation contributions, reportable fringe benefits, while some losses are added back.
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.\footnote{For example, in 2009 Medicare Levy Surcharge income was expanded to include concessional superannuation contributions and to add back investment losses.}

By examining the histograms overtime we can also test two important assumptions required for bunching analysis. Firstly, that taxpayers are aware of the tax schedule they face, and secondly, in the absence of the tax bracket and jump in marginal tax rate the distribution is smooth. Tax-filers appear to be aware of the more salient features of the tax code, with the excess mass moving with kink points as the thresholds are adjusted overtime. In addition, when thresholds are adjusted, the excess mass where the old kink point was dissipates over time with the distribution returning to being smooth. This is highlighted in Figure 3 which presents the distribution of tax-filers in 2008 and 2009, from $140,000 to $190,000. Over this period the top tax threshold was increased from $150,000 to its current level of $180,000. In 2008 there is evidence of bunching for incomes around $150,000. Following the increase in the threshold to $180,000 the following year the excess mass around $150,000 dissipates, while there is now a visible excess mass at the new threshold ($180,000).

1.6.1 Bunching analysis: all taxpayers

We begin our formal analysis by estimating the excess mass (b) and elasticity of taxable income (\(\varepsilon\)) for all tax-filers. We present the distributions of taxable income locally around the four statutory tax thresholds for 2010, with income normalised so that the threshold, or kink point, is centred at zero.\footnote{Figures for all years are available upon request.}

We find evidence of significant bunching at all four thresholds for most years where we are able to provide estimates (Figure 4).\footnote{Estimates for the second threshold were not presented for years where the Medicare Levy Surcharge threshold was set at the same rate as, or close to, the threshold (in 2000 it was set equal to the top threshold).} This finding is in contrast to studies of other countries that have typically found limited evidence of bunching across all thresholds (for example Saez (2010) for the United States, Chetty et al. (2011) for Denmark and Bastani and Selin...
The excess mass of the distribution is also typically skewed to the left of the threshold, which suggests the small bunching window should not be symmetric around the kink point. The rationale for this behaviour is less clear. One possible explanation is that some tax-filers may believe the threshold results in a change in the average tax rate (that is, the threshold represents a ‘notch’ or discrete jump in the average tax rate rather than a ‘kink’), and as such they perceive there are significant benefits from locating below the threshold.

![Graphs showing distribution around tax thresholds](image)

Figure 4: Distribution around main tax thresholds, 2010

We estimate the excess mass (b), which as noted previously is the number of tax-filers who bunch around the threshold relative to the average frequency of the counterfactual distribution of taxfilers in the small bunching window. Starting with the top threshold, which is the focus of most papers, we find the excess mass to be 18.96. This means that the number of people bunching at the top threshold is around 1896 percent of the average height of the counterfactual distribution at the threshold. Despite the significant excess mass we find the observed elasticity of taxable income (ε) with respect to the net of tax rate is only around 0.09, which suggests that for a 10 per cent increase in the net of tax rate, taxable income would fall by only around 0.9 percent. While the change in the net of tax rate at the top threshold is generally the smallest of the thresholds in the Australian personal tax system, and very small compared to the excess mass.

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While there are a number of reasons the top tax threshold is typically the focus it is generally because the top tax threshold has the greatest change in the next of tax rate, however, this is not the case for Australia.
to other thresholds examined by other countries, the behavioural response is comparable to those found in other studies. A possible explanation for this is that tax-filers at this threshold have more scope to adjust their taxable income, for example, transferring income to low income spouses or children, greater capacity to save income through concessionally taxed superannuation contributions or may reflect a higher proportion of self employed tax-filers.\(^{38}\)

Moving to the second threshold, for which the distribution is more populous, we find less bunching, with the excess mass estimated to be around 6.63. This suggests the number of people bunching at the second threshold is around 663 percent of the average height of the counterfactual distribution around the threshold. The observed elasticity of taxable income ($\varepsilon$) with respect to the net of tax rate is estimated to be around 0.08.

For the first threshold, which is generally the most populous part of the taxable income distribution, and where the change in the net of tax rate is the highest, for example in 2010 the change is around 19 per cent, we find the excess mass to be around 2.09. This suggests the number of people bunching at this threshold is around 209 percent of the average height of the counterfactual distribution around the threshold. The excess mass corresponds to an observed elasticity of taxable income ($\varepsilon$) with respect to the net of tax rate of around 0.03.

The last threshold examined is the effective tax free threshold, which is the tax free threshold plus the tax offset provided by the Low Income tax Offset. In 2010, this threshold corresponded to a taxable income of $15,000. We find the excess mass at this point to be around 3.74, with a corresponding observed elasticity of taxable income of around 0.12.

The observed elasticity at the effective tax free threshold is generally higher than the other thresholds. This result may reflect the likelihood that tax-filers at this threshold are part-time or casual workers and secondary income earners and are therefore more responsive to changes in their after tax income.

One potential problem that may affect the estimates around the effective tax free threshold is that tax-filers who are 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 understated. Caution should therefore be exercised when interpreting these results, and therefore for the remainder of the paper we focus on the first, second and top thresholds only.

### 1.6.2 Bunching analysis: wage earners and self employed

It is useful to examine bunching behaviour by wage earners and tax-filers with self employment income separately. Self employed tax-filers are likely to face less frictions in adjusting their taxable income, for example, they are likely to have more scope to choose the number of hours they work. They also have less third party reporting, so may have more opportunity to avoid or evade taxes, including greater ability to shift the timing of when income is realised, or engage in the so called ‘cash economy’.\(^{39}\) Previous studies examining bunching behaviour, have typically found where there is evidence of substantial bunching at a threshold it is typically a result of self-employed tax-filers (see for example, Saez (2010) for the United States,

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38 We explore many of these issues in Chapter 4.
39 For example, self-employed tax-filers could choose to defer issuing invoices to ensure they are paid in a later tax year, or request payment by cash which they choose to not report in their taxable income.
Chetty et al. (2011) for Denmark, Kleven and Waseem (2013) for Pakistan and Bastani and Selin (2014) for Sweden).

Consistent with our expectations, and in line with other studies, we find greater bunching and therefore higher estimates of the observed elasticity of taxable income for self-employed tax-filers compared to wage and salary earners (Figure 5 presents estimates for 2010). However, in contrast to other studies, we generally find significant bunching for wage and salary earners in most years across all thresholds, even where the change in the net of tax rate is relatively small.

At the top tax threshold, the self employed have an excess mass of around 33.61, which is almost double the baseline estimate for all tax-filers. The corresponding observed elasticity of taxable income is estimated to be around 0.15. In contrast, while we find significant bunching by wage and salary earners, the excess mass estimated to be only 1.34, with the estimated observed elasticity of taxable income while statistically significant, is effectively zero (0.006).

We see a similar pattern at the first and second thresholds. The excess mass at the second threshold for self employed tax-filers is estimated to 22.7, almost four times the baseline estimate for all tax-filers, while the corresponding elasticity is estimated to be around 0.26, suggesting a 10 per cent increase in the net of tax rate results in a 2.6 per cent fall in taxable income. For wage and salary earners, the excess mass is estimated to be around 0.62, with a corresponding elasticity of 0.007. At the first threshold the excess mass for self employed tax-filers is estimated to be 6.3, which compares to 0.24 for wage and salary earners. The corresponding observed elasticities are 0.086 and 0.003 respectively.

We find clear evidence of bunching by wage and salary earners suggesting they contribute to the bunching we observed for all taxpayers. This result is somewhat unique, and surprising particularly given the relatively small changes in the net of tax rate that we observe in the Australian tax system.

It is beyond the scope of this paper to provide a full cross country analysis of the drivers behind the differing results across countries. Saez, Slemrod, and Giertz, 2012 note that the elasticity of taxable income is not a structural parameter, and is dependent on the underlying features of the tax system. This provides some insights into the possible reasons for the differences. The Australian tax system is likely to have more scope for tax-filers to adjust their income. For example, in Denmark the main deduction from taxable income is contributions to retirement savings accounts, while in the United States tax-filers are able to take a standard deduction. In Australia, deductions are itemised and available for most work related expenditure, some other selected expenses, as well as certain contributions to superannuation accounts. It is possible that tax-filers could use these multiple forms of deductions to better target their income and reduce their tax liabilities. There is also significant scope in the Australian tax system to split income with others tax filers. For example, tax filers can utilise discretionary trusts to direct some forms of income to lower income relatives and beneficiaries. This may also help explain why from a visual inspection the distribution around the thresholds is typically skewed to the left of the kink.

In comparison with the US tax system, which is probably the most comparable to Australia’s, the finding of clear evidence of bunching at all thresholds is in contrast to the finding of Saez, Slemrod, and Giertz, 2012.

40 Estimates for all other years are available upon request.
41 As a result, the elasticity of taxable income can therefore be influenced by policy makers.
(a) First threshold, wage earners

(b) First threshold, self employed

(c) Second threshold, wage earners

(d) Second threshold, self employed

(e) Top threshold, wage earners

(f) Top threshold, self employed

Figure 5: Distribution around main tax thresholds, wage earners and self employed, 2010
Our result may suggest the Australian tax system is more salient or that Australian tax filers are more knowledgeable about the Australian tax system.

### 1.6.3 Bunching analysis: by gender

The size of our dataset allows us to examine subgroups of the population that we might expect to have differing responsiveness to marginal tax rates. Much of the labour supply literature has focussed on examining different demographic groups separately, in particular, we might expect women, who are often secondary earners, to be more responsive to the tax system than men. Similarly, younger tax-filers and tax-filers closer to retirement may have less attachment to the labour force and therefore be more responsive to changes in tax rates.

Examining male and female wage earners separately we find that, as expected, females are generally more responsive to the tax system than males at the top threshold (Figure 6 for 2010). While this finding is statistically significant there is little economic significance, with estimates of the elasticity of taxable income for both males and females effectively zero. Interestingly, at the second threshold, there is generally no significant difference in the elasticity of taxable income between male and female wage earners (Figure 6c for 2010), while at the first threshold, the elasticity for females is lower than that for males in most years (Figure 6a for 2010). Again, while the result is statistically significant the difference is not economically significant. There are a few possible reasons why the elasticity for females at the first threshold may be lower than for males. First, it is possible that more males at this threshold are the secondary earner. Second, it may also reflect differing demographic profile for exampleed, males at this threshold are less likely to be at prime working age and therefore can be expected to have less attachment to the labour force.

The findings for self employed males and females tell a different story. We find significant sharp bunching for both males and females across all thresholds and years, with females always more responsive (Figures 6b, 6d and 6f for 2010). We typically find the largest responses at the second threshold, which generally as the largest change in the net of tax rate. For example in, 2010, the excess mass for females is estimated to be around 29.72, while the excess mass for males is estimated to be around 17.98. This suggests that number of taxpayers bunching around the threshold is 2972 percent of the average counterfactual distribution for females and 1798 per cent of the average counterfactual distribution for males. These estimates, correspond to an observed elasticity of taxable income of 0.345 for females and 0.209 for males, suggesting a 10 per cent change increase in the net of tax rate corresponds to 3.45 percent reduction in taxable income for females and a 2.09 per cent reduction for males.

We can also extend the analysis to examine differences between married females, who are typically seen as being highly responsive to marginal tax rates, and single males. We focus on the post 2010 period, where data on martial status is more reliable. As expected, we find married females are significantly more responsive to marginal tax rates than single males. In

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42 As noted previously, Saez (2010) only finds evidence of bunching at the first threshold in the US tax system. He suggests this may reflect greater flexibility in work choices for tax filers around this threshold and that the tax system at this point is less likely to be less complex.

43 Estimates for 2010 are presented in the text, estimates for all years are available upon request.

44 As noted previously, Australia operates an individual based tax system, with some select elements based on the family/household unit.
Figure 6: Distribution around main tax thresholds, females and males, 2010
2013, the first year the marital status question returned to being a general question for all tax-filers, the observed elasticity of taxable income at the top threshold for married female wage earners is more than four times higher than that for single male wage earners, although still low at 0.013 (Figure 7c for 2010).

Our estimates at the first threshold are somewhat inconclusive. We find a significant difference between married female and single male wage earners in 2013 (Figure 7a), however no significant difference is found in 2014.45

We find a similar pattern for self-employed tax-filers, although consistent with our previous findings, observed elasticities are significantly higher for self employed tax-filers than for wage earners (Figures 7b and 7d).

The tax return also includes the number of dependants of the tax filer. Again we focus on the post 2010 data and find that female tax-filers with children are typically more responsive to the tax system and have a higher observed elasticity of taxable income than females with no children. In general, we find that the bunching parameter and associated observed elasticity of taxable income increasing with the number of children (Tables 3, 4, 5 and 6) although the differences are typically not statistically significant. For example, in 2013 the observed elasticity of taxable income for self employed females with no children at the top threshold is

45 We cannot examine the second threshold for single males in 2013 due to the interaction with the Medicare Levy Surcharge, however, in 2014 we find the observed elasticity of taxable income for married female wage earners is 0.016, while the elasticity for single male wage earners is 0.006
estimated to be 0.118, this compares to an estimated elasticity of 0.135 for females with three or more children, although the difference is not statistically significant.

Table 3: Female tax-filers, wage and salary earners, first threshold, 2013

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Note: Standard errors in parenthesis.

Table 4: Female tax-filers, self employed, first threshold, 2013

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Note: Standard errors in parenthesis.

Table 5: Female tax-filers, wage and salary earners, top threshold, 2013

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<td>0.009</td>
<td>0.007</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
</tbody>
</table>

Note: Standard errors in parenthesis.

1.6.4  Bunching analysis: by age

We now examine taxpayers responses to marginal tax rates by age cohort. Elasticities are likely to vary with age. For example, younger tax-filers are likely to have a lower attachment to the labour force, and may also be more risk taking and therefore more aggressive in their tax planning arrangements.

Again we find similar trends to those previously identified, with the observed elasticity of taxable income for wage and salary earners close to zero, and significantly smaller than that for the self employed for all age cohorts.

For wage and salary earners, we see a different pattern for males and females over the age cohorts and across the different thresholds.\footnote{We focus on tax-filers at the first and second thresholds where the distribution of tax-filers across the various age brackets is thicker.} For male tax-filers around the the second
threshold, the elasticity of taxable income is more constant over the age ranges, increasing as tax-filers approach retirement (Figure 8c). For females at the second threshold the elasticity of taxable income is significantly higher for tax-filers aged between 18 to 24 years old, likely reflecting their low attachment to the labour force (Figure 8c). The elasticity is also lower for females aged between 25 to 34 years old. The results at the first threshold are mixed, with the elasticity of taxable income for older males typically higher than that found for females (Figure 8a), suggesting that lower income males in this age cohort may have lower attachment to the labour force.

For the self employed, the elasticity of taxable income, at all thresholds, is generally highest for younger tax-filers, aged between 18 to 24 years old. For example, in 2010, the elasticity of taxable income for male and female tax-filers aged between 18 to 24 was around 0.96 and 1.18 at the second threshold while the elasticity for tax-filers aged between 25 to 34 years old is around 0.15 and 0.41 respectively (Figure 8d).\textsuperscript{47} One possible explanation for this is that for younger self employed tax-filers some of their taxable income is income transferred or ‘split’ from others tax-filers in their household who are trying to minimise their tax liability. For example, 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 equalised, at this point there is no incentive to distribute additional income to their family members.

For self employed tax-filers we also find that the elasticity of taxable income is also generally higher for females than males over the ages 18 to 44, which is around ages when they may have young children, and therefore their attachment to the workforce maybe lower. The difference between females and males starts to close over the last two cohorts from ages 45 to 64, with the elasticity for males generally increasing as as they approach retirement age.

\subsection*{1.6.5 Bunching analysis: time trends}

The bunching approach used to estimate the elasticity of taxable income in this paper only requires a single year of data, as a result we can also examine variations in taxpayer responses to marginal tax rates over time. The Australian tax system offers some advantages in this regard. First, the first threshold has remained relatively constant in real terms over much of the period, with the changes in the threshold broadly offsetting inflation. Second, in relation to

\footnote{For some years we are unable to present results for tax-filers aged between 18 to 24 years old at the second and top thresholds due to the thinness of the distribution, however even in these years we see a similar pattern with the elasticity of taxable income higher for 25 to 34 year olds.}
Figure 8: Observed elasticity of taxable income by age group, 2010

Note: The dashed lines represent the 95 per cent confidence intervals.
the top tax rate, it has gone through periods where the threshold was increased substantially and as such, the threshold is likely to apply to a different group of taxpayers, allowing us to examine how tax-filers respond to changes in thresholds and how they learn over time.

At the first threshold, the elasticity of taxable income for all tax-filers has trended downward for most of the period (Figure 9. One exception is in 2004 where the estimated observed elasticities for both wage and salary earners and the self employed fell sharply. There are a few possible explanations for this. First, in 2004 the threshold was increased for first time since the introduction of the Goods and Services Tax in 2000. This change may not have been anticipated making it difficult for people to negotiate new wages or adjust their behaviour. Some support for this can be seen looking at the trends post 2004, which generally show the elasticity of taxable income increasing over subsequent years. Another, somewhat related reason is that in wage negotiations there may be a bias towards whole numbers, and as such more filers would be more likely to locate around $20,000 compared to the new threshold in 2004 $21,600. However, if that were the case we would also expect a marked increased in the elasticity in 2007, when the threshold was increased to $25,000 or in 2008 when it was increased to $30,000, which we don’t observe, and would not explain the similar fall seen by the self employed.

For tax-filers around the top threshold the elasticity of taxable income tended to increase over the period 2001 to 2008 (Figure 10). This coincides with the period in which the top threshold increased from around 1.4 times average earnings to 2.5 times average earnings (OECD, 2016). This trend may reflect that tax-filers higher up the income distribution have greater opportunity to avoid tax and therefore as the real value of the threshold increased strongly over the period the behavioural response around the threshold also increased. This would be consistent with our earlier finding of greater bunching evidence at the top threshold, despite the smaller change in the net of tax rate.

Interestingly, since 2008 the elasticity of taxable income at the top threshold has tended to fall. In part, this may reflect increased income volatility as a result of, and since, the financial crisis making it more difficult for tax-filers to adjust their taxable income precisely around the threshold. Another possibility is that it may also reflect increased data matching and data validation by the Australian Taxation Office, which may have limited options for tax
avoidance and evasion. For example, from 2008 the Australian Taxation Office introduced extensive pre-filling of tax returns, available for both tax agents and self preparers, under the program certain income items, including dividends and bank interest, are pre-filled in a tax-filer’s tax return. While the tax-filer can override the value, these initiatives are likely to have reduced the scope for some tax-filers to evade tax by under-reporting these types of income. Furthermore, data matching has also enhanced the Australian Tax Office’s compliance enforcement capabilities.\textsuperscript{48}\textsuperscript{49} Lastly, it is also possible that because the thresholds have not been adjusted since 2009, the real value of the tax thresholds has fallen and consequently over time the threshold again applies to more tax-filers who have less capacity to adjust their income.

The trends across the different age groups follow a similar pattern to overall results presented above (Figures 10 and 11). One difference is that for tax-filers aged between 55 to 64 we find an increase in the estimated elasticity of taxable income for both males and females in 2006, and the following few years, this particularly evident for the self-employed (Figures 10g, 10h, 11g and 11h). This corresponds to the time when concessional taxation arrangements were introduced for tax-filers approaching retirement, increasing incentives to reduce taxable income by contributing more income to superannuation.\textsuperscript{50} For other tax-filers, the elasticity of taxable income is generally flat or falling at this time.

\textsuperscript{48} According to the Australian Taxation Office’s annual reports over 650 million transactions were available for data matching and pre-filling in 2013-14 up from around 540 million transactions in 2010-11. Data matching resulted in around 450,000 reviews and audits in 2013-14, up from around 416,000 in 2010-11. (ATO, 2015p.45 and ATO, 2011p.100)

\textsuperscript{49} An examination of the impact of reviews and audit on bunching behaviour is left for future work.

\textsuperscript{50} Under the arrangements taxpayers 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 simply ‘recycle’ their income by making pre-tax contributions from their taxable income back into their superannuation savings, effectively just reducing the marginal tax rate faced on some of their taxable income to 15 per cent.
(a) Wage earners, 25 to 34 years old

(b) Self employed, 25 to 34 years old

(c) Wage earners, 35 to 44 years old

(d) Self employed, 35 to 44 years old

(e) Wage earners, 45 to 54 years old

(f) Self employed, 45 to 54 years old

Figure 11: Observed elasticity of taxable income at first threshold, by age group, 2000-2014

Note: The dashed lines represent the 95 per cent confidence intervals.
Figure 10: Observed elasticity of taxable income at first threshold, by age group, 2000-2014 (Continued)

Note: The dashed lines represent the 95 per cent confidence intervals.
Figure 11: Observed elasticity of taxable income at top threshold, by age group, 2000-2014

Note: The dashed lines represent the 95 per cent confidence intervals.
Figure 10: Observed elasticity of taxable income at top threshold, by age group, 2000-2014 (Continued)

Note: The dashed lines represent the 95 per cent confidence intervals.
1.7 CONCLUSION

We examined bunching behaviour in the Australian personal tax system, utilising a new administrative dataset covering the universe of Australian personal tax-filers over the period 2000 to 2014.

Unlike previous studies for other countries, we find evidence of significant bunching at all the main thresholds in the Australian system with the excess mass of all tax-filers around the thresholds ranging from 2 to 19. We find significant variation in the observed elasticity of taxable income across the different thresholds with the estimated elasticity for all tax-filers ranging from 0.03 to 0.12, with the largest response 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 tax-filers compared to wage and salary earners. We find that observed elasticity of taxable income for self employed tax-filers to be typically greater than 0.1, while the elasticity for wage and salary earners is effectively zero.

Utilising the size and detail of our dataset, we also examine bunching behaviour and the associated elasticity of taxable income for a range of sub-groups of the population. We find the observed elasticity of taxable income is typically higher for married females, and females with children, possibly reflecting lower attachment to the labour market. We also find the elasticity of taxable income is higher for younger tax-filers, and in some cases greater than 1. In addition to younger tax-filers being less attached to the labour force, the higher elasticity may also reflect that younger tax-filers are less risk averse and more likely to be aggressive with their tax planning, and may also reflect family tax planning arrangements - where there is an incentive to have all family members facing the same marginal tax rate. An examination of these issues is left for future work.

We also examine trends in the observed elasticity of taxable income over the period 2000 to 2014. We find that the observed elasticity of taxable income generally increased from 2000 to around 2008, possibly indicating tax-filers becoming more aware of the thresholds following the significant changes to the system at the time the Goods and Services Tax was introduced. From 2008 there is a noticeable downward trend in the elasticity of taxable income. One possible reason for this decline is the increased use of data matching and pre-filling by the Australian Taxation Office. This result suggests the potential importance of tax administration and taxpayer compliance activities on the elasticity of taxable income. A fuller examination of this is left for further work.

The analysis presented in this paper provides a starting point for a rich examination of taxpayers behavioural responses and understanding of the Australian personal tax system. To date there has been limited analysis on how tax-filers actually respond. Chetty et al. (2011) find some evidence to suggest that in Denmark the bunching response relates, in part, to income shifting and aggregate bunching driven by collective wage negotiation. Australia’s data, however, allows for a deeper examination into the various mechanisms taxpayers use to reduce their taxable income, including, the use of deductions, retirement savings (superannuation) contributions, reducing earned versus unearned income and potentially income splitting between family members. We explore this in some detail in the next chapter.
The focus of this paper has been targeted at the main personal tax thresholds. In the future we plan to extend the analysis to examine other thresholds including, the the notch created under the Medicare Levy Surcharge which is designed to encourage the take-up of private health insurance; the kinks created by the Mature Aged Workers Tax Offset, which was designed to help encourage older Australians to remain in the workforce; and the effectiveness of retirement savings incentives and disincentives such as, the superannuation co-contribution scheme and the excess contributions tax.

In time, there would be significant value in linking the tax administration dataset to other datasets, particularly social security data. While this is unlikely to be a significant issue for the analysis presented in this chapter, linking to social security data would allow for a more complete examination of behavioural responses to the tax-transfer system, which is particularly important for Australia given its highly targeted means tested transfer system.


