Bunching in the
Norwegian Income Distribution

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The roots of education are bitter, but the fruit is sweet.

Aristotle (384 – 322 BC)
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Abstract

The distorting effects that lead to unintended behavioral responses in the population are an important aspect of any tax system. The elasticity of taxable income (ETI) is a measure aimed at capturing all such behavioral responses. Saez (2010) developed a method for using the bunching mass of individuals at a kink point in the tax system, a discontinuous jump in the marginal tax rate, to estimate the ETI at that kink. This thesis applies this methodology from Saez to the Norwegian income distribution for 2001-2010, focused primarily on the first surtax threshold for personal income. Following the bunching literature that reports large differences between wage earners and the self-employed, estimates are done for both regular wage earners and the self-employed at the first surtax threshold. The estimates are local average income effects at a particular segment in the income distribution and are estimated for each individual year. The time period includes a tax reform in 2006, which lowers the marginal tax rates of the surtax, as well as changes how business income is split into labor income and capital income.

I find that the most prevalent bunching among the self-employed stem from restrictions in the tax law, here referred to as artificial bunching, and also that the self-employed bunch at large rounded numbers in the income distribution. Removing these two sources of bunching the ETIs for the first surtax threshold is estimated. The results are fairly small, but significant: between 0.02 and 0.07 for the self-employed and below 0.01 for wage earners. The estimates are consistently larger after the 2006-tax reform. These small estimates suggest a correspondingly low level of distortion from the surtax system on personal income, at least locally.
Preface

This thesis is written as the finishing part of my Master in Economics at the University of Oslo. I have grown a lot from this process and my learning outcome has been tremendous, accompanied with the occasional high shoulders, long hours, joys and frustrations. In other words, everything as is to be expected. Even from a specialized part of the economics field I am grateful to have gained an insight into some of the great research and methodological discussions done in this world.

I would first and foremost like to thank my supervisor, Trine Engh Vattø, for her insightful comments and helpful advice in working with this thesis. Without her this thesis would surely be lacking in many regards. Also, through her and Statistics Norway, I have had the benefit of access to the datasets, as well as a place to work.

I am grateful to my fellow master and PhD-students at Statistics Norway for our regular lunch break conversations and discussions. Lastly, a note of thanks is directed towards my significant other, Anja, for showering me with food and affection during this period, as well as for valuable feedback and proof reading.

As this project comes to a completion I lastly want to note that any errors in this paper are mine, and mine alone.

Oslo, May 2016

Fredrik B. Dombeck
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1 Introduction

Most taxes employed in practice generate distortions, which - from the government’s perspective - induce an unintended change in individuals’ behavior. There are a multitude of ways to respond to income taxation, such as change in work effort, hours worked, income shifting, career and work choice, tax aversion and tax evasion. A central question within empirical public economics is then to quantify to which extent taxes are distortionary in practice.

Traditionally, hours worked was used to measure the effect of taxation. This was done by estimating change in hours worked resulting from a tax change. However, the change in hours worked encompasses only a part of the possible responses, albeit a very important one. From this initial focus there has been a shift in attention towards using the elasticity of taxable income to summarize the total efficiency costs that result from taxation, an approach first outlined by Feldstein (1995, 1999). In his 1995 paper Feldstein employs the concept of elasticity of taxable income (ETI) that, under certain assumptions, serves as a broad measure of the actual responses following a tax change. The ETI is measured with respect to the net-of-tax rate (one minus the tax rate), and was by Feldstein first used to evaluate behavioral responses after a tax reform.

Building on this concept Saez (2010) sets the foundation for using the distribution of reported taxable income to directly measure the elasticity of taxable income. This is possible in a tax schedule where there is a discontinuous jump in the marginal taxation, referred to as a kink point in the tax system. The increase in the marginal tax rate induces some individuals to decrease their income from above the kink point, to just below the kink. This would create an excess mass centered at the threshold of the kink when compared to the income distribution further away at either side of the threshold. By utilizing the neighboring distribution further away from the kink as the counterfactual, one can infer the counterfactual distribution for the distribution at the kink. By comparing the two one can evaluate the extent of the bunching mass. It is this difference in mass that Saez used to estimate the ETI with respect to the ratio of net-of-tax rate for that kink point.

In the wake of Saez’ paper the bunching method has been applied, and attempted refined, in several papers, using data from different countries such as Denmark (Chetty et al. 2011 and le
Maire and Schjerning 2013), Sweden (Bastani and Selin 2014), the Netherlands (Dekker and Strohmeier (2015) and Pakistan (Kleven and Waseem 2013). The reported elasticities vary from below 0.02 to 0.5, depending on which population or subgroups are under scrutiny. Reported elasticities are generally small for the population as a whole, but larger for certain subgroups. The elasticities are also consistently larger for the self-employed, and only minor for wage earners.

In this thesis I apply the approach from Saez (2010) on the Norwegian distribution of taxable income between 2001 and 2010. The data is provided courtesy of Statistics Norway through the annual tax return data and covers the entire population. Following the findings from the bunching literature I will aim towards two main points: Firstly, the focus will be directed towards bunching behavior in general and more specifically at differences between wage earners and self-employed. Secondly, the focus will be on estimating the ETI at the first threshold for the surtax. This threshold represents a fairly large increase in the marginal tax rate (ranging between 9 and 13.5 percentage points within the time period).

While I find considerable bunching among the self-employed, this is for the most part unrelated to the threshold for surtax itself. The majority of bunching is connected to the institutional framework and computation of taxable income for the self-employed, as well as simple bunching at large rounded numbers such as 100 000 and 150 000 NOK. The presence of bunching close to the surtax threshold that is seemingly unrelated to the increase in the marginal tax itself creates a potential for bias when estimating the elasticity of taxable income in relation to that tax kink. In years where bunching from other sources are adjacent to the tax kink this could give an upward or downward bias to the ETI, depending on the distance to the surtax threshold. In an attempt to overcome this potential bias I will estimate elasticities for each year before and after removing the bunching from other sources. The remaining estimates, after the removal of other sources of bunching, will be used as my main estimates for the elasticity of taxable income at the first surtax threshold.

The rest of this thesis is structured as follows: The subsequent chapter presents the theoretical foundation for bunching and how one can utilize bunching to empirically estimate the elasticity of taxable income. This framework is based on Saez (2010). Chapter three follows with a brief review on the relevant literature using the ETI and bunching. In chapter four the Norwegian tax system is presented as the institutional background in which the study takes place. Chapter five
presents the data and classifications employed as well as the descriptive statistics of the working population. Chapter six elaborates on the empirical strategy. Chapter seven presents the results; first the visual analysis of the aggregate distribution for the entire period of 2001-2010, then an in-detail look at the distributions for 2004, and lastly the estimation results of the ETIs. Chapter eight summarizes and concludes.
2 Theoretical Framework

The two first sections present a basic theory of tax responses, bunching and why general economic theory suggests that these phenomenon could occur. The third section extends this general theory to an empirical approach to calculate the elasticity of taxable income.

2.1 A basic concept of responses to taxation

In the standard model for labor supply and consumption an individual supplies labor and receives wage income at a fixed rate per hour worked. For simplicity one can think of two goods: consumption goods and leisure. An increase in working hours increases income for consumption goods, but reduces leisure. The consumer picks a level of working hours such that the marginal benefit of working one extra hour for income to consumption goods is equal to the marginal disutility of one hour less of leisure. In the standard model the consumer can adjust his labor supply in a continuum of possible hours worked. If the income tax rate increases, then the marginal benefit of working one hour more is reduced and the individual would change its number of hours worked to adjust the new tax schedule. Thus, increased income tax would result in a real shift in the labor supply (from individuals with elastic labor supply).

However, if (certain) jobs require a fixed number of hours worked per week, this would restrict the option of adjustment in working hours, at the margin, and the models ability to explain or predict distorting effects. And the labor supply response may not be the only possible source of adjustment. In addition to changes in work hours a set of responses may be available; for instance shifting to other tax bases, tax evasion, change in work effort, or more long run effects such as educational paths and careers (Kleven and Schultz 2014).

Extending from the simpler labor supply framework the purpose of the elasticity of taxable income (ETI) is to capture a larger set of responses to taxation and thus be a better estimate of the actual tax burden. The ETI is measured as an elasticity of taxable income with respect to the net-of-tax rate and aims to captures all behavioral responses, not only in terms of working hours. There are several possible ways to estimate this. The most frequently applied method is to estimate the differences resulting from a change in taxation through a tax reform, either by using panel data or repeated cross-sections, in a difference-in-difference approach.
Another approach - and the one applied in this thesis – is to use the behavioral response to a kink point in the tax system to estimate the ETI at that kink. The next section presents the foundation for this method.

2.2 A theory of bunching

To a large extent this exposition follows the foundation in Saez (2010), and starts by assuming a utility function for a representative individual. The utility depends positively on consumption $c$ and negatively on income $z$, where consumption correlates to income, but increased work time means loss of leisure and reduces opportunity to consume. This utility function is the same as for the labor supply model in 2.1, but exchanges hours worked with income ($z$). Changes in work hours will still be captured by the change in income, but the goal is to capture other effects on income as well.

Now, let income be taxed at a flat rate of $t_0$ so the individual budget constraint is defined by

$$c = (1 - t_0)z.$$  

Where $c$ is the consumption, $z$ income, and $t_0$ the tax rate. For zero taxed ($t_0 = 0$) consumption equals income. Suppose now we increase the marginal tax rate at a given income level, $z^*$ from $t_0$ to $t_1$, where $t_1 = t_0 + \Delta t_0 > t_0$. This introduces a kink in the tax system at $z^*$ and a kink in the budget constraint. In this scenario we can distinguish between three types of representative individuals: L, H and G. Individuals such as L have income lower than the kink, income $\leq z^*$, before the tax change and are not affected by the alteration of the tax schedule. Individuals such as H have income between $(z^* + \Delta z^*)$ and will be the bunching individual. Lastly, individuals such as G have income higher than $z^* + \Delta z^*$ and will be above the income level characterized by those who bunch, but still be affected by the tax change.

Starting with income distribution before the kink was introduced, there are within the segment $[z^*, z^* + \Delta z^*]$ two of the types of the individuals just presented; L and H. Individual L has an indifference curve tangent to point $z^*$, and thus stays at the same point after the reform. Individual H has a flatter indifference curve that is tangent to the slope $(1-t_0)$ at $z^* + \Delta z^*$, and has consequently chosen a higher income level than L, as seen in Figure 1. However, due to the increase in marginal taxation on income when the kink is introduced, individual H’s indifference
curve is no longer tangent and she now finds a new equilibrium by shifting to a lower indifference curve just tangent to the start of the slope (1 - t₀ - Δt). Individual H then represents the marginally bunching individual.

**Figure 1:** Illustration of the marginally bunching individual.

![Figure 1 illustration](image)

Figure 1 illustrates the different indifference curves that lead to different incomes. Increasing the marginal tax rate at \( z^* \) results in a kink in the tax schedule and all individuals such as H located in \( (z^*, z^* + Δz^*) \) will now reduce their income, resulting in bunching at \( z^* \). The figure is borrowed from Saez (2010).

All individuals in the segment \( (z^*, z^* + Δz^*) \) before the tax reform now will reduce their income and allocate to \( z^* \), just as individual H. This effect creates an excess mass, or bunching, of individuals at this income level precisely due to the increased marginal tax rate. The size of the excess mass depends on how large the change in marginal tax rate is and the number of individuals in the distribution around the kink. Note that the bunching at \( z^* \) does not necessarily imply that there need be a missing mass just after the kink, as individuals with even higher incomes (\( > z^* + Δz^* \)) might reduce their income and fill up this gap.

Bunching is a rational response to kink points in the marginal tax rate schedule. Still, not everyone may be able to change their income on the margin due to frictions in the real world. These frictions are known as optimization frictions and can be the result of for example a job requiring a fixed number of work hours per week, inability to shift income between other sources or time periods (legally or illegally), inattention to the shift in taxation or general inertia. Due to
these frictions often the observed bunching will not be a point mass, but a diffuse excess mass centered round the kink point. Larger differences in the marginal tax rate give larger incentives to overcome optimization frictions.

We use the elasticity of taxable income to measure the responsiveness of bunching individuals to change in the marginal tax rate. This is used to measure the percentage change in income following a percentage change in another variable, such as the price of a good or the net-of-tax rate. For large changes there would be income effects as well as substitution effects, the two components that can follow a price or income change. However, for a small change in the marginal tax rate $\Delta t$ we can use the compensated elasticity to measure the substitution effect in isolation. From the definition of the compensated elasticity of income applied with respect to one minus the tax rate, we have that

\begin{equation}
\frac{\Delta z^*}{z^*} = e \frac{\Delta t}{1 - t}.
\end{equation}

If we define the function for the density of incomes at $z^*$ as $h(z^*)$ in the case of only a flat tax rate, then the total number of individuals is given by $h(z^*)\Delta z^*$, where $\Delta z^*$ is defined from equation (2).

\subsection*{2.3 Empirical estimation of ETI using bunching}

This segment follows Saez (2010) in laying the foundation to empirically estimate the elasticity of taxable income using the bunching theory. Since actual kink points are not necessarily small, as supposed in the result leading up to equation (2), this will generalize the framework to larger kinks. We start by considering a simple parameterized model which has a quasi-linear and iso-elastic utility function of the form:

\begin{equation}
\begin{aligned}
\frac{\Delta z^*}{z^*} &= e \frac{\Delta t}{1 - t}.
\end{aligned}
\end{equation}

\begin{equation}
\begin{aligned}
&u(c, z) = c - \frac{n}{1 + 1/e} \left( \frac{z}{n} \right)^{1+1/e}
\end{aligned}
\end{equation}
Let $n$ be the optimally chosen income level when no taxes applies, with a density given by $f(n)$ and cumulative distribution of $F(n)$. The iso-elasticity assumption implies that the elasticity is constant and equal to $e$.\footnote{Allowing for heterogeneity in preferences means $e$ equals the average of individual elasticities at income $z^*$.}

Maximizing $u(c,z)$ subject to a linear budget constraint where consumption is equal to income, $c = (1 - t)z$, and rearranging w.r.t. $z$ we get

\begin{equation}
(4) \quad z = n(1 - t)^e.
\end{equation}

And with no taxation ($t = 0$) $z = n$, as in the previous model.

Let $H_0(z)$ be the cumulative density distribution (cdf) of income for a fixed marginal tax rate, $t_0$. And one gets $H_0(z) = \Pr(n(1 - t_0)^c \leq z) = F(z / (1 - t_0)^e)$ and the corresponding density distribution $h_0(z) = H_0'(z) = f(z / (1 - t_0)^e) / (1 - t_0)^e$.

Now we introduce the (convex) kink in the tax system and consequently in the budget set, by increasing the marginal tax rate to $t_1$ for income level above $z^*$ (where $t_1 > t_0$). Set $h(z)$ as the density distribution of realized income and $H(z)$ as the cumulative distribution of $h(z)$ in the situation with a kink in taxation and the corresponding budget set.

For income levels with $z < z^*$ we still have $z = n(1 - t_0)^e$ such that $h(z) = h_0(z)$. For income levels $z > z^*$ we have $z = n(1 - t_1)^e$ and $H(z)$ becomes $F(z / (1 - t_1)^e)$, and $h(z) = f(z / (1 - t_1)^e) / (1 - t_1)^e$.

Expressed in relation to the original distribution $h_0(z)$ for $t = t_0$ for $z > z^*$ this results as $h(z) = h_0(z((1 - t_0) / (1 - t_1))^e) \cdot ((1 - t_0) / (1 - t_1))^e$. Denote the left limit of $h(z)$ as $h(z)_-$ for $z \rightarrow z^*$, and conversely $h(z)_+$ for the right limit as $z$ approaches $z^*$ from the right. The limits are now defined as $h(z)_- = h_0(z^*)$ and $h(z)_+ = h_0(z^*((1 - t_0) / (1 - t_1))^e) \cdot ((1 - t_0) / (1 - t_1))^e$.

Individuals with $n \in [z^*/(1 - t_0)^e, z^*/(1 - t_1)^e]$ choose $z = z^*$ and will bunch at the kink point. The bunching individual at the upper margin has $n = z^*/(1 - t_1)^e$ and hence had income equal to $z^*((1 - t_0) / (1 - t_1))^e$ under the linear tax system with a constant marginal tax rate of $t_0$. Effectively all individuals with an income level between $z^*$ and $z^* + \Delta z^*$ in the linear tax system will bunch at $z^*$ in the piecewise linear tax system, where:
This framework generalizes equation (2) to larger kinks, expressed as (5). The fraction of the population bunching is now:

\[
\begin{align*}
B &= \int_{z^*}^{z^* + \Delta z^*} h_0(z) dz \\
&\approx \Delta z^* \frac{h_0(z^*) + h_0(z^* + \Delta z^*)}{2} \\
&= \frac{h(z^*)_- + h(z^*)_+ / \left(\frac{1 - t_0}{1 - t_1}\right)^e}{2},
\end{align*}
\]

where the last equation in (6) results from using trapezoidal approximation for the integral. By combining (5) and (6) we get a resulting quadratic equation in \((1 - t_0) / (1 - t_1)\)^e and the bunching mass can be expressed as (7):

\[
B = z^* \left[ \left(\frac{1 - t_0}{1 - t_1}\right)^e - 1 \right] \frac{h(z^*)_- + h(z^*)_+ / \left(\frac{1 - t_0}{1 - t_1}\right)^e}{2}
\]

This expresses the elasticity \(e\) as a function of observable or empirically estimable parameters: 1) the kink threshold \(z^*\), 2) the net-of-tax ratio \((1 - t_1) / (1 - t_0)\) associated to the kink, 3) the density of the distribution just below and just above the kink \(h(z^*)_-\), \(h(z^*)_+\), 4) the amount of bunching \(B\) at \(z^*\).

Both the kink threshold \(z^*\) and the net-of-tax rate are parameters that are directly observable. Thus we need to estimate parameters 3) and 4).

To estimate \(B\) we need to evaluate how much excess mass exist at the kink point \(z^*\). As noted in the previous section on the theoretical basis of bunching, we can expect optimization frictions in the real world. Thus the observed bunching mass will most likely be a diffuse increase in mass centered at the threshold for the kink point, and not a point mass as the simple model of bunching would predict. For a given empirical distribution \(h(z)\) we can by visually studying the distribution define an income band around the kink, \((z^* - \delta, z^* + \delta)\), and two surrounding income bands \((z^* -\)

$2\delta, z^* - \delta$) and $(z^* + \delta, z^* + 2\delta)$ below and above the kink. These bands are depicted in **Figure 2**. The parameter $\delta$ measures the width in those three bands and is the result of the visual inquiry. The middle band surrounding the threshold for the tax kink contains the bunching mass. The two adjacent bands serve as measures of the counterfactual distribution in the state without a kink. By inferring the counterfactual density on the bunching mass we get an estimate of the excess mass. The simplest estimate of excess mass is the difference between the number of individuals in the band centered at the kink, and the number of individuals in the two surrounding bands:

$$B = \int_{z^* - \delta}^{z^* + \delta} h(z)dz - \int_{z^* - 2\delta}^{z^* - \delta} h(z)dz - \int_{z^* + \delta}^{z^* + 2\delta} h(z)dz$$

If the distribution is perfectly even, then the excess mass would be zero, since the amount of individuals in the center and exterior bandwidths would be the same. In the case of an uneven distribution the curvature of the underlying distribution could affect the estimate. If the assumed counterfactual distribution changes its slope within the bands there would also be an underlying uneven distribution of individuals, even in the case of no kink. So if the density $h(z)$ is convex at $z^*$, then (8) will overestimate the bunching as convexity implies an already excess mass in the middle of the three bandwidths. Conversely, if the underlying distribution is concave, then (8) will underestimate $B$.²

---

² This potential issue of curvature as well as other potential sources of bias will be addressed in chapter 6.
The figure illustrates the symmetrical bandwidths around the kink threshold, with an existing increase in marginal tax rate at the kink and an excess mass of bunching individuals within the center bandwidth \((z^* - \delta, z^* + \delta)\). The two surrounding bandwidths - \((z^* - 2\delta, z^* - \delta)\) and \((z^* + \delta, z^* + 2\delta)\) - are used to infer the counterfactual distribution to measure the excess mass in the center bandwidth. Figure 2 is borrowed from Saez (2010).

As noted by Saez the estimation of \(B\) and \(e\) can be sensitive to the choice of bandwidth \(\delta\), and the simplest method to ensure the full excess mass to be included in the center bandwidth is to determine the bandwidth visually. This approach will be employed to determine the bandwidths for the bunching mass in this thesis.

The number of individuals in each of the three bandwidths is denoted by \(\hat{H}^*_\) for the first, \(\hat{H}^*\) for the second and \(\hat{H}^*_+\) for the third bandwidth. The estimation of the number of individuals is done by simultaneously regressing a dummy variable for belonging in each band on a constant among the sample of individuals that belong to any of the three bandwidths. Using these three groups of individuals the estimation of \(h(z^*)\) can be done empirically by utilizing the number of individuals in the lower band \((z^* - 2\delta, z^* - \delta)\) divided by \(\delta\) so that \(h(z^*) = \hat{H}^*_\ / \delta\). Similarly is the estimation of \(h(z^*)_+\) from \((z^* + \delta, z^* + 2\delta)\) such that \(h(z^*)_+ = \hat{H}^*_+ / \delta\). The number of individuals bunching is then computed as \(\hat{B} = \hat{H}^*_+ - (\hat{H}^* + \hat{H}^*_+)\). This can, along with the other parameters, be used to estimate \(\hat{e}\) with standard errors through the delta method.

The delta method is a technique to approximate expected values of functions of random variables.
when the direct evaluation of the expectation is not feasible. This is done by taking the
expectation of a polynomial approximation to the variable, usually a Taylor approximation, and
yields estimations of the ETI with a confidence interval (Oehlert 1992).
3  Related literature

3.1 Elasticity of taxable income (ETI)

After Feldstein (1995, 1999), the focus on elasticity of taxable income (ETI) has gained more attention along with the increased availability of large sets of administrative data. Feldstein (1995, 1999) showed that under certain conditions the ETI serves as a sufficient measurement for efficient and optimal taxation, “which places this parameter at the center stage of all the major normative questions in public finance” (Kleven and Schultz 2014, 271). Investigating and summarizing some of the growing literature on estimating the elasticity of taxable income Saez, Slemrod and Giertz (2012) review both assumptions and methods for using the elasticity as a measurement tool. They note that while the estimates found from using the ETI are initially large, the subsequent literature finds much smaller estimates, raising questions of about both the ability to identify this parameter correctly, and as well as its merit and use as a sufficient statistic for welfare analysis. Furthermore, any given tax system may differ in its deductions, group-specific taxation and potential externalities, so the actual observed elasticity will be heavily dependent on the tax system and composition of incomes at hand. Saez, Slemrod and Giertz conclude that they find it unconvincing that the ETI should contain all the behavioral responses, and this makes the inquiry into the anatomy of behavioral responses an important aspect when investigating the ETI. Thus, whether the ETI can serve as an accurate indicator for efficiency cost is highly situational and dependent on both the tax system itself and the ability to include inter-temporal changes in income and externalities in the parameter.

Adopting the method from Feldstein (1995), panel data has been the most prevalent approach used in ETI-studies and Saez, Slemrod and Giertz suggest that the positive effects from using panel data compared to repeated cross-section has been somewhat overstated, especially when looking at the top income earners.

Saez (2010) showed in his seminal paper “Do Taxpayers Bunch at Kink Points?” how to use tax register data to estimate the ETI by utilizing the excess mass in the income distribution that kinks in the tax system can create. This triggered a new wave of papers employing and refining the
bunching approach. In the next section I will give an overview on some of the relevant studies using this approach.

### 3.2 Studies with the bunching methodology

Saez (2010) investigates behavioral responses to the earned income tax credit (EITC), a refundable tax credit for low- to middle-income working individuals and couples with income below a fixed threshold. The EITC is especially beneficial for low income families with children, and for low income individuals in general the EITC represents a substantial added income. Saez finds a large bunching at the first kink where “the credit reaches its maximum level - with an implied elasticity of earnings around 0.25” for the general recipients and an even larger elasticity of around 1 for those with income from self-employment. This bunching is increasing over time. He also finds evidence for bunching at the first tax bracket for taxable income with an implied elasticity around 0.2, but no bunching elsewhere in the tax system – even for large and stable jumps in the marginal tax rate.

Chetty, Friedman, Olsen and Pistaferri (2011) analyze Danish data for 1994-2001 using tax records as the foundation for estimating elasticities. Their method is based on the bunching mass methodology as in Saez (2010), but with a somewhat different approach. They estimate the counterfactual distribution by omitting a band around the kink and fitting a polynomial from the observed distribution through the unobserved distribution. This estimates the distribution at the kink point in the absence of the kink. Since the bunching mass around a kink is usually diffuse rather than a single point mass, the counterfactual distribution is motivated to reduce the noise caused by imperfect bunching. The results reported show generally small elasticities for taxable income for wage earners, below 0.02, but for the self-employed they find an elasticity of 0.24 at the top and largest kink, and 0.10 at the middle. This suggests optimizing behavior related to kinks in the tax schedule is constrained by frictions, which the self-employed face fewer of. A point is made that some of this difference between “the observed elasticity at the middle kink is smaller than that at the top kink because capital income is subject to the middle tax, but not the top tax” (Chetty et al. 2011, 800). About 40% of the bunching at the top kink is estimated to be from tax evasion. Eliminating this component reduced the observed elasticity for the self-employed at the top kink to 0.14.
Bunching in Danish data has been studied further by le Maire and Schjerning (2013). Trying to sort real responses from income shifting le Maire and Schjerning (2013) investigate taxable income for the Danish self-employed with a panel data from 1994-2009. They find a taxable income elasticity of 0.43-0.53, but more than half of the bunching is driven by intertemporal income shifting. This results in an implied structural elasticity of 0.14-0.20 when income shifting is subtracted from the bunching mass. Their initial estimates are roughly double of what Chetty et al. (2011) find, but their definition of self-employed is narrower and restricted to only those whose primary income are from self-employment. The excess mass for wage earners is small, similar to Chetty et al. (2011)’s results.

Bastani and Selin (2014) study bunching in the Swedish tax schedule by applying the procedure from Chetty et al. (2011). Among wage earners they find no economically significant bunching, even at a large kink point. For the self-employed they find “sharp and statistically significant” (p. 37) bunching at the first kink point, but the implied elasticities are small and range from 0.02 for broad groups of self-employed to 0.07 for the “purely” self-employed, i.e. those without wage income. Their analysis suggests that the response from the self-employed is not due to a real shift in labor, but an intertemporal shift in income.

Dekker and Strohmaier (2015) analyze bunching in the Dutch tax system that is best characterized by a system with frequent small kinks. Dekker and Strohmaier use a sample dataset of 1% of the Dutch population that includes their exact taxable income. They also employ a different method for determining the bunching window: First, by removing a large window, then running a linear regression through to create a predicted distribution, and lastly, using the bins where the midpoints are outside the band to create the actual bunching window. This is a data driven procedure, which also opts away from the normal approach using symmetrical bandwidths. Their findings are a general elasticity of 0.024 for the pooled sample, 0.044 for the self-employed and 0.017 for wage earners, meaning that the findings for the pooled sample is not purely driven by bunching from self-employed.

While many tax systems employ kinks, Kleven and Waseem (2013) study the Pakistani system that uses notches that result in discontinuities in the choice sets of agents in the tax schedule. Notches would in a frictionless world have an excess bunching mass at the low-tax side and a missing mass at the high-tax side of a cutoff, where a region in the tax system is strictly
dominated an would have zero mass. Using this method on the Pakistani tax system, they find that observed bunching is large and sharp, the optimization frictions quite considerable, and that this holds even though the structural elasticities driving these observations are small. Kleven (2015) provides a good overview of the bunching method and the different theory, approaches, identification assumption and issues for both kink points and notches in the existing literature.

3.3 Other related studies

In the study done by Kleven and Schultz (2014), their dataset is based on tax return data for the full Danish population since 1980. This is narrowed down to a panel data between 1984 and 2005 and a with difference-in-difference approach applied to it. They find the behavioral elasticities to be larger when estimated from tax reforms with large changes in the marginal tax rate, than the elasticities that result from smaller changes. The large treatment elasticity is around 0.2 and the smaller treatment elasticity is about 60% of the large, which equals 0.12. This is consistent with the general argument that large tax changes are more likely to reveal structural long-run elasticities due to larger incentives to overcome optimization frictions made by Chetty et al. (2011). Kleven and Schultz also note that compared to Chetty et al. (2011) their own “difference-in-differences estimates using large tax reforms are quantitatively much stronger than their bunching estimates using large kinks (as even the large-kink elasticity in Denmark is tiny, about 0.01)” (p.294). The overall conclusion is that tax systems with an as broad a tax base as possible and extensive information reporting can impose high marginal tax rates and still have fairly modest behavioral responses.

In his master’s thesis Berg (2015) examines the tax responsiveness of the self-employed in Norway for the period of 2001-2010. Excluding the primary sector, Berg studies self-employed in other sectors using a panel data and a difference-in-difference approach to estimate the ETI and the elasticity of hours worked for the 2006-tax reform. Following the reduction in marginal tax rate from the 2006-tax reform, the self-employed increase their income by working more hours. The results show an ETI of about 0.2 and the elasticity of working hours to be between 0.13 and 0.19, meaning that the majority of the ETI response is a real response and not from income shifting.
4 The Norwegian tax system

This chapter presents the Norwegian tax system as the institutional background for the data discussed in this thesis. The first section presents the 1992-tax reform that introduces a dual income tax in Norway. The second section proceeds with the changes made in 2006-tax reform.

The Scandinavian tax systems are, according to Kleven (2014), generally built to ensure a low level of tax evasion with a broad tax base, and a well-developed information trail and third-party information reporting.

4.1 A system of dual income taxation

Dual income taxation saw increased popularity among the Scandinavian countries in the 90s, and the 1992-tax reform introduced a dual income tax system for capital income and labor income in Norway. This schedule is characterized by a flat base tax of 28 percent on general income from capital and labor (“alminnelig inntekt”) and a progressive surtax on labor income (“personinntekt”).

The general income measure includes the gross income from business, capital and labor, after removing all deductible expenses, and is then levied on all taxable individuals and enterprises. There are several possible deductions, most notable a basic tax allowance (“minstefradraget”) for all individuals, which is calculated as a percentage of the gross income, but restricted to an upper and lower limit. After the 92 tax reform this was a fixed rate. For 2001 this rate was 22% with a lower limit of 4 000 NOK and upper limit of 40 300 NOK. After the 2006 tax reform the basic personal allowance was differentiated w.r.t. rates and limits for wage income and pensions. If the actual work-related expenses (such as transport, insurance, education or clothing) exceed the basic personal allowance, one can have these deducted by reporting them through the income tax return, incentivizing bookkeeping and reporting.

In 2014 the base tax rate on general income was reduced to 27 %, and then in 2016 reduced to 25 % accompanying a change in the tax system from surtax tax to stepwise increase in marginal tax rate.

In 2010 this amount was 42 210 NOK for most individuals and twice that for single parents or individuals providing for a spouse.
Taxes are levied on individual gross labor income (actual gross labor income, not “net gross income”) with a social security tax and a progressive surtax, both as rates of the income. Gross labor income includes wages (for employees) and an imputed personal income (for self-employed), in addition to pensions, unemployment benefits and social security. There are some differences between wage earners and self-employed regarding the tax on labor income; There are no deductions for wage income and limited deduction options for the self-employed, and the social security tax rate is higher for the self-employed - by about three percentage points - as their income is not subject to payroll tax. I will employ this gross labor tax income as the variable for taxable income in this thesis (more in section 5.1.1).

The surtax rates are the same for both wage earners and the self-employed, both in rates and activation thresholds. The surtax rate from 2001 is 13.5% at the first threshold and 19.5% at the second, representing a 13.5 percentage points increase in marginal tax rate at the first threshold and then a 6 percentage points increase in tax rate at the second threshold for the period before the 2006-tax reform. For the northernmost parts of Norway the first surtax rate is lower, 9.5%, but applied at the same income threshold. The second surtax rate is the same at 19.5%

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6 From 2001 to 2007 wage earners and the self-employed in the primary sector pay 7.8% in social security tax, the self-employed in other sectors pay 10.7%. From 2008-2010 the rate for wage earners and the primary sector stays the same, for the self-employed in other sectors it is increased to 11%.
Figure 3: Marginal tax rates on gross labor income, 2001-2010

Figure 3 displays the marginal tax rates of labor income that can be subject to surtax, for wage earners in the period 2001-2010. Surtax rates 1 and 2 are added at activation thresholds to the general basic tax rate (28%) and the flat social security tax (7.8%). The graph is similar for self-employed, but their marginal tax rates would be about 3 percent points higher due to the higher social security tax (10.7%).

Figure 4: Wage adjusted thresholds for surtax, 2001-2010

The figure displays the two thresholds for taxable income eligible to surtax from 2001 to 2010, wage adjusted to 2010 levels. The first threshold has largely been kept the same though there has been an increase in the period. The second threshold has had a major reduction between 2004 and 2007 is part of the 2006-tax reform. The thresholds are the same for both wage earners and self-employed.
The split-model

In 1992 the highest marginal tax rate on labor income was 48.8%, leaving a difference of 20.8 percentage points between capital and labor income. By 2004 this difference had increased to 27.3 percentage points, resulting in a clear incentive to shift income from labor to capital for higher incomes (Thoresen 2009). To offset some of the incentives for income shifting the “split-model” (“delingsmodellen”) was introduced with the 1992-reform for “the self-employed, partnerships and closely held firms; the latter defined as businesses in which the active owner owned more than two-thirds of the shares” (Berg and Thoresen 2016, 5).

For those included in the split model the business income was divided into capital and labor by estimating a personal labor income based on the business income. This imputed personal income for the self-employed was based on net business income and deducting imputed capital income and earned income allowance (“lønnsfradrag”). Imputed capital income is calculated as total capital of input multiplied by a fixed rate of return on capital. The imputed personal income is included in the personal basis of income and is there subjected to social security taxation and potentially surtax. The deduction of earned income allowance is restricted to owners of sole proprietorships with employees. The split model was meant to reduce the differences between the tax schedule for wage earners and potential incomes for self-employed.

The criterion to be included in the split model was that the owner or owners who worked in their own company had a joint share of at least 2/3 of the company. Thus, owners had the option to sell 1/3 of the company’s shares to a non-closely related passive owner and legally circumvent this rule.

The owners of sole proprietorship with employees could multiply the wage expenses of the employees and deduct this amount as an earned income allowance from own imputed personal income. The limit for this deduction could not reduce imputed personal income below 6G (LigningsABC 2004, 790), where 1G is equal to one basic amount in the social security system and to which 6G is a multiplicand (1G=74 721 NOK in 2010).

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7 The difference in taxation was originally planned to be combined with a later reform on taxation of wealth, but for various reasons this never took place in the 1990s (Department of Finance 2011).
Imputed personal income had some upward restrictions as well: Liberal (or independent) professions (doctors, dentists, lawyers, etc.) had early on some restrictions, but from 1998 there was no upper limit on personal income. In the split model imputed personal income for non-liberal professions had different restrictions during the 90s, and for higher segments of income between 23G and 75G was only taxed the base 28%, but taxed fully before and after these thresholds.

In the research period from 2001 imputed personal income in the split model is restricted to 16G for incomes from non-liberal professions (LigningsABC 2004 p.818). This is a restriction applied solely in the split model, and thus this limitation does not occur after the subsequent tax reform.

### 4.2 The tax reform of 2006

The 2006-tax reform was implemented over the period 2005-2007 and abandoned the split model in favor of a more diverse categorization of business enterprises. The goal was not to remove the possibility of adjustments, but to reduce the motivation for adjustments by smoothing the highest tax rates for the different income categories (Department of Finance 2011, 10). This was achieved by reducing the surtax rates on labor income and by taxing capital above some risk-free return more heavily. The reform resulted in a more balanced treatment of income from different enterprise forms, and ultimately an almost identical taxation of labor and capital income (Department of Finance 2011).

**Changes to taxation of labor income**

The basic tax rate of 28% for both labor and capital income was kept, and is the same in the entire research period of 2001-2010. The surtax rates for labor income were reduced, but the second surtax threshold was also lowered substantially. The first surtax threshold was kept largely the same. Between 2004 and 2006 the first surtax rate was reduced from 13.5% to 9%, and the second rate reduced from 19.5% to 12%, as seen in
Figure 3. Apart from the reform-changes, the surtax thresholds have been fixed in real terms, adjusted approximately equal to the income growth for each year, as seen in Figure 4.

Changes to enterprise categorization and taxation

The split-model was replaced by the enterprise model (“foretaksmodellen”), the shareholder model (“aksjonærmodellen”) and the participant model (“deltakermodellen”) for private enterprises. The three models are all based on the principal idea to tax return from capital investment exceeding that of a risk free return, referred to as the shielding method: The government calculates a rate for risk-free return and return up to this level is shielded from taxation (“skjermingsfradraget”). The main purpose for deduction equal to a risk-free return is to avoid distortions in the financial structure of enterprises or distortions in investments – from shares over to bonds, property etc.

In the shareholder model capital return is taxed 28% at the enterprise level, and return after shielding is taxed is 28% at the individual level. Together, dividends and premiums from shares have a marginal tax rate of 48.16%. This is close to the marginal tax rates of labor income at 47.8% for wage earners and 51% for self-employed.8

In the participant model the enterprises are not taxable subjects themselves and the participants income is based on their share of the enterprise’s income and wealth. Similar to the shareholder model capital return after shielding is taxed 28% at the individual level. Jointly these changes meant that shareholders and participants were taxed more equally to the self-employed in the enterprise model.

For the enterprise model the procedure of imputed personal income is kept as means to estimate personal income and taxing it as such, but with a basis in the shielding method. The return from capital is taxed as imputed personal income – same as labor income – with social security tax and potential for surtax. Thus, while the principle for taxation changed, the method for estimating personal income for the self-employed is largely the same as in the split model.

The upper limits for imputed personal income were then removed, along with the removal of different tax rates for intervals of higher income. However, with regard to owners of sole

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8 The marginal tax rate for wage earners is not including payroll tax. The difference in rates is due to the difference in social security tax rates levied on the two groups.
propriatorships with employees the lower limit after the deduction of wage expenses to the employees was maintained at 6G (LigningsABC 2009/10, 422).
5 Data and classifications

All analysis and estimations are done using STATA 13.1. The dataset is provided through collaboration with Statistics Norway.

5.1 The dataset

The data used are income tax return data for all residents in Norway in a 10-year period, for the years 2001–2010, processed by Statistics Norway. The datasets include a large variety of variables, such as several income categories, age, gender, education, country of birth, government transfers and marital status. Due to the focus on labor income and bunching I restrict the data to individuals between 18 and 66 years of age, with 67 being the general age of retirement in Norway. This will restrict the observations to include adults in working age. However, Norway has a broad use of contractual pension (AFP-ordningen), where the majority of the population is eligible for retirement or partial retirement from the age of 62. This means the dataset will most likely contain some individuals with income from pension. And whilst I will also be looking at some of the bunching effects from recipients of government transfers such as pensions and social security, these categories will be excluded from the main sample as they tend to create bunching in certain intervals since government transfers are often set to certain minimum or maximum levels. This type of bunching resulting from the institutional framework will be referred to as artificial bunching. I will also restrict the sample to positive taxable income below 1.4 million NOK (in 2010 NOK). This includes the bulk of income earners as well as the two activation thresholds for the surtax, with the threshold for the second surtax reaching just under 1.2 mill NOK at its highest. All monetary values will be expressed in 2010-adjusted NOK when studying the pooled sample for the entire period, and expressed in year-specific levels when considering specific years. This is done to display certain characteristics of the bunching behavior which will be clarified in the results.

When aggregating over all 10 years, the number of observations sum up to almost 30 million, starting with slightly below average in 2001 and ending slightly above average in 2010 due to population growth.
5.1.1 Taxable income

Included in the data from the annual tax return is an income variable that is the foundation for surtax eligibility. This is the gross personal income for each individual, with the few deductions possible for self-employed, as described above. It is this variable I will be using as the variable for taxable income, and the variable is coded as exact numbers rounded to closest natural number for most years, but rounded to closest 100 NOK in 2001-2003. Consequently, all numbers and graphs for taxable income will be based on this variable unless otherwise stated.

The fact that taxable income is reported in 100 NOK for the early 2000s can lead to estimation error for these years when attempting to control for bunching unrelated to the surtax threshold since this would mean removal of not only the non-related bunching, but other incomes at this level as well.

5.1.2 Classifications of the self-employed

To categorize the self-employed I apply the definition of self-employed as individuals with the majority share of their income from self-employment relative to wage income. While they may still have some wage income, they are best characterized as self-employed. This stricter definition is more suitable with regards to capturing intended bunching among different income groups and is closer to the “true” self-employed since they are less dependent on wage income. From this definition there are about 150 000 self-employed per year between 2001 and 2010, but starting from 165 000 in 2001 and dropping down to 135 000 in 2010.

The self-employed is a diverse group including liberal professions (such as doctors, lawyers, accountants etc.) owners of small shops and restaurants, creative artists, farmers, fishers and more. Heterogeneous preferences and widely varying incomes can therefore be expected, both between individuals, but also between different years. The income from self-employment is split

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9 There are two main definitions of the self-employed applied in the literature. The first is anyone with income from self-employment through any source or just in self-reported income. The second is those who have the majority of their income from self-employment. A third potential definition is those with income solely from self-employment. The second definition captures a potentially large group of individuals that can be described as self-employed with less optimizing frictions than wage earners, whereas the third definition has been mostly used as a subgroup.
into primary and secondary industries, which allows for differentiating between farmers and fishers, and the other sectors.

5.1.3 Classification of additional income categories

By the argument for classification of the self-employed, other notable income categories will be defined correspondingly; through the majority share of their income. The sorting of pensioners, students and social security recipients will also be done this way. Wage earners are sorted partially by a negative definition, those whom are not self-employed. This means that when compared to business income the majority of the income is from wages. Wage earners are defined by excluding self-employed, so without other restrictions it would be a category including everyone with any other kind of income or transfer as well; for instance the three categories receiving governmental transfers mentioned above. The importance of investigating the composition of wage earners follows.

5.2 Descriptive statistics

This section presents some of the characteristics of the population in the restricted sample. The sample follows the earlier specifications and thus consists of individuals with a positive taxable income below 1.4 million NOK wage adjusted to 2010-levels, that fall between 18 and 66 years of age. Moreover the descriptive statistics displayed are for the core sample, meaning the retired and social security recipients are excluded and leaving the two major work groups of wage earners and self-employed. These restrictions apply as annual restrictions and so most individuals will be included for the entire span of 2001 to 2010. The means, with standard errors, for the period are weighted averages weighted on the number of observations per year. Number of observations is reported as the mean of the observations in the period.

There are some differences between the two main categories of workers. As the self-employed only make out a small subgroup of the population, the means of the wage earners are naturally close to that of the pooled sample. The self-employed make out on average 150 000 individuals per year whereas the wage earners total 2.3 million per year, leaving a ratio of 1 to 15 between the groups. The self-employed are on average five years older, have slightly less education, but a
higher income than wage earners. They also consist predominantly of males, as women only make out 29 percent of the self-employed. Only 10 percent of the self-employed are immigrants (defined by country of birth), compared to 12 percent among wage earners and the pooled sample.

Gender is coded binary, and equal to 0 for male and 1 for female. Age is reported as natural numbers for each individual’s age at the end of the year. Taxable income is for most years reported in exact numbers rounded to the closest natural number, and is for 2001-2003 reported as closest 100 NOK. Education is reported for the highest completed level and is categorized as follows: 0 = no education or unknown, 1 = primary school, 2 = middle school, 3 = started high school, 4 = completed high school, 5 = University, lower degree, 6 = University higher degree, 7 = University, research degree. This a re-categorization of the Norwegian Standard Education Classification (Statistics Norway 2005a) to provide a more condensed and accurate representation of the education levels for an adult working population. In this regard, individuals whose education is unknown have been exempt from the statistics on education. Country of birth is also recoded into a binary variable equal to 0 for individuals born in Norway and 1 for any other country.
**Table 1:** Group characteristics, total and by work group

**Total**

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<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std.dev</th>
<th>Observations</th>
</tr>
</thead>
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<td>223 389</td>
<td>2 476 004</td>
</tr>
<tr>
<td>Age</td>
<td>39.7</td>
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<td>Gender</td>
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<tr>
<td>Education</td>
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<td>2 334 770</td>
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<tr>
<td>Country of birth</td>
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<td>0.32</td>
<td>2 476 004</td>
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</tbody>
</table>

**Wage earners**

<table>
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<th>Mean</th>
<th>Std.dev</th>
<th>Observations</th>
</tr>
</thead>
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<tr>
<td>Taxable income</td>
<td>377 111</td>
<td>219 240</td>
<td>2 326 419</td>
</tr>
<tr>
<td>Age</td>
<td>39.3</td>
<td>12.7</td>
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<td>Gender</td>
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<tr>
<td>Education</td>
<td>3.9</td>
<td>1.18</td>
<td>2 190 520</td>
</tr>
<tr>
<td>Country of birth</td>
<td>0.12</td>
<td>0.32</td>
<td>2 326 419</td>
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</table>

**Self-employed**

<table>
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<th>Observations</th>
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<td>Education</td>
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<tr>
<td>Country of birth</td>
<td>0.10</td>
<td>0.3</td>
<td>149 585</td>
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6 Empirical strategy

This chapter will present some of the choices made regarding the elasticity estimations, based on implications from the theory. Also some of the possibilities for estimation errors and bias in the ETI-estimates will be discussed.

6.1 Estimating ETI-estimates and standard errors

As explained in the chapter covering the theoretical foundations in Saez (2010) the elasticity of taxable income will be calculated based on equations (7) and (8). Equation (7) estimates the bunching mass in the distribution and (8) estimates the ETI. When estimating the elasticities with standard errors, using the delta method, the conventional 95 % confidence interval for standard errors will be applied. Alternatively, the standard errors can be computed through the bootstrap method. By bootstrapping one does iterated draws from the empirical income distribution $h(z)$ for N draws and calculate the elasticity ê with a 95 percent confidence interval to adjust for sensitivity in the estimation of the standard errors.

Saez notes, however, that these two methods yield similar results for large samples, a result also found from the data in this thesis, so the standard errors estimated using the delta method will be the ones displayed.

6.2 Potential elasticity estimation errors and bias

There are several potential sources of bias in the estimation of the ETI. One, mentioned by Saez (2010), is that the curvature of the underlying distribution at the kink could bias the estimates, where convexity tends to overestimate and concavity tends to underestimate. To correct for this Saez suggests the possibility to fit a Taylor expansion around $z^*$ and estimate the curvature below and above the kink. Chetty et al (2011)’s approach to calculate the counterfactual distribution by omitting the bandwidth will also correct for this bias if the underlying curvature at the threshold does not affect the bandwidths used in the counterfactual. If the bandwidth is sufficient to include the bunching mass, as it should, the curvature would then be corrected for. The size of the bias will covariate with the size of the curvature, and thus with a relative flat segment of the distribution we would expect only a minor bias, if any.
The self-employed make out a smaller share of the total population and the resulting distribution for taxable income is relatively flat. The threshold for the first surtax for the wage earners lands on the downward sloping side of the bell in the distribution. The distribution is nonetheless a fairly smooth and with a constant slope except within the bandwidth. Thus, curvature should not be an issue that has a notable effect on the estimates in any of the two groups.

Another point, made by Kleven and Waseem (2013), is that the self-employed tend to report taxable income in round numbers, and that there is only a small prevalence of this among wage earners. They suggest this is a side-effect of poor record keeping. Another explanation could be that self-employed individuals who can set their own income naturally choose rounded numbers out of simplicity when determining their own income. Thresholds at, or close by, rounded numbers will then have more frequent observations and this could bias the bunching estimates in either direction. The bias will depend on which bandwidth the added observations fall into, the center bandwidth or the exterior bandwidths.

Higher frequencies of income at rounded numbers are also found in the Norwegian distribution of self-employed. This is predominantly observed for larger round numbers such as 100k and 150k, although some minor, sporadic bunching does occur at 10k. I find virtually no rounding for wage earners.

To see how this affects the estimated elasticities, I will calculate elasticities for each year isolated and this will give grounds for comparison between elasticities and their relation to rounded numbers. Doing this both including and excluding the bunching at rounded numbers gives an estimation of the added effect from this bunching.

A similar point can be made for bunching from other sources; for instance bunching created by institutional settings (referred to as artificial bunching). An example of this is the restrictions on deductions when imputed personal income for sole proprietorships with employees is calculated, with a lower limit at income equal to 6G.\textsuperscript{10} There is considerable bunching at this threshold among the self-employed for all years in the research period from 2001 to 2010. Moreover, for the time period this limit at 6G is also close to the first surtax threshold for most years.\textsuperscript{11} I will adjust for this other potential source of bunching by estimating elasticities for each year; first

\textsuperscript{10} See section 4 on The Norwegian tax system for more detail.\textsuperscript{11} An overview of these two thresholds is found in Figure 18 in the appendix.
including, and then excluding, the bunching at 6G for the self-employed. The reduced sample excluding both bunching at 6G and large rounded numbers will then serve as the estimate for the ETI for the self-employed at the first threshold for surtax. As these other sources of bunching are not prevalent among wage earners the ETI for wage earners can be estimated more directly.

Another argument for estimating elasticities per year in isolation is that the growth rates for thresholds that can lead to bunching can differ over the years. Aggregating this difference over multiple years would then skew the bunching in the distribution.

I use the averages of wage growth per year to adjust the income for the pooled sample for 2001–2010, adjusting the income to a base year of 2010. However, the first and second threshold for the surtax has increased by different rates than that of the average wage growth. Similarly the growth of the baseline amount 1G (used within the social security and tax system) has increased at different rates than the average wage growth. Notably, the growth in the amount 1G has been much closer to the growth in the first threshold for surtax, when compared to average wage growth.13

**Setting the bandwidth**

Bunching is a highly visual phenomenon and the visual component is also important when determining the bandwidth for estimating the bunching mass. The bandwidths are picked based on visual study of the bunching mass for each year. For simplicity I use the same bandwidth for wage earners as for the self-employed, as the wage earners do not display any clear bunching mass.

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12 The average growth rates are calculated from the average monthly wages of the working population, which includes both part-time and full time workers. These numbers are publicly available at www.ssb.no.

13 The largest difference between 1G and average wage is -1.5 percentage points, while the largest difference between 1st threshold and average wage is 4.3 percentage points. The full list of thresholds, growth factors and differences in these are found in Table 6 in the appendix.
For the years 2001-2006 the bandwidth is about 6 000 NOK and for 2007-2010 about 9 000 NOK. These are fairly similar to bandwidths used in other papers such as Chetty et al. (2011) and le Maire and Schjerning (2013), but larger than that of Bastani and Selin (2014).\textsuperscript{14}

Since these are year-specific-bandwidths the estimates will naturally be sensitive to the specification. Done correctly, this should still give the best foundation for the ETI estimates. An example of the bunching mass and bandwidths will be given in section 7.2.

\textsuperscript{14} Chetty et al. (2011) use bandwidths of 7 500 DKK per year, and le Maire and Schjerning adopt these and note that the elasticities are not very sensitive to specification of bandwidths between 5 000 to 10 000 DKK. Bastani and Selin (2014) use bandwidths of 5 000 SEK adjusted to 2008-levels. This equates about 4 250 NOK in 2008-levels.
7 Results

This chapter will present the results for the bunching in the Norwegian income distribution for the years 2001-2010. Firstly, attention will be given to bunching in the aggregated distribution for the entire period, and for some subgroups. Then, in depth focus will be directed to 2004 to illustrate trends in the different years, as well as the challenges regarding estimating the ETI. The third section presents the results for the elasticity of taxable income for the first surtax threshold. The elasticities found are fairly small, with an average estimate for the self-employed of around 0.025 pre-reform and 0.056 post-reform. Elasticities for wage earners are much smaller, with insignificant estimates below 0.01 pre-reform and estimates still below 0.01, but statistically significant, post-reform. The last section discusses sensitivity in the ETI-estimates.

7.1 The aggregated sample

The distribution of taxable income for 2001 to 2010 is aggregated and adjusted to 2010-levels. The threshold for tax-exempt income is maintained at the 2010-level, due to discontinuous jumps in the values for the threshold. The threshold for the first surtax is set to the mean of the adjusted thresholds equating 457 000 NOK. This is equal to the 2010-threshold and with the majority of the thresholds for the other years clustered relatively close (in 2010 NOK). Due to the 2006-tax reform decreasing the threshold for the second surtax rate this threshold is split in two, with indicators at the mean for the pre-reform and the post-reform thresholds. The two periods mentioned are from 2001-2004 and from 2007-2010.

The general distribution of taxable income for 2001-2010 is displayed in Figure 5 and shows little indication of bunching at the thresholds for surtax. Over the time period the average wage growth has been notably different from that of the first surtax threshold, and as such there could be some smoothing of the bunching mass by adjusting to 2010 income levels. There is however some bunching at the cutoff for tax-exempt income as well as two large spikes in the distribution. Studying the composition of the distribution gives a more nuanced representation of the income groups and characteristics of the bunching.
Figure 5: Aggregate distribution for the pooled sample, 2001-2010

The figure contains the taxable income for the pooled sample over the period 2001-2010 for all inhabitants between 18 and 66 years of age, reported in 2010 NOK. The taxable income is restricted to be positive and below 1.4 million NOK. The width of the income bins are 500 NOK.

Albeit the general retirement age has been excluded from the pooled sample, the availability of early contractual pension allows for partial or full retirement for the majority of the Norwegian workers from the age of 62. Figure 6 displays the distribution of individuals whose majority share of income is from pensions or social security. There is a clear overlap between spikes in this distribution and the two large spikes in the pooled distribution. Pensioners make up about two-thirds of the pooled spikes and social security recipients about one-fifth.
Figure 6: Aggregate distribution of recipients of pensions and social security, 2001-2010.

The figure contains taxable income for individuals whose majority share of income is from pensions (≥ 50%) or social security (≥ 50%), aggregated for the period 2001-2010 for all inhabitants between 18 and 66 years of age. Taxable income is restricted to be positive and below 1.4 million NOK. Income is reported in 2010 NOK.

Removing these two groups from the sample reduces the number of observations by 4.3 million, where 3.3 million are pensioners and 1 million are recipients of social security. This also removes the strongest bunching present in the pooled sample.

The remaining sample can now be separated into two working groups, self-employed and wage earners. The self-employed exhibit notable bunching at the surtax threshold and several large spikes just after the threshold for the second surtax. And this is to a large degree artificial bunching created by restrictions in the tax system. For the 10-year period the lower limit for imputed personal income after earned income allowance - set at 6G - is adjacent to the threshold for the first surtax in almost all of these years.15 The occurrence of bunching at the first surtax threshold needs thus not be exclusively related to the threshold itself.

15 In general, there is less than 10 000 NOK between the first surtax threshold and 6G in year-specific monetary values. Three years differ: 2001, where the threshold for 6G is 14 500 NOK above the first surtax threshold, and 2005 and 2006, where the distance between these exceed 20 000 NOK. Only for 2001 is the threshold of 6G higher, and also here there is significant bunching greatly exceeding that of the surtax threshold.
The figure shows the aggregate distribution of self-employed for 2001-2010. There is a notable spike in the distribution at the first threshold for surtax and just after the second threshold for surtax. These spikes are for income equal to 6G and 16G.

Adjusting for this artificial bunching removes most of the large spikes at the first threshold. The spikes after the second threshold are due to the upper limit on income from non-liberal professions at 16G in 2001-2005. In order to correctly estimate the ETI, it is necessary to adjust for artificial bunching, which is a consequence of the tax law itself. I do this by removing individuals with income exactly at 6G and 16G. Both of these thresholds can easily be identified by their income being so frequent and equal to this exact amount, a characteristic not shared by income in general.

For wage earners - including students – the distribution presents itself as a fairly smooth right skewed distribution with a high frequency at the start then leading a small concave transition up to a clear peak and the frequently observed long tail to the right.
The figure contains the taxable income for the pooled sample over the period 2001-2010, for all inhabitants between 18 and 66 years of age, reported in 2010NOK. The taxable income is restricted to be positive and below 1.4 million NOK.

There is no clear excess mass at any of the surtax thresholds, however there is some at the cutoff for tax-exempt income. This cutoff is primarily used by students to earn a small income beside their full time studies, either through a part-time job or during the summer holiday.

7.2 A closer look at 2004

It is worth studying an isolated year to distinguish trends in the bunching behavior. 2004 is chosen as the last year in the pre-reform period and the characteristics displayed in this distribution are to a large extent shared by the other years. As with the aggregated sample the distribution for 2004 displays two large spikes (just after 100k) and smaller spikes in the vicinity of the surtax thresholds.
Figure 9: Pooled income distribution for 2004

The figure shows the pooled income distribution for 2004. Taxable income is restricted to positive income below 1 million in 2004 NOK.\textsuperscript{16}

The two largest spikes are, again, from pensioners and social security recipients. Removing these two groups allows us to a larger extent study the income distribution that results from actual work-related income. There is also one last separate group that could be worthwhile to study related to groups specific bunching behavior; students receiving governmental scholarships.

\textsuperscript{16} This equates to income in 2004 below 1.4 million when adjusted to 2010-levels.
The definition of students applied in this graph is individuals with income from scholarship equal to 20% or more of their income.

The students face two main thresholds for increased marginal tax rates. The first is the threshold for tax-exempt income, which applies for anyone in the population. In 2004, this is set to 23,339 NOK and the marginal tax rate increases to about 25% after this. The second is an income threshold for students only, where every extra NOK in income above this threshold reduces their scholarship by 60%. Thus, the effective increase in marginal tax rate for students at this threshold is then 60 percentage points.

The income threshold is set at an income that is larger than the amount received in governmental loans and scholarships as a full time student. Thus, students with income at this threshold, or higher, would not be counted as “students” by the standard categorization based on the majority share of income. Lowering the percentage of income from governmental loan and scholarship to for instance 20% or more could help locate this bunching. The results seen in Figure 10 display some bunching at the threshold for tax-exempt income and some minor bunching just before the income threshold. While information could be an issue, it could also be that students with these high incomes are unable to adjust their income levels to the threshold.

17 This rate of reduction was later decreased to 50%, starting from the school year 2006-2007.
The definition of students based on having minimum 20% of their income from scholarships could easily include part-time students as well. Part-time students are not constrained by the same income threshold for reduced scholarship as the full time students, and thus do not have the same incentive to bunch at this point. Also, part-time students report having on a much higher income than full time students, so their income share from the scholarship could easily be lower than 20% (Statistics Norway 2006).

**Wage earners**

For wage earners in general the distribution is a fairly smooth one, holding the same characteristics as the aggregated distribution of wage earners for the entire period. There is no visible bunching at either of the surtax thresholds, but a minor excess mass at the threshold for tax-exempt income. These characteristics are held by both the aggregate distribution as well as the distributions in the remaining years. This excess mass is at least for the most part compiled by students.

**Figure 11**: Income distribution for wage earners 2004

The figure presents a smooth income distribution for wage earners, with a right skew. The peak at the start consists mainly of students working part-time jobs.
**Self-employed**

As noted previously, there is bunching among the self-employed at 6G and 16G due to restrictions in the imputed personal income, as well at large rounded numbers. These characteristics are well exemplified in the 2004 distribution, seen in Figure 12. For 2004, 6G is equal to 348,834 NOK and the threshold for first surtax is at 354,300 NOK, leaving the limit at 6G just 6,500 NOK below the surtax threshold. The second threshold for surtax is at 906,900, and the limit of 16G is 23,000 NOK larger, at 930,244 NOK. The limitation at 6G is present for the entire period, while the upward restriction on income for self-employed in non-liberal professions at 16G applies only for 2001-2005. To best illustrate the bunching at rounded numbers the figure has indicators at intervals of 50,000 NOK, starting from this amount and increasing correspondingly. The general distribution of taxable income for the self-employed is characterized by the two large spikes which are for income exactly equal to 6G and 16G.

**Figure 12:** Income distribution for self-employed 2004

The figure depicts the distribution of taxable income for the self-employed in 2004. There is notable artificial bunching at 6G and 16G as well as spikes at large rounded numbers. Dotted lines are at 50,000 NOK intervals, dashed lines for thresholds for tax-exempt income and surtax.

Removing the artificial bunching at 6G and 16G created by the institutional framework leaves the distribution with far fewer large discrepancies. The remaining ones are most notably the rounded
numbers and the somewhat increased mass centered at the first threshold for the surtax. This picture is also an accurate description of the other years. There is no visible bunching at the second surtax threshold.

**Figure 13**: Income distribution for self-employed 2004, removed bunching at 6G and 16G

The dotted lines are at 50 000 NOK intervals starting at the same amount, dashed lines for thresholds for tax-exempt income and surtax.

It is also possible to compare by sector two different groups within the self-employed; those working in the primary sector and those working in other sectors. Self-employed within the primary sector are farmers and fishers who bunch very little at rounded numbers, but much more at the first surtax threshold. The distribution for self-employed in the other sectors displays bunching at large rounded numbers, and some bunching at the first surtax threshold.
Figure 14: Income distribution for self-employed 2004, primary sector

The income distribution for the primary sector is shown in the first figure and for other sectors in the second figure. Dotted lines are at 50 000 NOK intervals and starting at the same amount, dashed lines for thresholds for tax-exempt income and surtax. In 2004 there are 35 000 individuals with 50% or more of their income from the primary sector, and 105 000 individuals with the majority of their income from other sectors.

Figure 15: Income distribution for self-employed 2004, other sectors
An example of the small bunching mass found centered at the first surtax threshold is presented in Figure 16, along with the bandwidths applied. For 2004, the bandwidth ($\delta$) is set to 6,000 NOK. While income equal to exactly 350,000 NOK is removed there is still a spike at this bin in the distribution. This could be an indication of imperfect bunching towards large rounded numbers.  

Figure 16: Bunching mass at first surtax threshold, 2004

For 2004 the first surtax threshold is at 354,300 NOK, bandwidth ($\delta$) is at 6,000 NOK.

Figure 17 plots the distribution for wage earners and self-employed for a better comparison between the two, where the first is a smooth distribution and the second is more jagged with several minor humps. Among the self-employed there is a notable increased mass at the first surtax threshold, as well as several instances before this threshold. While the first humps represent the bunching at large rounded numbers, the distribution for the self-employed is without the bunching at 6G and 16G, and the bunching at 350,000 NOK is removed. Thus the bunching mass at the first surtax threshold is the actual bunching mass, same as in Figure 16.

18 For a comparison between pre-reform and post-reform bunching mass, the distribution for 2010 centered at the first surtax threshold is displayed in the Appendix, Figure 19.
Figure 17: Density-distribution of wage earners and self-employed in 2004

The distribution for wage earners is seen in red, and for self-employed in blue. The distribution for wage earners (red) is again a smooth one, while the distribution for self-employed (blue) is more jagged.\(^\text{19}\)

7.3 Elasticity estimates at the first surtax threshold

The elasticities found are generally small, even for the self-employed, as indicated by the graphical results. Estimated elasticities at the first surtax threshold for the 10 year period are shown in Table 2 for self-employed, self-employed with removed bunching at 6G, self-employed with 6G and large rounded numbers removed, and for wage earners. The elasticities are smaller in the pre-2006-tax-reform period of 2001-2004 than for the post-reform period 2007-2010 for all the four specifications.

\(^{19}\) The distributions are both done using the STATA-command epan2 to best display the difference in smoothness.
**Wage earners**

As seen in the last row in Table 2 the elasticities for wage earners are virtually zero, with insignificant elasticities pre-reform and below 0.01, but statistically significant post-reform. These small estimates might be explained by the fact that wage earners, who are faced with more optimizing frictions related to work-specific regulations, can have a hard time changing their work hours at the margin.

**Self-employed**

There are three specifications for the self-employed to illustrate sensitivity to bunching from other sources, depicted in Table 2. The estimated elasticities for the self-employed range from just below 0.02 to 0.14, and are smaller in the pre-2006-tax-reform period of 2001-2004 than for the post-reform period of 2007-2010 for all the three specifications.

The initial “naive” estimates are fairly large, but show substantial year-to-year variance. The 2002-2004 estimates are at 0.08, whereas the 2005, 2006 and 2001 estimates are only 0.02. For the period 2007-2010 all estimates are above 0.1 with the highest at 0.14.

For the most part, bunching at 6G and rounded numbers are within the core bandwidth and this will then increase the bunching mass, and with each removal of these there is a notable reduction in the estimates. 2001, 2003 and 2004 are the only years which have some bunching in the exterior bandwidths and for these years there is accordingly an increase in the estimates when removing this specific bunching. Excluding the artificial bunching at 6G for the self-employed lowers the estimated elasticities and also removes some of the large year to year differences observed in the initial “naive” estimates. This reduces estimates between 2001-2006 to 0.02, and estimates for 2007-2010 to 0.06 with 2007 as the highest with an estimate of 0.08.

The income frequencies, when sorted into income bins of 500 NOK, is larger at large rounded numbers in the lower part of the income distribution, than in the most frequent bin of bunching mass at the first surtax threshold, as presented in the 2004 details. This prevails even when a rounded number is close to the surtax threshold.
Table 2: Elasticities for self-employed and wage earners 2001-2010

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Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001
Table 3: Instances of 6G or rounded numbers in core or exterior bandwidth

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Posted in Table 3 is the bandwidth used per year and whether the artificial bunching at 6G or bunching at large rounded numbers fall within the core or exterior bandwidths. Incidents of increased mass in the core bandwidth would increase the elasticity estimate, and increased mass in the exterior bandwidth would decrease the estimate (when not adjusted for).

The third row in Table 2 displays the estimates after the removal of bunching at 6G and rounded numbers for the self-employed. On average, the estimates are 0.025 in the pre-reform years 2001-2004 and 0.056 in the post-reform years 2007-2010. While the increase in the ETI over the time period is substantial, the elasticities are in economic terms still fairly small. Both the increase in elasticities and bandwidth appear to be an effect of the 2006-tax reform. Within the time period there is also a decrease in the number of self-employed. Although this decrease is not solely tied to the tax reform, the reform does change some of the early incentives for organizational structure of enterprises.

For most years there are substantial differences between the elasticities of male and female self-employed (see Table 4 in the appendix). However, neither sex has consistently higher or lower elasticities than the other, so the differences are not consistent over time. The self-employed within the primary industries exhibit much larger elasticities than the self-employed in other industries. Also when divided by sector there are large variations between years, both in the estimates themselves and the level of significance. It is worth noting that many of the workers in primary industries face a more lenient tax system than other self-employed, as well as subsidies that can affect both their income over time, and result in less optimization frictions.
For the purpose of comparison and inspection the elasticities for the second surtax threshold are also estimated. As with the first threshold these are estimates after the removal of the other two sources of bunching, at 16G and rounded numbers. The estimates are small and statistically insignificant for both the self-employed and wage earners. The results from the second threshold are reported in the appendix.

Overall, the behavioral responses at the surtax thresholds in the tax schedule are fairly small. These small estimates suggest a correspondingly low level of distortion from the surtax system on personal income, at least locally. If preferences are not too heterogeneous, then this can be viewed as a positive aspect of the Norwegian tax schedule if this reflects small distorting effects in general.

This thesis has its focus on labor income, and as such behavioral responses to change in capital income and the resulting effects are not captured here. The overall conclusion from Kleven and Schultz’ study of the Danish tax system (along with Kleven et al. 2011) was that a tax schedule with a very broad tax base and extensive information reporting can impose high marginal tax rates with only fairly modest behavioral responses. The results in this thesis seem to exemplify this conclusion.

7.4 Sensitivity in the ETI-estimates

In this section I discuss how the choice of bandwidth affects the estimated elasticities of the self-employed.

The optimally chosen bandwidths for the self-employed in the main results are for the most part 50% larger in the post-reform period compared to pre-reform. The increased bandwidth of the excess mass seems thus be a consequence of the tax reform. If the same bandwidths were used for all the years, this would either increase the pre-reform estimates somewhat ($\delta = 9,000$ NOK), or reduce the estimates post-reform to half ($\delta = 6,000$ NOK). Since the estimates are year specific the choice of bandwidth is best kept as year specific as well. The estimates are however not very sensitive to smaller changes in bandwidth of around 500-1000 NOK.

The estimates are, as demonstrated, affected by their proximity to larger rounded numbers and the corresponding bunching located there. Most instances where this occurs in the time period
this results in larger elasticities in the given year, as the threshold equal to 6G falls within the core bandwidth. Here it is worth noting that the thresholds for 6G usually fall just at the end of the bunching mass that is centered at the threshold for the first surtax. Hence, some of the mass within the bunching mass may be from individuals that had their imputed personal income deducted down to almost 6G, and with no intention to bunch at the surtax threshold. The close relation between 6G and first surtax threshold is then still a potential source for spurious effects for the estimation of ETI.

This continued proximity could also be part of the bunching behavior where it leaves a greater interval in which to aim the income level for sole proprietorships with employees. In the available data, there is no potential to estimate what the taxable income would have been without the deduction of the earned income allowance. And it is therefore not possible to estimate to what degree some of the excess mass centered at the first surtax threshold could be bunching towards the limit of 6G. Similarly, it is not possible to estimate to what extent the individuals with imputed personal income equal to 6G are exactly at this income or how much further their imputed income could have been reduced. That is, to check if there is indication of bunching specifically towards 6G and not the surtax threshold.
8 Conclusion

This thesis investigates bunching in the Norwegian income distribution from 2001 to 2010, with the primary attention directed towards the first threshold for surtax. With reported taxable income as the variable of focus, I study bunching in the distribution of personal income for the population in general and for specific subgroups. Using the approach from Saez (2010), the bunching in the distribution of taxable income is firstly demonstrated graphically for the pooled sample and then for different subgroups.

While bunching is present in the distribution, the sources of this bunching vary. In the general population there is a notable artificial bunching stemming from individuals receiving pensions or social benefits. Among the self-employed, there is distinct artificial bunching due to restrictions in imputed personal income for self-employed in sole proprietorships with employees. The self-employed also bunch at large rounded numbers and somewhat at the first surtax threshold. For wage earners in general, there is little bunching, though students, as subgroup of wage earners, display some bunching at the threshold for tax-exempt income.

The elasticity of taxable income is estimated for the first surtax threshold for each year in the research period for wage earners and self-employed, and then for some subgroups of the self-employed. Due to the presence of artificial bunching and bunching from other sources, the ETI is calculated at a number of specifications with the subsequent removal of income at exactly 6G and income at rounded numbers. The latter estimates are employed as ETI-estimates for the self-employed at the first surtax threshold. These estimates are generally small, but significant: ranging from 0.02 to 0.07 for the self-employed and below 0.01 for wage earners. The self-employed in the primary sector bunch on average more at the surtax threshold than those in the other sectors. Some differences are found between the sexes of the self-employed, but these differences are not consistent throughout the period. The elasticities are, however, consistently increasing after the 2006-tax reform, along with an increase in the area of the bunching mass, centered at the threshold.

The preferred ETI-estimates are smaller than what is found for the Norwegian data for the same period by Berg (2015) using the same Norwegian data, but another methodology (panel data). As Berg measures an average effect of the “treated” in the 2006-tax reform, his estimates are not directly comparable to the estimates reported here, which are year-specific.
local ETI-estimates. My estimates are, however, similar to the estimates found using similar bunching methods in Sweden (Bastani and Selin 2014) and the Netherlands (Dekker and Strohmaier 2015).

This study is limited to investigating year specific elasticities of taxable income on the individual level, and the method used is restricted to that from Saez (2010). Applying other approaches from the bunching literature, such as the data driven approach to determine the bunching window (Dekker and Strohmaier), would be an interesting addition to help test the robustness of the ETI-estimates.

The individual bandwidths are set by visual inquiry. The sizes of the bandwidths often correlate with the distance between the threshold for the first surtax and the amount equal to 6G. A closer investigation of the relationship between these two thresholds could therefore help separate the artificial bunching, and bunching related to the surtax threshold. In this regard, it is worth noting that the deduction of earned income allowance, down to the lower limit of 6G, was removed in 2012. A potentially interesting study could then be to examine whether this change increases bunching elsewhere in the income distribution.

Adding to the growing literature that applies the bunching method, this study provides new ETI-estimates for the self-employed and wage earners from the Norwegian data, as well as an example of some of the confounding sources of bunching – both artificial bunching from an institutional setting and bunching at rounded numbers. The aspect of artificial bunching has not had much focus in the literature, but has been an important issue when estimating the elasticity of taxable income from the bunching mass of personal income from Norwegian tax data. Hopefully, this study contributes with some added insight into the versatility of bunching in the income distribution.
References


Thoresen, Thor O.. 2003. ”Synkende skatteprogressivitet i Norge på 90-tallet. I hvilken grad har skatteendringene i perioden bidratt til dette?” (Decreasing tax progressivity in Norway in the 90s. To what extent has the tax changes contributed?) Vedlegg i 6 i NOU 2003:9 Skatteutvalget, Oslo: Akademika, 385-398.
Appendix

This appendix presents some of the tables and graphs with relevant information for the thesis that are not included in the main text.

As noted earlier, the thresholds for the first surtax and the lower limit for imputed personal income for sole proprietorships with employees at income equal to 6G is adjacent to each other for the most of the period. The two thresholds are presented in Figure 18. The difference between the two is usually under 10 000 NOK, with 6G residing below the first surtax threshold. Exceptions are in 2001, where 6G is about 14 500 NOK above the surtax threshold, and in 2005 and 2006, where 6G is 20 000 NOK below the surtax threshold.

Figure 18: Thresholds for the first surtax and 6G, 2001-2010

Values are given in year-specific values.
For comparison, and to illustrate the larger bunching masses after the 2006-tax reform, the bunching mass with bandwidths is displayed in Figure 19. There is a more distinct mass centered at the threshold, as well as larger bandwidths when compared to 2004.

Figure 19: Bunching mass at first surtax threshold, 2010

In 2010 the first surtax threshold is at 456 400 NOK, bandwidth (δ) is at 8 500 NOK.

The next tables, 4 and 5, present elasticities by work group and gender, as well as for the second surtax threshold.

Lastly, in Table 6, are some of the growth rates related to sources of bunching behavior. These are for the first surtax threshold, 6G and annual wage growth. The annual wage growth is estimated based on official average wages for the population for each year, and is these growth rates that are used to adjust income for each year to 2010-levels. Within the growth rates of the surtax thresholds, 1G and average wages there is a notable difference in the growth rates between these three. The annual growth in the first surtax is close to the annual growth of 6G. These are for some years quite different from the annual wage growth. This illustrates a potential problem when measuring bunching when adjusting data for several years to one wage- or price-level.
Table 4: Elasticities by gender and by work group, 6G or rounded numbers removed

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Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

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Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001
Table 5: Elasticities at the second threshold for surtax, 16G or rounded numbers removed

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<td>1937</td>
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| **Wage earners** |        |        |        |        |        |        |        |        |        |        |
| ê                | 0.0010 | 0.0006 | 0.0000 | 0.0004 | 0.0002 | 0.0021**| 0.0014 | 0.0007 | 0.0018*| 0.0013 |
| (se)             | (0.0006)| (0.0006)| (0.0006)| (0.0006)| (0.0006)| (0.0008)| (0.0008)| (0.0008)| (0.0007)| (0.0007)|
| N                | 90626  | 78418  | 70831  | 67979  | 60571  | 61958  | 65768  | 64565  | 61389  | 58394  |

Bandwidth = 6 000 NOK for each year
Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001
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