The elasticity of corporate taxable income: new evidence from UK tax records

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The Elasticity of Corporate Taxable Income: New Evidence from UK Tax Records[*]

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Abstract

We use the population of UK corporation tax returns between 2001 and 2008 to estimate the elasticity of corporate taxable income with respect to the statutory corporation tax rate. We analyse bunching in the distribution of taxable income at two kinks in the marginal rate schedule. We find an elasticity of between 0.13 and 0.17 for companies with profits around the £300k kink, implying a marginal deadweight cost of 6% of marginal revenue. We find a much higher elasticity of between 0.53 and 0.56 for companies around the £10k kink. By matching the corporate tax return data with accounting records and analysing joint bunching in the corporate and personal tax system, we decompose this into two parts: an elasticity of total income with respect to the net of tax rate of between 0.2 and 0.31, and an elasticity of the share of income taken as profit with respect to the difference between the personal and corporate tax rates of between 0.05 and 0.08. These imply a marginal deadweight cost of the tax around £10k of around 29% of the resulting tax revenue.

1 Introduction

A growing literature has examined the marginal excess burden of personal income tax. Following seminal contributions from Feldstein (1995, 1999), this literature has derived estimates of the marginal excess burden of the tax from estimates of the elasticity of taxable income. This approach does not require differentiation of the various channels through which the tax may affect behaviour - for example, a reduction in effort or a rise in tax evasion - as long as all of these behaviours are optimally chosen by the economic agent, and reflect social costs. A number of papers have developed this approach further to consider cases when the elasticity is, and is not, a sufficient statistic for measuring the marginal excess burden (this literature is reviewed by Saez, Slemrod and Giertz (2012)). There have also been several developments in empirical approaches to measuring the elasticity (also reviewed by Saez, Slemrod and Giertz (2012)).

Relatively little attention has been paid to other taxes, and in particular to the corporate income tax. Although the corporate income tax typically raises considerably less revenue than the personal income tax, it has the potential to generate a large excess burden. In most countries, most private economic behaviour is organised by corporations. And corporations can modify their behaviour in a number of ways in response to taxation, for example: changing the scale of production and hence the demand for labour, capital and other factors; the choice of financial policy; and the international location of real activities and profit. The effects of taxation on all of these forms of behaviour have been widely studied, and many margins have been found to be sensitive to taxation. But there has as yet been little attempt to analyse the elasticity of corporate taxable income, and the corresponding marginal excess burden.[1]

Section 2 provides a conceptual framework for analysing the elasticity of corporate taxable income with respect to the statutory rate and the marginal excess burden, which draws on the personal tax literature of, for example, Feldstein (1999) and Chetty (2009). One difference from the literature on personal tax is worth noting. That is, in the personal tax literature, it is typically assumed that the costs of generating additional income are not tax deductible: they are typically assumed to reflect effort or hours worked. However, companies generate total income in a variety of ways in addition to the labour supply of the owner: for example, through greater investment and hiring labour, both of which generate a deduction. Greater deductibility of costs reduces the elasticity of taxable income with respect to the tax rate.

The main empirical technique used in this paper, set out in Section 3, is based on the

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[1]Two published papers that estimate the elasticity of corproate taxable income are Gruber and Rauh (2007) and Dwenger and Steiner (2012). We discuss these further below.

analysis of bunching at kinks in the tax schedule, developed by Saez (2010) and extended by Chetty et al. (2011). The basic idea of this approach is that an increase in the tax rate at a certain kink point in the tax schedule is likely to induce agents to reduce their taxable income. Those relatively close to the kink would not reduce their taxable income below the kink point, implying that there would be bunching in the distribution at the kink point. To identify the scale of this bunching, it is necessary to estimate the counterfactual of what the distribution would have been without the kink in the tax schedule. Saez (2010) proposed estimating this counterfactual distribution by considering only agents whose incomes are not affected by the kink. Chetty et al. (2011) modified this approach slightly to ensure that the estimated counterfactual distribution is based on the same population as the observed empirical distribution. We follow this approach, and also allow for regular bunching at round-numbers in the distribution, as proposed by Kleven and Waseem (2013). In addition, when a kink was abolished, we compare these counterfactual distributions with the observed distribution in the period following the abolition, when the incentive to bunch had been removed. Our estimates are fairly insensitive to the estimation method of the counterfactual distribution.

This paper estimates the elasticity of corporate taxable income with respect to the statutory tax rate in the UK, using confidential tax return data provided by HMRC. We have access to the population of corporation tax returns (around 1 million returns per year) for an 8-year period 2001/02-2008/09. As described in Section 4, this period is useful since it provides variation in the statutory corporate tax rate in two dimensions. First, the UK tax system applies different rates of tax at different levels of income. In particular, there is a significant increase in the rate at taxable income of £300,000, creating a kink in the tax rate schedule. This allows the elasticity of taxable income to be estimated by analysing bunching at the kink, as described above. Second, there have been a number of reforms to the tax rate schedule over this period. In particular, the UK introduced a zero starting rate of tax for the first £10,000 of taxable income, starting in 2002. The rate that applied to income between £10,000 and £50,000 was raised so that the average tax rate on income of £50,000 and above was unaffected. Two years later, this was modified by applying the zero rate only to retained earnings. And in 2006 the zero rate was abolished. As a result of these reforms, a significant kink in the tax schedule was first introduced, then modified, then abolished, all within the period of our data. Following the approach described above, we find an elasticity of between 0.13 and 0.17 for companies with profits around the £300k kink , implying a marginal deadweight cost of 6% of marginal tax revenue, and a much higher elasticity of between 0.53 and 0.56 for companies around the £10k kink.

An important issue in using the elasticity of taxable income to infer the marginal excess

burden is whether agents can shift income into forms that are taxed at different rates. In this case the reduction in one tax base as a result of a higher rate may be offset by a rise in another tax base. In the context of the small companies analyzed in this paper, there may be many ways of shifting income between tax bases, including the use of stock options, debt and intertemporal movement. Straightforward evasion is another possibility. We analyse one specific option, the opportunity for an owner/manager of a small company to declare income as salary, as opposed to as corporate profit. A rise in the corporate tax rate may induce a reduction in total income generated by the company, but also a reduction in the proportion of total income declared as corporate profit. Our conceptual framework allows for both forms of response. The excess burden of the corporation tax depends on the size of both, since the latter reflects simply that some income is being taxed at a different rate. In the UK during this period, the tax rate on corporate profit, even including personal tax on dividends paid, was generally lower than the overall tax rate on personal income (including national insurance contributions).

To analyse the share of total income declared as corporate profit, we combine the corporation tax return data with accounting data for each company and each year from the FAME database. We are able to match approximately 90% of corporation tax returns in this way. Accounting data include information on the remuneration paid to the directors of the company. For small companies we take the total taxable income of the company to be the sum of the corporate taxable income and directors' remuneration. Our approach exploits kinks arising in the personal tax schedule, which create bunching also in personal taxable income. Specifically, we follow the same approach as already described, analysing bunching at kinks in the corporation tax schedule, but we do so separately for the subset of companies where the total remuneration of directors is observed to be at the first kink in the personal income tax schedule. Since they are at this kink, they are less likely to change their personal income in response to a marginal change in the corporation tax rate. Under certain conditions described in Section 2, the response of total income to a change in the corporation tax rate is the same as the response in corporate taxable income. Analysing this response for these companies identifies one element of the elasticity, and allows us to decompose the overall elasticity into its two components: an elasticity of total income with respect to the net of tax rate of between 0.20 and 0.31, and an elasticity of the share of income taken as profit with respect to the difference between the personal and corporate tax rates of between 0.05 and 0.08. These imply a marginal deadweight cost of the tax around £10k of around 29% of the resulting tax revenue.

Analysis of these combined data reveal that very few companies followed a pure tax minimisation strategy, with almost all declaring a significant part of their total income as

personal income. One possible explanation of this could be a salience problem: small business owners may typically take their income as personal income, but they may have been aware, for example, of the £10,000 tax-free corporate profit. They may not have understood that declaring more than £10,000 as corporate profit may reduce their tax liability further. An alternative explanation is that there are other costs associated with declaring income as corporate profit. This may reflect a liquidity issue. While wages are typically paid regularly - weekly or monthly - dividends are typically paid less frequently. A small business owner may prefer to receive a regular flow of income, thereby avoiding the cost of additional borrowing. We do not model this explicitly in the paper, but we introduce a convex cost of declaring income as corporate profit which is intended to reflect such costs.

Two issues are not addressed explicitly in this paper. First, consideration of the inter-temporal dimension raises issues about the type of behavioural response of a company to the marginal tax rate in the current period. For example, the response is less likely to be due to changes in the investment decisions which may depend on the anticipated tax rates over the life of the investment, and not just in the current period. We do not explore here the type of behavioural response, but focus only on the within-period elasticity of taxable income. Second, changes in the corporation tax rate, especially the introduction of the zero starting rate, may induce effects on the extensive margin of the choice of legal form. There was a significant increase in the number of companies when the starting rate was introduced. However, we focus solely on the elasticity of corporate taxable income, conditional on the business having corporate form and therefore being liable to corporation tax on its profit.

Our contribution is related to the existing literature on the elasticity of personal taxable income. Saez, Slemrod and Giertz (2012) report that the "best available estimates range from 0.12 to 0.4", with a mean elasticity estimate of around 0.25. It is worth nothing that the few studies using bunching around kink points to identify behavioural responses generally find in general small elasticities of taxable income. For example, Saez (2010) estimates the elasticity of taxable income to be approximately 0.2 around the first kink point in the U.S. personal tax schedule and zero (and precisely estimated) around the higher kink points. Chetty et al. (2011) identify that the observed elasticity from bunching at the large 30% top kink in the Danish tax schedule is around 0.01 for all wage earners and around 0.02 for married women. They attribute the small elasticity estimates to the presence of optimization frictions including switching and attention costs combined with a small utility gain of bunching in response to jumps in marginal tax rates. Kleven and Waseem (2013) present evidence of behavioural responses to notch points in the Pakistan income tax system. They adjust the amount of bunching below the notch points by the fraction of taxpayers that respond to the tax incentives to estimate the long-run elasticity of taxable income that is not attenuated by

optimization frictions. The baseline results suggest the long-run elasticity of taxable income in Pakistan is around 0.05 and 0.2, which is considerably larger than findings in the other two studies but is nevertheless at the low-range of the elasticity estimates in the existing literature. One general conclusion from these studies is that the elasticity of taxable income depends itself on the tax system: one with a broad tax base and extensive use of information reporting is usually associated with more modest responses in personal taxable income.

Fewer studies have directly addressed the elasticity of corporate taxable income. Two published papers have focused on corporation tax: Gruber and Rauh (2007) and Dwenger and Steiner (2012). The first of these uses accounting data and therefore suffers from the familiar problem that accounting records do not generally accurately record tax liabilities, but rather an estimated provision for tax. It focuses primarily on the elasticity of corporate taxable income with respect to a measure of the effective marginal tax rate on new investment, of the form developed by Hall and Jorgenson (1967), King and Fullerton (1984) and others. This implies a focus on one particular behavioural response to the tax which is not in the spirit of the literature on the personal tax. The second paper uses German tax administration data to estimate the elasticity of corporate taxable income with respect to an average tax rate. This average tax rate is equal to the statutory rate except where losses brought forward from the previous period can be used to reduce the current tax liability. This paper follows the approach of Gruber and Saez (2002) in identifying the effects of a tax reform by calculating the tax that would have been paid post-reform if the pre-reform regime had been in place but there had been no behavioural change. The difference from actual taxable income post-reform is therefore due to the behavioural response to the reform. In this case, however, the difference in the average tax rate appears to depend crucially on the losses brought forward into the period prior to the reform, rather than the behavioural response to the reform.

The existing empirical literature, on the other hand, provides strong and convincing evidence that corporate taxes influence business behaviour in several important ways. For example, the tax difference between corporate and non-corporate earnings play an important role in firms' choice of organizational forms.[2] Companies alter their financing choices in response to the tax advantage of debt and other tax incentives,[3] and also the scale of business

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[2]See, Gordon and MacKie-Mason (1994), Mackie-Mason and Gordon (1997), Gordon and Slemrod (2000), Goolsbee (1998, 2004), and Liu (2012) for evidence in the U.S. and de Mooij and Nicodeme (2008) and Egger, Keuschnigg and Winner (2009) for experience in Europe.

[3]Graham (2003) reviews the empicial evidence of corporate taxes on the financial policy of domestic firms. Altshuler and Grubert (2003), Desai, Foley and Hines (2004) and Fuest, Hebous and Riedel (2011), among others, suggest that corporate tax rates and thin capitalization rules also matter for the financial structure of multinational firms.

investment[4] and dividend payouts.[5] Several recent studies survey the international aspects of corporate taxes and business behaviour, including de Mooij and Nicodeme (2008) and Feld and Heckemeyer (2011). These conclude that there are significant effects of corporate tax policies on multinationals' location decision, cross-border investment, and allocation of taxable income among taxing jurisdictions.

The paper is organised as follows. In Section 2 we present a conceptual framework for analysing the impact of the corporation tax rate on corporate taxable income allowing for two effects: on the total income generated by the company, and on the share of that income that is declared as corporate profit, as opposed to personal income. Section 3 describes the empirical approach used in estimating the elasticity of the tax base with respect to the tax rate, and our method for decomposing that elasticity into the two parts. Section 4 presents the relevant institutional background for the UK. Section 5 presents our results from analyzing the elasticity of corporate taxable income. Section 6 analyses the possibility of shifting income into a different form. Section 7 discusses the implied marginal deadweight costs of corporate income taxes using our elasticity estimates. Section 8 briefly concludes.

2 Conceptual Framework

We consider the welfare implications of taxes levied on the profit of a small firm in two steps. First, we assume that the firm declares all income as profit, and therefore faces only a corporation tax levied on taxable profit and a tax on dividends paid out of profit. This yields expressions analogous to those derived in the literature on personal income tax. Second, we consider the case where the firm can choose the form of income, where different forms of income are taxed at different rates.

2.1 All income declared as profit

Consider a company that aims to maximize the total net of tax profit of the shareholders, π, which is the only form of income:

$$\pi = y - c(y) - T, \tag{1}$$

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[4]See Hassett and Hubbard (2002) for a recent survey on this topic. A small selection of recent studies on tax policy and business investment include Caballero and Engel (1999), Cooper and Haltiwanger (2006), and House and Shapiro (2008).

[5]See, for example, Bond, Chennells and Devereux (1996), Chetty and Saez (2005) and Dharmapala, Foley and Forbes (2011).

where y is the total output of the company with the output price normalized to unity, $c(y)$ is the minimum cost of producing y using a combination of inputs and T is the tax liability, described below. The minimum cost varies across companies, depending on a number of possible characteristics, including the expertise of the owners and managers; there is therefore heterogeneity in output choices across companies.

T represents the corporation tax liability of the company including any taxes on dividends paid by shareholders:

$$T = t_c(B_c - A_c) + E \qquad (2)$$

where t_c is the marginal tax rate, B_c is corporate taxable income, A_c is the lowest point of the relevant corporate tax band, and E represents tax levied at other rates on income below A_c. The total tax base, B_c, is assumed to be non-negative and is defined as:

$$B_c = y - \alpha c(y), \qquad (3)$$

where $0 \leq \alpha \leq 1$ is the proportion of the total cost of generating y that is tax deductible. This cost includes items that are entirely deductible such as wages paid to employees, items that may not be deductible at all such as the effort of an owner/manager, and the costs of capital investment which may be partially deductible. In the case where c reflects greater effort, it is measured in units of foregone consumption.

The company chooses y to maximize π. As long as the company is not at any kink in the tax rate schedules, the first order condition is

$$c'(y) = \frac{1 - t_c}{1 - \alpha t_c}. \qquad (4)$$

This is the normal marginal condition: that output will be increased up to the point where the marginal value of output is equal to its marginal cost. In the absence of tax, this is 1. In the presence of tax, the cost depends on the parameters of the tax regime.

We are interested in the impact of corporation tax on total welfare, which we take to be a simple aggregate of private consumption plus tax revenue, $W = \pi + T$.[6] Consider a small increase in the net of corporate tax rate, $1 - t_c$. Since the company is assumed to optimally choose y, we can apply the envelope theorem to ignore any indirect effects of the change in $1 - t_c$ on π through y.[7] In addition, the direct effects of a change in the tax rate on the tax

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[6] This ignores the possibility that companies may be owned by non-residents. For such companies, the additional transfer from the private sector to the government arising from an increased tax rate would result in a welfare gain.

[7] This does not apply if the firm is at a kink in the tax schedule; we neglect this in deriving the expression

liability net out since the tax is simply a transfer, reducing π, but increasing T. The overall effect on welfare is therefore:

$$dW = t_c \frac{\partial B_c}{\partial (1 - t_c)} d (1 - t_c) = \frac{t_c e B_c}{(1 - t_c)} d (1 - t_c), \qquad (5)$$

where e is the elasticity of corporate taxable income, B_c, with respect to $1 - t_c$.

Note that

$$dB_c = (1 - \alpha c'(y)) \, dy = \left(\frac{1 - \alpha}{1 - \alpha t_c} \right) dy. \qquad (6)$$

A rise in $1 - t_c$ would increase output y. However, the extent to which there is a rise in B_c depends on the extent to which costs are deductible from tax. In the standard case considered in the literature on personal tax, costs are not deductible, in which case $\alpha = 0$ and $dB_c = dy$. In the other extreme, if all costs were deductible, then $\alpha = 1$ and $dB_c = 0$. This is because at the margin in this case, $c'(y) = 1$ and the marginal addition to output is just matched by a marginal addition to costs, leaving the tax base unaffected. In general, for $0 < \alpha < 1$, $dB_c < dy$: there is a smaller effect on the tax base than on output of a rise in the net of tax rate.

We can compare the change in welfare to the mechanical change in tax revenue in the absence of any behavioral response. Holding y constant, the mechanical change in revenue is

$$dM = - (B_c - A_c) \, d (1 - t_c), \qquad (7)$$

and hence

$$dW = - \frac{B_c}{B_c - A_c} \frac{t_c e}{(1 - t_c)} dM. \qquad (8)$$

To evaluate the total welfare effect of a change in the tax rate, we aggregate over companies, following Saez, Slemrod and Giertz (2012). Denote by $\overline{B}_c$ the average combined corporate taxable income of companies within the relevant tax bracket. Then we can define $\overline{e}$ as the aggregate elasticity of taxable income with respect to the net of tax rate, which is equal to the average of the individual elasticities weighted by individual taxable income. Define the ratio $a = \overline{B}_c / (\overline{B}_c - A_c)$. If the distribution of B_c is Pareto, then a is the shape parameter of the Pareto distribution. Hence, in aggregate, this yields the standard formula used in the literature for estimating the marginal deadweight cost by a small increase in the corporate tax rate[8]:

$$\frac{dW}{dM} = - \frac{a t_c \overline{e}}{(1 - t_c)}. \qquad (9)$$

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for welfare.

[8] For example, see Saez, Slemrod and Giertz (2012).

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We use this approach to estimate the marginal deadweight cost for companies at and above the £300k kink in the corporation tax schedule.

2.2 Choice of income form

In principle, there may be a number of other ways in which the owner/manager of a small company can extract profit from the company so that they are taxed under the personal tax rather than the corporate tax, e.g. use of stock options and loans to the firm. There may also be an opportunity to shift profit between periods to take advantage of different tax rates around a kink. We consider just one alternative option: income may be declared as salary and be subject to personal income tax instead of as profit.

Assuming that allowances are common across the two forms of taxation (as in the UK), then total taxable income can be split across the two taxes with B_c applying to profit and B_p applying to salary, so that the total tax base is $B = B_c + B_p$. Similarly the lowest points on the tax schedule for which the relevant marginal rates apply are A_c and A_p for profit and salary respectively, with $A = A_c + A_p$. A share s of B is recorded in the form of profit, and the remaining share $1 - s$ is recorded in the form of salary, so that $s = B_c/B$. A share $\widehat{s}$ of $B - A$ in the relevant tax band is recorded in the form of taxable profit, so $\widehat{s} = (B_c - A_c)/(B - A) = (sB - A_c)/(B - A)$. The overall tax is now $T = \tau(B - A) + E$, where the overall marginal tax rate is

$$\tau = \widehat{s}t_c + (1 - \widehat{s})\, t_p, \tag{10}$$

and where t_p is the tax rate on salary of shareholders that are employed by the company.

Note that, in the empirical application of the UK, generally $t_p > t_c$. We therefore introduce a convex cost of transforming a unit of total taxable income into profit, $h(s)$, which implies that not all income is declared as profit. We treat this cost as a real resource cost, rather than a transfer, and hence it reduces not only private consumption but also total welfare. For simplicity we assume that this cost is not deductible, reflecting nondeductible efforts of the owner/manager.[9]

The company now chooses both y and s to maximize $\pi = y - c(y) - T - h(s)B$. As long as the company is not at any kink in the tax rate schedules, the first order conditions are now

$$c'(y) = \frac{1 - (\tau + h(s))}{1 - \alpha(\tau + h(s))}, \tag{11}$$

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[9]Making these costs tax deductible has no qualitative effect on the basic model.

and

$$h'(s) = t_p - t_c. \tag{12}$$

The first expression now incorporates the cost of shifting income into the form of profit. The second expression indicates that the company will increase the share of total income declared as profit up to the point at which the marginal cost, $h'(s)$, is equal to the gain, $t_p - t_c$.

As before, we are interested in the impact of a change in the corporation tax rate on total welfare, $W = \pi + T$. Again we can apply the envelope theorem, and ignore transfers, so that the overall effect on welfare is therefore:

$$dW = \left\{ \frac{\partial T}{\partial y} \frac{\partial y}{\partial (1 - t_c)} + \frac{\partial T}{\partial s} \frac{\partial s}{\partial (1 - t_c)} \right\} d(1 - t_c),$$

Given that the overall tax rate, τ, but not the tax base, B, is a function of s, and holding t_p constant, then:

$$\frac{\partial T}{\partial s} \frac{\partial s}{\partial (1 - t_c)} = (B - A) \frac{\partial \tau}{\partial \widehat{s}} \frac{\partial \widehat{s}}{\partial s} \frac{\partial s}{\partial (t_p - t_c)} = -B (t_p - t_c) \frac{\partial s}{\partial (t_p - t_c)}$$

Combining this with the first term of dW, which is equivalent to the case above, then

$$dW = B \left\{ \frac{\tau x}{(1 - t_c)} - sz \right\} d(1 - t_c), \tag{13}$$

where x is the elasticity of total taxable income, B, with respect to $1 - t_c$ and z is the elasticity of the share of income taken as corporate profit, s, with respect to the difference in tax rates, $t_p - t_c$. For a given tax base, a rise in $t_p - t_c$ would induce a higher share of income being taken as corporate profit. Since we assume that there are real costs associated with taking income in this form, this would induce higher welfare costs.

We can again compare the change in welfare to the mechanical change in tax revenue in the absence of any behavioral response. Holding y and s constant, the mechanical change in revenue is

$$dM = -\widehat{s}(B - A) d(1 - t_c). \tag{14}$$

Rearranging, and substituting for $\widehat{s} = (B_c - A_c)/(B - A)$ implies

$$dM = -(B_c - A_c)d(1 - t_c), \tag{15}$$

so that

$$dW = \frac{B_c}{B_c - A_c} \left\{ z - \frac{\tau x}{(1 - t_c)s} \right\} dM. \tag{16}$$

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To evaluate this in aggregate, we calculate $\overline{dW}$, the average welfare effect of a change in the tax rate as in eq. (13) and $\overline{dM}$, the average mechanical loss in tax revenue as in eq. (15), where we use firm-specific values for B_{c_i}, τ_i, z_i x_i and s_i where i represents any company with corporate taxable income between £10k and £50k. The resulting marginal change in welfare expressed as a fraction of mechanical change in revenue, is:

$$\frac{dW}{dM} = \frac{\sum_i B_{c_i} \left\{ z_i - \frac{\tau_i x_i}{(1-t_c)s_i} \right\}}{\sum_i (B_{c_i} - A_c)}.$$ (17)

We use this approach to estimate the marginal deadweight cost for companies around the £10k kink in the corporation tax schedule.

2.3 Decomposing effects

We take two approaches to identify welfare effects. First, we consider a group of companies that bunch at the £300k kink in the corporation tax schedule. We assume that companies in this group will not change their personal tax base in response to a change in $1 - t_c$ on the grounds that the company is widely enough held that shareholders will not want to transfer income to the managers. In effect, for this group, we simply apply the model in which all income is declared as profit, and use expression (9) to identify welfare effects.

However, for the second approach, we aim to take into account the opportunity to declare profit in the two forms. Expression (13) requires estimates of two elasticities, x and z. However, our empirical approach is primarily based on estimating the elasticity of corporate taxable income with respect to the net of corporate tax rate, denoted e. Since $B_c = sB$, for given t_p, e is related to x and z as follows:

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\begin{aligned}
e &= \frac{\partial B_c}{\partial(1-t_c)}\frac{(1-t_c)}{B_c} = s\frac{\partial B}{\partial(1-t_c)}\frac{(1-t_c)}{sB} + B\frac{\partial s}{\partial(1-t_c)}\frac{(1-t_c)}{sB} \\
&= x + \left(\frac{1-t_c}{t_p - t_c}\right)z.
\end{aligned}
$$ (18)

Our approach is to generate estimates of both e and x from different groups of companies, and to use these values in this expression to derive z, which then allows us to apply the formula in (17). To do this, we consider two subsets of companies that bunch at the £10k kink in the corporate tax schedule.[10] One group does not bunch at the kink in the personal tax rate schedule; a second group bunches at the personal tax kink as well. Applying the empirical bunching technique described below to the former group generates an estimate

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[10]It is possible that owner/managers that bunch at both kinks are more aware of the details of the tax system, and are therefore more sensitive to the incentives created; our analysis neglects this.

of e. If the second group does not change its personal income in response to a change in the corporate tax rate, then a resulting change in total taxable income will be equal to the change in corporate taxable income. For these companies, applying the same technique to estimate e also provides an estimate of x, since in this case $x = eB_c/B$.

To examine this in more detail, consider the case where an owner/manager is at kinks in both the personal and corporate tax schedules; empirically, we investigate the first kink in each schedule, below which income is not taxed. The net gain to generating an additional unit of output is

$$1 - (\tau + h(s)) - [1 - \alpha(\tau + h(s))]\, c'(y). \tag{19}$$

For an owner/manager at both kinks, we can assume that this net gain is negative. Note that in this case, s is determined arbitrarily by the relative size of the two kinks. The relevant tax rate τ depends on the form of income which would be chosen, given the individual tax rates and the cost function. There are two possibilities: (a) $t_p < t_c + h'(s)$ where the personal income tax rate is lower than the combination of the corporate income tax rate and the marginal cost of shifting profit, and hence an additional unit of income would be declared as personal income; and (b) $t_p > t_c + h'(s)$,the opposite is true and an additional unit of income would be declared as corporate profit.

Now consider a reduction in the corporate tax rate, t_c falling to t_c^*. This is intended to reflect the abolition of the kink in the corporate tax schedule, by applying the rate below the kink also above the kink. Define the initial output as y and the initial share of corporate income as s. After the change define these two values as Y and S respectively. We consider a discrete change, rather than a marginal change, since this is how we identify the effect empirically. Allowing for a discrete change implies that the effects of the tax reduction will depend on the size of the tax reform and three possible configurations of tax rates, rather than just two. Consider the 3 possibilities in turn.

1. $t_p < t_c^* + h'(s) < t_c + h'(s)$

In this case, if the owner wanted to increase output, it would be advantageous to declare the first £1 of income as personal income, rather than profit, in which case $\tau = t_p$. Since the reduction in the corporate tax rate does not affect this ranking, then this situation will continue to hold and there will be no response.

2. $t_c^* + h'(s) < t_c + h'(s) < t_p$

This is the opposite extreme. Even without the corporate tax cut, the owner would have preferred to take the first additional £1 of income as profit, so that $\tau = t_c$. The reduction in the corporate tax rate may make the net gain to an additional unit of output positive. This would induce the owner to increase output and initially to declare the additional income as profit, increasing both $h(s)$ and $c'(y)$. At some point, he will either (a) stop increasing

output, since the first order condition in y holds; or (b) he will continue to increase output but declare some of the income as personal income, so that the first-order condition for profit shifting holds, with $h'(S) + t_c^* = t_p$. However, if this latter point were reached, this combination of tax costs and adjustment costs would be higher than before the reform, since with a convex $h(.)$ function, $t_p > t_c + h'(s)$. Since by revealed preference the owner chose not to expand output before the reform, then he would not reach this point. Consequently, in this case, (a) would be reached first, and the entire increase in output would be declared as profit.

3. $t_c^* + h'(s) < t_p < t_c + h'(s)$

In this case, prior to the tax reform, if the owner wanted to increase output, it would be advantageous to declare the first £1 of income as personal income, rather than profit, in which case $\tau = t_p$. But the reduction in the corporate tax rate alters the ranking, so that post-reform it would be advantageous to initially choose to declare income as profit. The reform may therefore induce the owner to increase output, and hence again to increase both $h(s)$ and $c'(y)$. In this case, the question again arises as to which first order condition will be reached first. In this case, we cannot rule out the possibility that the owner would want to declare some of the additional income as salary: by comparing conditions before and after the reform, he would reach this point if

$$h(s) > [1 - \alpha t_p] \left(c'(Y) - c'(y) \right) / (1 - \alpha c'(y)). \tag{20}$$

It does not seem unreasonable to suppose that $h(s)$ is small, so that condition (20) does not hold. In that case, again all income arising from additional output from the tax reform would be declared as profit. In that case, for owners at both kinks, the response of total income to a change in the corporate tax rate would be the same as the response of corporate taxable income to the same change in the tax rate, irrespective of which of the cases analyzed here holds in practice. The bunching technique outlined below which identifies the response of corporate taxable income to a change in the corporate tax rate would in this case yield the response in total income to a change in the corporate tax rate.

If (20) does hold, then it is possible that a reduction in the corporate tax rate could induce an increase in personal income as well as profit. In this case, the change in corporate taxable income would be lower than the change in total income. Our estimate of the response of corporate taxable income to a change in the corporate tax rate would then underestimate the response of total income. In this case, our estimate of the elasticity of total income with respect to the corporate tax rate should be seen as a lower bound.

3 Empirical Methodology

We use the bunching estimation method proposed in Saez (2010) and Chetty et al. (2011) to identify the elasticity of corporate taxable income. In the context of corporate income taxes, consider a tax reform that introduces a small increase in the marginal corporate tax rate from t_1 to t_2 at some income level K. Taxable income below K continues to be taxed at the rate t_1, and income above K is now taxed at the rate t_2. Abstracting from any income effects, the fraction of companies who choose to locate at the kink point K in response to the small increase in the marginal tax rate can be expressed as $B(t_1, t_2) = \int_{K}^{K+\Delta z} g(z)dz$, where $g(z)$ is the density distribution of taxable income when there is a constant marginal tax rate τ_1 throughout the distribution and $K + \Delta z$ the highest level of pre-reform earnings that now bunch at the kink point. Assuming that $g(z)$ is uniform around the kink, the elasticity of corporate taxable income at the kink point is

$$e \simeq \frac{B(t_1, t_2)/g(K)}{K \ln(\frac{1-t_1}{1-t_2})} = \frac{b(t_1, t_2)}{K \ln(\frac{1-t_1}{1-t_2})}, \tag{21}$$

where $b(t_1, t_2)$ denotes the fraction of companies who bunch at the kink relative to the counterfactual density. In eq. (21), the kink point K and the tax rates defining the kink point, t_1 and t_2, are given policy parameters, whereas the excess mass of companies $b(t_1, t_2)$ needs to be estimated empirically in order to identify e.

We aim to estimate the counterfactual density, that is, the distribution of taxable income had there been no kinks in the tax rate schedule, from the observed density outside the income range affected by bunching. A complication to the credible identification of bunching due to tax kinks, however, is that companies have a tendency to report taxable profit in round numbers, generating mass points at integer numbers in the empirical distribution. This is similar to round-number bunching in personal taxable income in Kleven and Waseem (2013), although the pattern of round-number bunching in the corporate taxable income is different and changes substantially through the income distribution.[11] Since kinks are themselves located at salient round numbers, a failure to control for round-number bunching could confound true kink bunching with round-number bunching and overstate behavioural responses to the kink. Like Kleven and Waseem (2013), we use counterfactual excess bunching at round numbers that are not kinks to control for round-number bunching.

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[11]Round-number bunching is strongest near the bottom of the distribution. There is excess mass at every income level that is multiple of 5k for profits up to £20k and at income levels that are multiples of 10k between £20k and £100k. Above £100k, excess mass is only noticeable at multiples of 50k for profits below £300k and at multiples of 100k for profits above £300k. Outside the context of taxable income elasticity, Manoli and Weber (2011) also present evidence of individual bunching around retirement thresholds that are multiples of 10 years.

We first group companies into small income bins of £100. Denoting by c_j the number of companies and z_j the level of earnings relative to the kink point in bin j, we then fit a flexible polynomial of order q to the bin counts in the empirical distribution, excluding bins around the kink point in the range (z_L, z_U) around the kink point by estimating a regression of the following form:

$$c_j = \sum_{l=0}^{q} \beta_i \cdot (z_j)^l + \sum_{i=z_L}^{z_U} \gamma_i \cdot \mathbf{1}\,[z_j = i] + \sum_{r \in R_k} \rho_{r_k} \cdot \mathbf{1}\left[\frac{z_j}{r} \in N\right] + \varepsilon_j, \tag{22}$$

where γ_i is a bin fixed effect for each bin in the excluded range. A set of round-number dummies is also included to control for bunching at integers. Specifically, N is the set of natural numbers, R_k is a vector of round number multiples that capture rounding in the annual tax return and equals $\{5k\}$ or $\{50k\}$ depending on income bracket k. The parameter ρ_{rk} is the fixed effect associated with round number multiple in income bracket k. The initial estimate of the counterfactual distribution is the predicted values from the regression (22) by setting all the dummies in the excluded range to zero but not omitting the contribution of the round-number dummies:

$$\widehat{c}_j^0 = \sum_{l=0}^{q} \widehat{\beta}_i \cdot (z_j)^l + \sum_{r \in R_k} \rho_r \cdot \mathbf{1}\left[\frac{z_j}{r} \in N\right].$$

The initial estimate of excess bunching, defined as the difference between the observed and counterfactual bin counts within the excluded range, is given by

$$\widehat{B}^0 = \sum_{j=z_L}^{z_U} (c_j - \widehat{c}_j^0).$$

This simple calculation overestimates $\widehat{B}$. That is because the higher tax rate above the kink induces companies above the threshold to decrease their taxable income. Given that the number of companies in each bin tends to fall with taxable income, the observed number of companies in each bin to the right of the kink will tend to be lower than the case had there not been a higher tax rate above the kink. Hence the estimated counterfactual is likely to be based on an underestimate of the number of companies that would have been observed had there not been a higher tax rate above the kink. To address this, we follow Chetty et al. (2011) and shift the counterfactual distribution to the right of the kink upward until it satisfies the constraint that the number of companies in the counterfactual distribution is equal to the number of companies in the observed distribution. Specifically, $\widehat{c}_j$ are the fitted

values from the following regression omitting the contributions of bins in the excluded range:

$$c_j \cdot \left(1 + \mathbf{1}\left[j > R\right] \frac{\widehat{B}^0}{\sum_{j=Z_U+1}^{\infty} c_j}\right) = \sum_{l=0}^{q} \beta_i \cdot (z_j)^l + \sum_{r \in R_k} \rho_r \cdot \mathbf{1}\left[\frac{z_j}{r} \in N\right] + \sum_{i=z_L}^{z_U} \gamma_i \cdot \mathbf{1}\left[z_j = i\right] + \varepsilon_j,$$

(23)

and $\widehat{B} = \sum_{j=z_L}^{z_U}(c_j - \widehat{c}_j)$ is the excess mass implied by this counterfactual.[12] The empirical estimate of b, which is defined as the excess mass around the kink relative to the average density of the counterfactual distribution where bunching occurs, is derived as:

$$\widehat{b} = \frac{\widehat{B}}{\sum_{j=z_L}^{z_U} \widehat{c}_j / N_j},$$

with N_j the number of bins in the excluded range.

Standard errors are calculated using a residual-based bootstrap approach. From the regression model specifying the company counts, eq. (23), we obtain the estimated residual $\widehat{\varepsilon}_j$. We draw a new set of errors by sampling from the estimated residuals with replacement and create bootstrapped company counts by adding the new set of errors to the original counts, $c_j^b = c_j + \widehat{\varepsilon}_j^b$. We use the bootstrapped company frequencies and follow the same steps above to compute new estimates of frequencies and excess mass. This bootstrap procedure is repeated 500 times and the standard error of the excess mass is estimated by computing the standard deviation of the 500 estimates. Finally we estimate the elasticity of taxable income as a non-linear combination of $\widehat{b}$, the tax kink K, and the relative changes in the net-of-tax rate $\ln(\frac{1-t_1}{1-t_2})$ as in equation (21). Standard errors of the implied elasticity are then computed using the delta method.

4 Institutional Background and Data

4.1 Income tax system in the UK: 2001 to 2008

Different types of income in the UK are subject to different taxes. Income received in the form of corporate profits is subject to corporate tax and dividend tax upon distribution to shareholders. Income received as non-corporate earnings such as wage and self-employment income, is subject to personal taxes and national insurance contributions (NICs). In the UK, the tax year for personal tax purposes runs from April 6 of the current year to April 5 of the next, while the financial year for corporate tax purposes runs from April 1 to March

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[12] We estimate (23) by iteration and recompute $\widehat{B}$ using the estimated $\widehat{\beta}_i$ until we reach a fixed point. The reported bootrapped standard errors account for this iteration procedure.

31.[13] Unless stated otherwise, all years in the paper refer to financial years according to the calendar year in which they end. Table 1 provides a detailed overview of tax schedules by income type in 2001-2008.

Corporate tax

There are currently two rates that define the basic structure of the corporate tax schedule. Taxable profit over £1.5 million is taxed at the main rate, which was at 30 percent in 2001-2007 until being reduced to 28 percent in 2008. Companies with taxable profit below £300,000 are taxed at the small profits rate (previously known as the small companies' rate), which varied around 20 percent in 2001-2008. Taxable profits between £300k and £1.5 million are taxed at a higher marginal relief rate of around 32 percent during most years in this period.[14] For example, in 2002, adding £1 of taxable profit to £300k increases the marginal corporate tax rate from 19 percent to 32.75 percent. This discrete jump in the marginal rate creates a large convex kink point at £300k in the corporate tax rate schedule.

In addition to the small profits rate, an even lower starting rate was applied to taxable profits between £0 and £10k for a significant part of this period. This rate was 10 percent in 2001, reduced to zero for the next four years, and was eventually abolished in 2006. While the starting rate was in place, a higher marginal rate of approximately 20 percent was applied to taxable profits between £10,001 and £50k, thus creating another convex kink point at £10k. In addition, a non-corporate distribution rate (NCDR) of 19 percent was levied in 2004 and 2005; this was applied as a minimum rate to corporate profits distributed to persons who are not companies. Specifically, the marginal tax rate for the first £10,000 corporate profit was zero if retained within the company and 19 percent if distributed to non-corporate shareholders in 2004 and 2005.

Summarising, there are two large tax kinks at £10k and £300k before the abolition of the starting rate in 2006. Since then, a flat rate of around 19 percent has been applied to taxable profits below £300k, leaving £300k as the only tax kink in the remaining years during this period. The corporate tax section in Table 1 lists the marginal rates around the tax kinks by year. While the difference in the marginal tax rates around £300k has remained relatively stable, we observe large and frequent changes in those around £10k due to the reduction and abolition of the starting rate.

Distributed profits in the UK are taxed both at the corporate level (via corporation tax) and at the personal level (via income tax), although dividend income at the personal level is not subject to NICs and carries a credit for corporation tax paid. As a result, the effective

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[13]However, companies typically make tax returns based on their accounting year: these may therefore span different tax years.

[14]The purpose of marginal relief is to ensure that the total tax liability for profit at £1.5 million is equal to the main rate applied to £1.5 million.

dividend tax rate is zero for taxpayers with personal income below the basic rate threshold for personal income tax and 25 percent for those above throughout the years 2001-2008.

Personal tax and National Insurance Contributions

The tax unit of personal tax in the U.K. is an individual rather than household. Similar to the corporate tax schedule, personal tax operates through a system of allowances and income bands that are taxed at different rates. Each individual has a personal allowance, and income up to this amount in each year is exempt from tax. Above this amount there are a number of tax bands. The basic rate applies to taxable income within the basic rate band and the higher rate is charged to taxable income above the basic rate threshold. A starting rate of income tax was also in place in 2001-2007, which taxed income between the personal allowance and the basic rate band at 10 percent.

In addition to paying income tax, employees, employers and the self-employed must also pay national insurance contributions. Employees and employers pay contributions according to a complex classification based on employment type and income. Class 1 NIC is charged to employees at several rates depending on various income thresholds, and to employers as well for each employee earning above the secondary threshold. Earnings below the Lower Earnings Limit (LEL) pay no NICs and received no credit for state pension. Earnings between the LEL and primary threshold, however, are not liable for any contributions but are nevertheless credited for contributory benefits. The personal allowance or the primary threshold in the NICs schedule, whichever is lower, represents the first tax kink in the combined income tax schedule. As we show in Table 1, these two thresholds tend to track very closely with each other.

Preferential tax treatment for corporate profits

Denote the marginal corporate tax rate by θ_c and marginal dividend tax rate by θ_{div}, we can express the effective marginal tax rate on corporate income as $\widetilde{t}_c = \theta_c + (1 - t_c)\theta_{\mathrm{div}}$ to reflect the double taxation of corporate income at the personal level. Similarly, denote the marginal personal tax rate by γ_p and the corresponding employee/employer NICs rate by $nic_{\mathrm{employee}}/nic_{\mathrm{employer}}$, we can express the effective marginal tax rate on wage and salary as $\widetilde{t}_p = \gamma_p + nic_{\mathrm{employee}} + nic_{\mathrm{employer}}$. A distinct feature of the U.K. tax system, evident in Table 1, is that except at the very low end of the income distribution, income earned as corporate profits is generally taxed at a lower rate than non-corporate earnings such as wages and salaries (or self-employment income).

4.2 Data and descriptive statistics

Our empirical analysis exploits two datasets. To study firms' bunching behaviour we use administrative tax return data on the population of UK companies through the financial years 2001-2008. The dataset has around 8.4 million observations for around 2.5 million separate companies and includes tax variables corresponding to the items recorded on the corporate tax return form. Since we are interested in the different margins through which companies respond to the tax structure, we include additional firm characteristics and accounting variables by linking the corporation tax return data with the FAME database, available from Bureau van Dijk. We match the tax data and accounting data for each company and each year for approximately 90% of corporation tax returns in this way. Table 2 presents descriptive statistics of the key variables in this study; income variables are presented in real terms, in 2005 prices. Companies with zero tax liabilities account for around 37 percent of the sample but are larger than average when measured in terms of trading turnover or number of employees. Small companies with positive taxable profits below £50k account for around 43 percent of the sample but pay relatively few corporate taxes. A small number of large companies with taxable profits above £1,500k, on the other hand, contribute the main share of the corporate tax revenue in the UK.[15]

5 The Elasticity of Corporate Taxable Profit

We begin our analysis by presenting evidence of bunching at two kinks in the corporation tax schedule, at £300k and at £10k. We discuss the option of using personal income in the next section.

5.1 Evidence from the £300k Kink

Companies with taxable income around £300k are interesting for two reasons. First, they are relatively small-sized businesses measured in terms of turnover and number of employees. But they are much less likely to shift income between personal and corporate tax base compared to the owner-manager companies with lower levels of taxable profits., There may be a number of other ways in which the owner/manager can extract profit from the company so that they are taxed under the personal tax rather than the corporate tax, e.g. use of stock options and loans to the firm, although we are not in a position to test these. Bearing these caveats in mind, we approximate the elasticity of total taxable income by the elasticity of corporate

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[15]Specifically, the top 1 percent of companies contributes about 81 percent of corporate tax payable in the UK.

taxable profit for companies around £300k. Second, companies in this group have limited international activities. Compared to large multinational companies, they are therefore less likely to engage in profit shifting across borders.

Panel (a) in Figure 1 shows the observed and counterfactual densities around £300k in 2001, with the excluded income range demarcated by the vertical-dashed lines and the £300k tax kink demarcated by the vertical-solid line. The solid line with dotted markers plots the observed number of companies in income bins of £1k. Each dot denotes the upper bound of a given bin and represents the number of companies in each bin.[16] The solid-smooth line shows the counterfactual density based on fitting a 5th order polynomial using company counts with taxable income between £250k and £350k, except for firms in the excluded range close to £300k. The next three panels focus on subsequent periods within which the marginal tax rates around the kink were unchanged. In these panels, bunching b is defined as the excess mass in the excluded range around the kink in proportion to the average counterfactual frequency in that range, and e is the elasticity of the corporate taxable profit with respect to $1 - t_c$, with standard errors shown in parentheses. The elasticity estimates are also summarised in column 3 of Table 3. We compare the baseline elasticity estimates with those from alternative specifications in Appendix A and show that while the estimated point elasticity depends on the specification of the estimation range, the polynomial order, as well as the income range excluded from estimation, varying these parameters does not have a significant effect.

Three main findings are worth noting in the figure. First, there is large and sharp bunching around £300k. The excess mass is between 5.87 and 7.36 times the height of the counterfactual distribution and is precisely estimated. This provides strong evidence that companies respond to the tax structure. Second, bunching at £300k is asymmetric. The income range that is clearly affected by bunching around the kink lies between £290k and £304k, and there is considerably more excess mass to the left of the kink. Optimization error would generally lead to symmetric bunching around the kink. Greater mass to the left of the kink appears instead to reflect some risk aversion: that companies aim just below the kink to allow for errors. Third, despite the fact that the degree of bunching increases with the difference in the marginal net-of-tax rates, the underlying elasticity is consistently and precisely estimated to be between 0.13 and 0.17, and the pairwise difference in the elasticity estimates across years is statistically insignificant.

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[16]Note that we estimate the counterfactual density and excess mass using companies counts in income bins of £100. For disclousure purposes we aggregate the observed and predicted number of companies in each income bin of £1,000 subject to HMRC's confidentiality requirement.

5.2 Evidence from the £10k Kink

Compared to the £300k kink point with relatively stable marginal tax rates, marginal tax rates around £10k went through large and frequent changes during this period. Panel (a) in Figure 2 reports the observed number of companies in bins of £1k when profits below £10k are taxed at a lower rate. The graphs also depict the corresponding marginal tax rate in dashed lines using the right y-axis. The starting rate of corporation tax was reduced from 10 percent in 2001 to zero in 2002. Correspondingly, bunching around £10k is stronger in the latter year. While the marginal tax rates remain the same in 2002-2005, a non-corporate distribution rate (NCDR) was in place between 1 April 2004 and 31 March 2006, taxing distributed profits to non-corporate shareholders at the rate of 19 percent. While in theory the NCDR partially removed the benefit of the starting rate, there is no discernible decrease in the degree of bunching in 2005, the last year before the starting rate was abolished altogether.

Panel (b) in Figure 2 reports the observed company frequencies following the abolition of the starting rate of tax in 2006. Starting from 2006, companies with profits up to £300k were taxed at a flat rate of 19 percent. Consistent with the removal of the tax incentives, there is an immediate and large decrease in the excess mass around £10k in 2006. By 2007, clustering at £10k is entirely due to the integer number effect and the degree of clustering is no different than clustering at any income level that is a multiple of £5k. In contrast to the gradual adjustment in personal income bunching that has been documented in Chetty et al. (2011) and Saez (2010), these corporate earnings adapted to changes in the tax kink in a very quick and precise way. Such differences may shed some light on the type of adjustment cost in each case. While bunching around the personal tax kink involves costs in job search and hours choice, there may be less costly opportunities to manipulate corporate profit in a particular year.

Figure 3 reports the observed and counterfactual densities around £10k using the full sample, with the elasticity estimates summarised in column 3 of Table 4. The regression specification now accounts for finer bunching at 5k integers at the very low end of income distribution. We only include companies with profits up to £40k in the estimation. This is because profits above £50k (up to £300k) are taxed at a lower rate, and so there are incentives to move away from the £50k. We therefore bound the estimation range £10k away from this kink. Bunching is symmetric around £10k and earnings within £2k of the kink are excluded from estimation of the counterfactual. The point elasticity estimate increases by around 0.15 from 2001 to 2002-2003 when the starting rate was further reduced to zero, and remains around 0.56 in the later period.

Because companies bunching around £10k may differ from those around £300k in many

dimensions, it is not surprising that we obtain different elasticity estimates of corporate taxable income for these two groups. On the other hand, the scope of the tax incentives also varies for the two groups. Lowering the starting rate to zero in 2002 also reduced the average tax rate for companies with profits between £10k and £50k. As a result, companies with profits less than £50k saw a decrease in the effective average tax rate, with the largest decrease applying for companies with profits around £10k. A decrease in the average tax rates represents an increased tax advantage to incorporation. We examine whether the elasticity estimate is different for new and existing companies and summarise the results in column 4-5 of Table 4. The elasticity estimate for the new firms is quite similar to that for existing firms in 2002-2003 but significantly decreased following the introduction of the NCDR in 2004. The decrease may imply that new companies are more inclined to distribute more of their profit as dividends, in which case they would benefit substantially less from the zero starting rate after the NCDR was introduced.

5.2.1 Using post-reform distribution to estimate the counterfactual density

The standard bunching method relies on the identification assumption that in the absence of the tax kink, companies at the tax kink would behave similarly to companies further away from the kink. If so, the distribution of taxable income had there been no tax kinks can be predicted from the observed density outside the income range affected by the kink. As we have demonstrated in the case of £300k bunching, this method requires careful choice of the excluded region around the kink point. A conservative choice of the excluded region under-captures the full excess mass of the firm and leads to an underestimate of the underlying elasticity. Conversely, excluding observations over a wider range underutilizes useful information in the data and implies a loss of efficiency.

The 2006 tax reform, which replaced the zero starting rate with a flat rate of 19 percent for profits up to £300k, therefore removed the kink in taxable income at £10k. This offers us an opportunity to estimate directly the counterfactual distribution from the post-reform income around the old kink. The identification assumption for this approach is that the shape of the underlying probability density function is stationary and does not change as a result of the tax reform. More formally, we require that $g(z) = g(z|t)$. Under this condition, we estimate the probability density function over the finite income interval $(z_{\min}, z_{\max})$ non-parametrically using the histogram estimator:

$$\widehat{p}_H(j) = \frac{c_{j,t_{post-kink}}}{\sum_{i=z_{\min}}^{z_{\max}} c_{i,t_{post-kink}}},$$

where $c_{j,t_{post-kink}}$ is the number of companies in income bin j after the abolition of the tax

kink. We choose the income interval to be between £2k and £40k so that the counterfactual region does not include part of the bunching region for the other kink point. We compute the counterfactual density as

$$\widehat{c}_j = \widehat{p}_H(j) \cdot \sum_{i=z_{\min}}^{z_{\max}} c_{i,t_{kink}},$$

and compute the excess mass, elasticity, and the associated standard errors using the same procedure as before.

Panels (a) and (b) in Figure 4 show the counterfactual distribution as the dotted line and corresponding elasticity estimate in 2002-2003 and 2004-2005, respectively. It also shows the counterfactual distribution and elasticity estimates using the standard bunching estimation method for comparison purposes, with income between £8k and £12k excluded from estimation and demarcated by vertical dashed lines. The counterfactual density in the dashed line accounts for the integration constraint and is higher everywhere to the right of the kink compared to the uncorrected density in the solid line. Though using different estimation methods, the underlying elasticity estimates are broadly similar. In all three cases, the elasticity is consistently estimated at around 0.6, and the pairwise differences in the point estimates are not statistically significant. The fact that the three elasticity estimates are statistically similar lends support to the validity of the identification assumption in the standard bunching method.

6 Shifting Profit

The previous section presented robust estimates of the elasticity of corporate taxable income with respect to the corporate tax rate. But, as highlighted earlier, the value of this elasticity for welfare analysis depends on the extent to which income is shifted to other forms that are also subject to taxation. We first present results which estimate the extent to which the total income depends on the difference between the personal and corporate tax rates; this allows us to infer the elasticity of the proportion of total income declared as profit with respect to the difference between the personal and corporate tax rates. These are used in estimating welfare effects in the next section. We also briefly analyze one form of intertemporal shifting of profit.

6.1 The Elasticity of Total Taxable Income

In Section 2 we showed that, by analyzing the response of corporate taxable income for companies that also bunch at the personal tax kink, the elasticity of corporate taxable

income can be decomposed into two elasticities of interest: the elasticity of total taxable income, and the elasticity of the share of income that is recorded as profit. While income shifting between the corporate and personal tax base has been discussed in the literature, there is relatively little direct evidence of the size of this behavioural response. We identify around 1.5 percent of companies with taxable profits up to £50k as bunching at the first personal tax kink. As set out in Section 2, changes in the marginal corporate tax rate are unlikely to affect the salary payout for companies that are at the personal income tax kink. In this case, changes in the corporate taxable income reflect changes in total taxable income. The elasticity of total taxable income x is then equal to the elasticity of corporate taxable income scaled by the share of total income paid as corporate profits: $x = e \cdot \frac{B_c}{B}$, with $B_c = £10\text{k}$ and approximately, $B = £15\text{k}$. However, in some circumstances, it is possible that a reduction in the corporate tax rate may induce some additional income to be declared as salary; given this possibility, the estimated effect on corporate taxable income should be seen as a lower bound on the effect on total taxable income.

Figure 5 depicts the counterfactual density of corporate taxable income and the corresponding elasticity estimates for companies that also bunch at the £5k personal allowance kink. Some companies in this group continue to bunch at the £10k corporate income kink, implying that their total reported taxable income is bunched around £15k. Compared to other non-bunchers, companies at the personal income tax kink are smaller when measured by turnover, total asset, and number of employees. This is consistent with that micro owner-managed companies are more likely to follow a tax-minimisation strategy in allocating between corporate and personal income. For this group of companies, the estimated elasticity of corporate taxable income is 0.45 in 2002-3, compared to 0.56 in the full sample, and is 0.29 in 2004-2005 compared to 0.53 in the full sample, although the difference in either period is not statistically significant. Using these elasticity estimates, we compute the elasticity of total taxable income x assuming that it is the same for companies with corporate profits between £10k and £50k. Following eq. (18) we compute z, the elasticity of the share of income taken as corporate profit with respect to the tax rate difference $t_p - t_c$ for the same group. Since this depends on t_p, we use two sets of personal tax rates: one applies for the basic-rate taxpayers and one for the high-rate taxpayers, and calculate the elasticity of the share of income as corporate profit in each case.

Table 5 summarises the corresponding tax parameters and elasticity estimates. For companies with taxable profits between £10k and £50k, we estimate their elasticity of total taxable income to be around 0.20-0.31. The elasticity estimate of the share of income recorded as corporate profit for basic-rate taxpayers is around 0.05 and 0.08, which is slightly higher compared to that for higher-rate taxpayers. The elasticity of total income with re-

spect to the corporation tax rate is a little higher than that at the £300k kink. This may be due to a number of factors, one of which is simply that non-recording of income may be higher at this end of the distribution. The elasticity of the share of total income declared as profit seems surprisingly low. However, this may be due to the same reason: if it is perceived to be relatively cheap to evade taxes, then the main effect of a change in the tax rate may be greater evasion (and hence a fall in total declared income), rather than a switch in the form in which income is declared.

6.2   Intertemporal Shifting of Profit from 2006 to 2005

So far we have considered behavioural responses to corporate taxable profit accounting for potential shifting of income across personal and corporate tax bases. Another form of profit shifting could be intertemporal: a company may shift profits between periods to take advantage of a lower rate in one period. If companies do engage in such intertemporal profit shifting, then our estimated elasticities will also reflect this behavioural response. In this section we investigate the extent to which companies shifted their reported taxable profit across time in response to the announcement in December 2005 that the starting rate of corporation tax would be abolished with effect from April 2006. This reform not only removed the £10k tax kink, but also introduced additional incentives for companies with taxable profit less than £10k in 2005 to move reported taxable profit from 2006 into 2005. Only companies with accounting period ending between December 2005 and March 2006 would have benefited from profit shifting in anticipation of the tax changes. We would therefore expect a temporary upward spike in this group of companies bunching around £10k over and above the normal extent of bunching in the absence of the anticipated tax increase.

The change in the number of companies bunching at £10k due to the anticipated tax increase can be identified by comparing the excess mass around £10k in 2005 to the previous year, 2004, which had the same marginal tax rate schedule. We hence compare the distribution of taxable profit in these different years. Comparing month-by-month, the number of companies bunching in each year was almost identical. In particular, there appears to be no evidence that the excess mass around the kink point between December 2005 and March 2006 was higher than the equivalent months of the previous year.

More formally, we compute changes in the excess mass between 2004 and 2005 and estimate the elasticity of corporate taxable profit due to intertemporal income shifting. Consistent with the graphical evidence, the estimated difference in the excess mass is small and statistically insignificant, with the point estimate -0.180 and a standard error 0.299. The estimated elasticity of taxable profit due to intertemporal profit shifting is -0.066, with a standard error

0.110.

7   Marginal Deadweight Cost of Corporate Income Tax

We now estimate the marginal deadweight cost of corporate income tax combining all the relevant elasticity estimates from the previous sections. Following the discussion in Section 2, we first calculate the fraction of welfare loss through behavioural responses if every company with taxable profit between £300k and £1,500k faces a one-percent increase in their marginal corporate tax rate. In this case, the marginal deadweight loss can be calculated using the standard formula in (9), assuming that all income at the margin is declared as profit. The ratio a denotes the shape parameter of the Pareto distribution and measures how thin the top tail of the corporate income distribution is. We estimate a throughout the sample period and plot its value in Figure 6. The upper panel plots the average value of a for profits up to £9 million and the lower panel plots a for each year and each profit level between £50 and £1 million. The value of a remains quite stable over the tail of the income distribution and is around 1.07 at £300k.

With an average estimate of $\overline{e} = 0.13$ and marginal corporate tax rate of 29.75 percent, the fraction of welfare loss relative to the mechanical change in tax revenue is around 6.1 percent if corporate profits are retained within the company or distributed to shareholders that are taxed at the basic rate. If dividend income is taxed at the higher rate then the estimated marginal deadweight cost increases to 13.6 percent. Although we are not aware of any previous estimate of the deadweight cost of corporate taxes, Saez, Slemrod and Giertz (2012) calculate the fraction of tax revenue lost through behavioural responses to be around 27.7 percent due to a small increase in the top personal tax rate in the U.S. Their estimate applies to taxpayers at the top federal income tax bracket in the U.S. and is substantially larger than ours.

The above calculation assumes that corporate taxable income £300k follows a Pareto distribution, allowing us to apply a common value of a to every profit level above the threshold. An alternative, assumption-free method is to calculate the ratio $B_c/(B_c - A_c)$ for every company above a certain income threshold. We follow this approach and calculate the marginal deadweight cost due to a small increase in the marginal tax rate for profits around £10k as in eq. (17). Using tax rates and elasticity estimates summarised in Table 5, we estimate the marginal deadweight cost of corporate income tax to be around 28.64 percent for basic-rate taxpayers and 37.47 percent for higher-rate taxpayers should the statutory corporate tax rate for profits between £10k and £50k increase by one percent.

8   Conclusion

In this paper we estimate the elasticity of corporate taxable income with respect to the UK statutory tax rate, and derive estimates of the marginal deadweight cost of the tax. We use corporation tax return records that allow us to identify precisely the taxable income of each company, and hence to identify companies that are located at kinks in the marginal tax rate schedule. We exploit bunching of companies at these kinks, as well as several tax reforms that took place during this period, to estimate the elasticity.

We pay particular attention to the nature of the elasticity. For widely held companies bunching at a kink at £300k in the tax schedule, it is reasonable to assume that marginal increases in profit reflect increases in total income. For such companies we estimate a relatively small elasticity of between 0.13 and 0.17. This translates into a small marginal deadweight cost: our central estimate is a marginal deadweight cost of approximately 6% of the revenue that would have been generated by a marginal increase in tax, ignoring behavioural responses.

However, owner-managed companies have the opportunity to choose the form in which their income is declared for tax purposes: either as corporate profit or as personal income. For such companies, the elasticity of corporate taxable income may in part be determined by changes to the proportion of total income declared as profit. This issue is of particular importance at a much lower kink in the tax schedule at £10k. To address this, we match corporation tax records with information on the remuneration of directors taken from company accounting records. Combining the two sources of income allows us to identify the total income of the owner/manager and the share taken as profit. For such companies, we decompose the elasticity of corporate taxable income into two parts: the effect of changes in the tax rate on total income and the effect on the share of total income taken as profit. The empirical decomposition is based on companies that are bunched at kinks in both the personal tax schedule and the corporate tax schedule. For companies at the £10k kink in the corporate income tax schedule, we find much higher elasticities of corporate taxable income with respect to the tax rate, of between 0.53 and 0.56. These can be decomposed into (i) an elasticity of total income with respect to the net of tax rate of between 0.20 and 0.31, and (ii) an elasticity of the share of income taken as profit with respect to the difference between the personal and corporate tax rates of between 0.05 and 0.08. Combining these estimates generates an estimate of the marginal deadweight cost of the tax at the £10k kink of around 29% of the revenue that would have been generated by a marginal increase in tax, ignoring behavioural responses. We also investigate whether companies responded to an anticipated tax reform in 2006 by bringing forward income from the following year. We find no evidence

that they did so.

There is clearly evidence of variation in the elasticity of corporate taxable income with respect to the tax rate across companies, especially depending on their size. We find a higher elasticity for companies with very low income. This may reflect the more informal nature of such companies: their accounts may not be audited and it is plausible that evasion may be much more prevalent. Medium-sized companies with profits around £300k appear to be much less sensitive to the tax rate. We speculate, though present no evidence in support and leave for future research, that very large companies may also have a relatively high elasticity as they may have more opportunities to avoid tax, or to shift activities between countries.

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Figure 1. Bunching at £300k: Full Sample
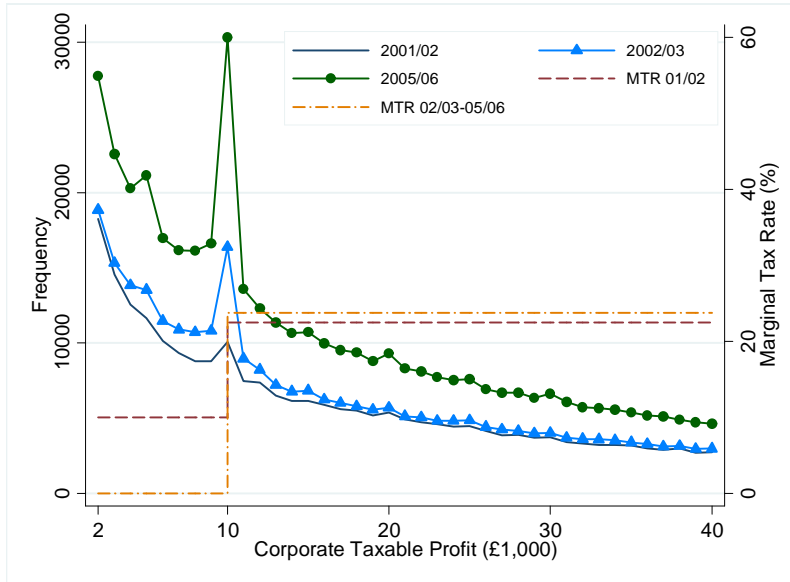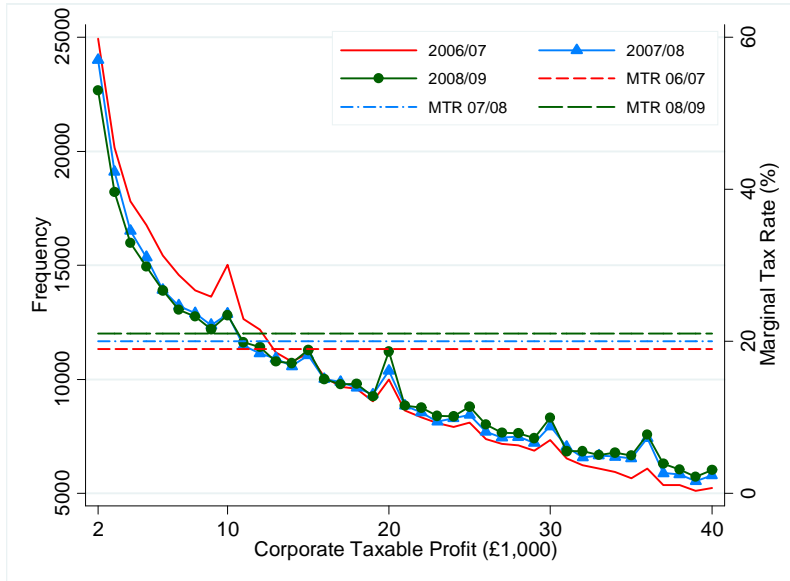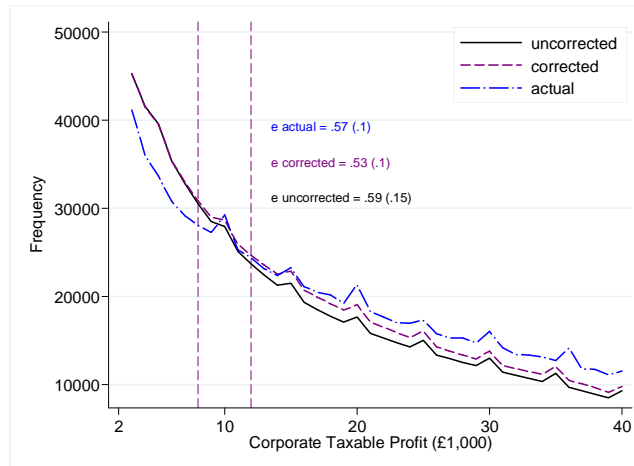
(a) 2001
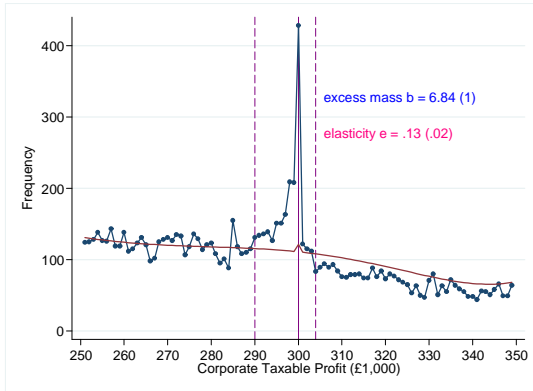
(b) 2002-2006
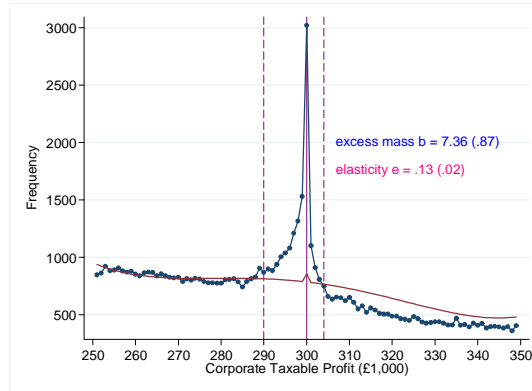
(c) 2007
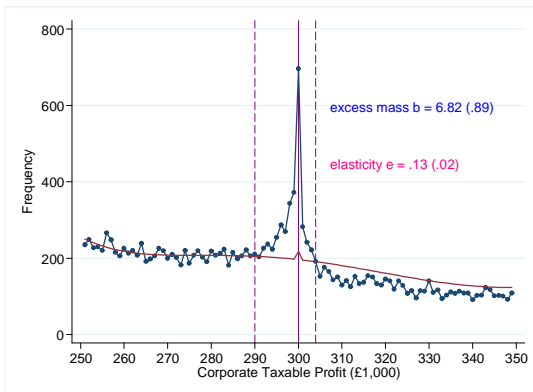
(d) 2008
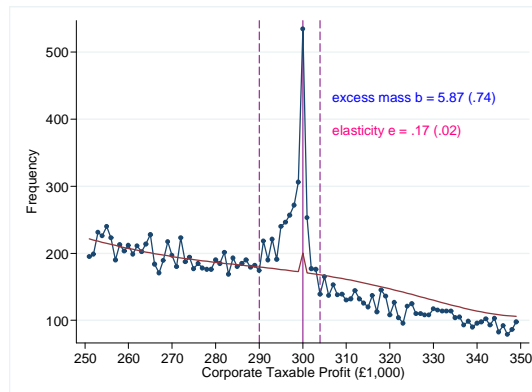
Notes: the figure shows the observed distribution (solid-dotted line) and the estimated counterfactual distribution (solid-smooth line) of corporate taxable income in 2001-2008. The counterfactual is a fifth-order polynomial estimated as in eq. (23). The excluded ranges around £300k are demarcated by the vertical-dashed lines. Bunching b is excess mass in the excluded range around £300k relative to the average counterfactual frequency in this range, and e is the implied elasticity of corporate taxable income. Standard errors are shown in parentheses.

Figure 2. Dynamics of Bunching at £10k

(a) 2001-2005

(b) 2006-2008

Notes: the figure shows the distribution of corporate taxable income in income bins of £1k in 2001-2008. The right y-axis depicts the corresponding marginal tax rates in horizontal-dashed lines.

Figure 3. Bunching at £10k: Full Sample

(a) 2001

(b) 2002-2003
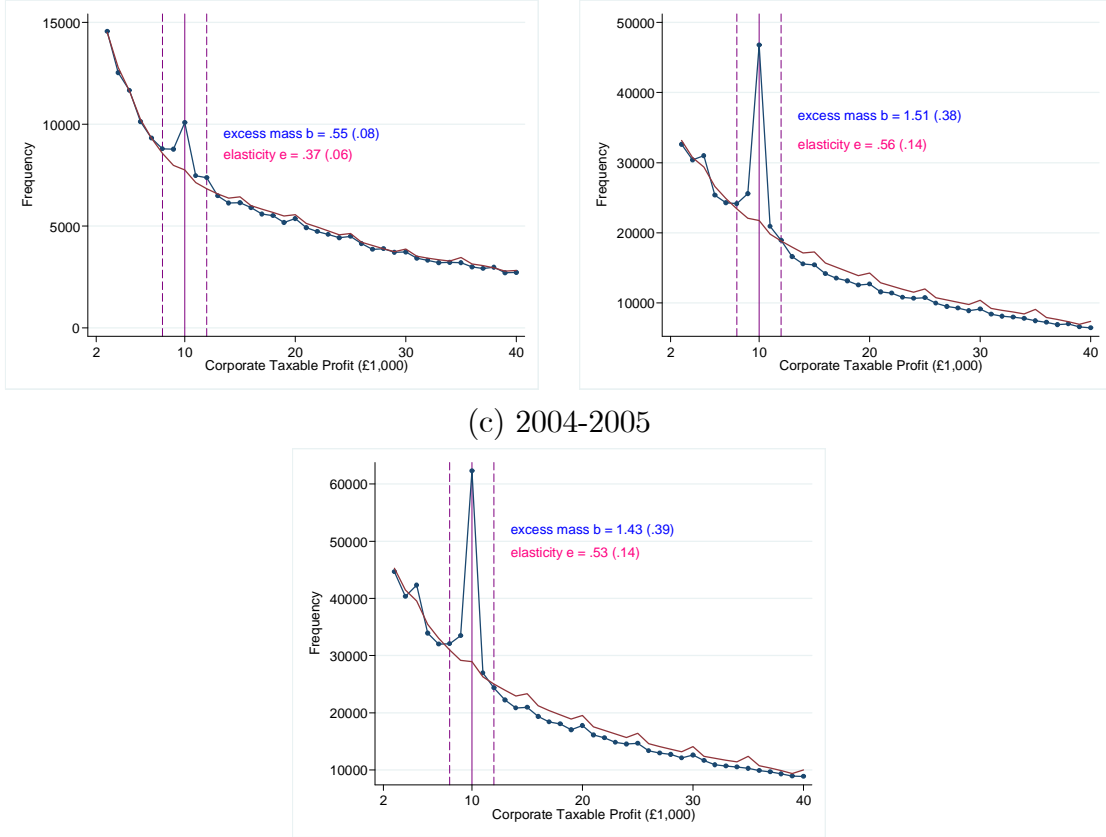
(c) 2004-2005

Notes: the figure shows the observed distribution (solid-dotted line) and the estimated counterfactual distribution (solid-smooth line) of corporate taxable income in 2001-2005. The counterfactual is a fifth-order polynomial estimated as in eq. (23). The excluded ranges around £10k are demarcated by the vertical-dashed lines. Bunching b is excess mass in the excluded range around £10k relative to the average counterfactual frequency in this range, and e is the implied elasticity of corporate taxable income. Standard errors are shown in parentheses.

Figure 4. Bunching at £10k: Estimation Method Comparison
(a) 2002-2003
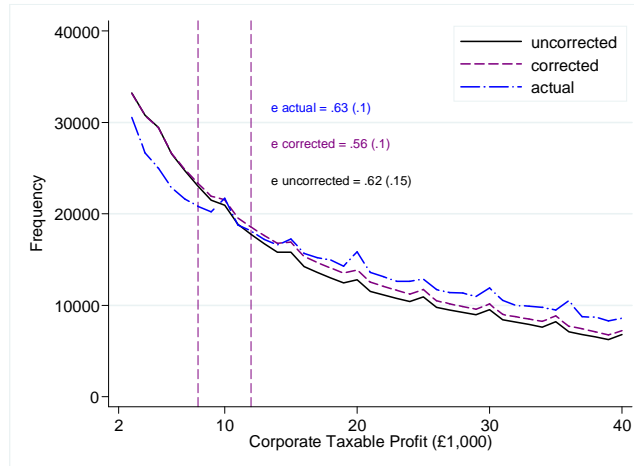
(b) 2004-2005

Notes: the figure compares the counterfactual density distribution and the corresponding elasticity estimate using different bunching estimation methods. "e uncorrected" refers to the bunching estimation ignoring the integration constraint. "e corrected" refers to the standard bunching estimation method which preserves the total number of companies to be the same as in the empirical distribution. "e actual" refers to the bunching estimation method based on the post-reform actual distribution of corporate taxable income.

Figure 5. Bunching Twice at £10k
(a) 2002-2003
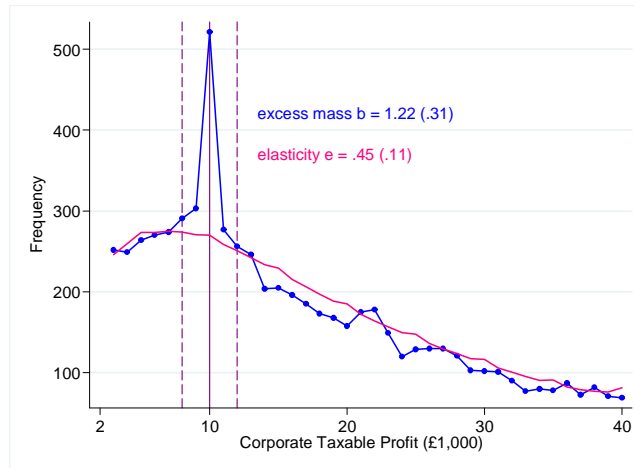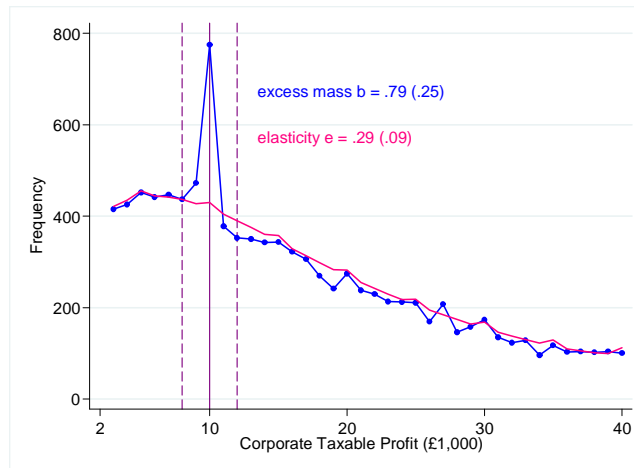
excess mass b = 1.22 (.31)

elasticity e = .45 (.11)

(b) 2004-2005

excess mass b = .79 (.25)

elasticity e = .29 (.09)

Notes: the figure shows the observed distribution (solid-dotted line) and the estimated counterfactual distribution (solid-smooth line) of corporate taxable income for companies that bunch at the first personal tax kink. The counterfactual is a fifth-order polynomial estimated as in eq. (23). The excluded ranges around £10k are demarcated by the vertical-dashed lines. Bunching b is excess mass in the excluded range around £10k relative to the average counterfactual frequency in this range, and e is the implied elasticity of corporate taxable income. Standard errors are shown in parentheses.

Figure 6. The Pareto Parameter

(a) Overall
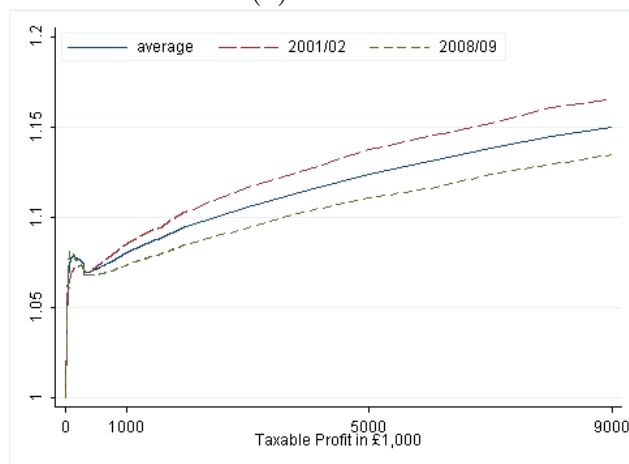
(b) By Year
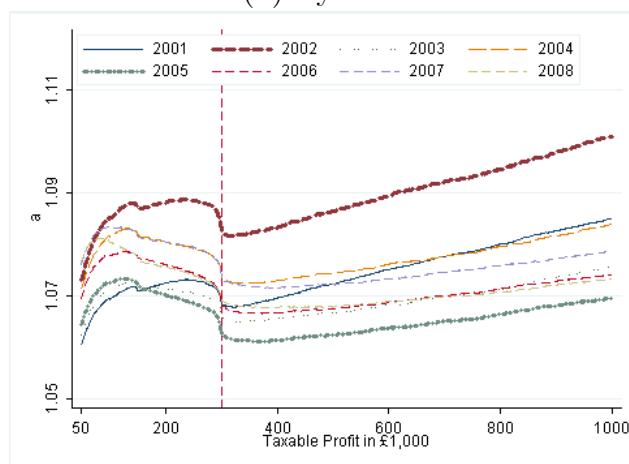
Notes: this figure shows the overall value of Parameter ratio a as a function of corporate income z between £0 and £9 million in the upper panel and the value of a in each tax year for corporate income between £50k and £1,000k. The ratio a is computed using the average income level above each income threshold z, z_m, divided by the difference between z_m and z: namely, $\frac{z_m}{z_m - z}$.

Table 1. Income Tax Schedules in the U.K.

	2001	2002	2003	2004	2005	2006	2007	2008
Corporate tax								
Income upper limit (UL)								
10,000	0.1	0	0	0	0	0.19	0.2	0.21
50,000	0.225	0.2375	0.2375	0.2375	0.2375	0.19	0.2	0.21
300,000	0.2	0.19	0.19	0.19	0.19	0.19	0.2	0.21
1,500,000	0.325	0.3275	0.3275	0.3275	0.3275	0.3275	0.325	0.2975
over 1,500,000	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.28
NCDR	0	0	0	0.19	0.19	0	0	0
Dividend tax								
tax credit rate	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
basic rate	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
higher rate	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
Personal tax								
personal allowance	4,535	4,615	4,615	4,745	4,895	5,035	5,225	6,035
starting rate UL	6,415	6,535	6,575	6,765	6,985	7,185	7,455	-
starting rate	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-
basic rate UL	29,400	29,900	30,500	31,400	32,400	33,300	34,600	34,800
basic rate	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.2
higher rate	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Employed-income NICs								
Lower Earnings Limit	3,744	3,900	4,004	4,108	4,264	4,368	4,524	4,680
Upper Earnings Limit	29,900	30,420	30,940	31,720	32,760	33,540	34,840	40,040
employee's contribution								
primary threshold	4,524	4,628	4,628	4,732	4,888	5,044	5,200	5,435
basic rate contracted-in	0.1	0.1	0.11	0.11	0.11	0.11	0.11	0.11
basic rate contracted-out	0.084	0.084	0.094	0.094	0.094	0.094	0.094	0.094
higher rate	0	0	0.01	0.01	0.01	0.01	0.01	0.01
employer's contribution								
secondary threshold	4,524	4,628	4,628	4,732	4,888	5,044	5,225	5,435
basic rate contracted-in	0.119	0.118	0.128	0.128	0.128	0.128	0.128	0.128
basic rate contracted-out	0.089	0.083	0.093	0.093	0.093	0.093	0.091	0.091
higher rate	0.119	0.118	0.128	0.128	0.128	0.128	0.128	0.128

Notes: all rates and allowances are in nominal terms. NCDR refers to the non-corporate distribution rate. The lower basic NICs rates apply when the employee contracted out of the State Second Pensions and are associated with the reduced benefits.

Table 2. Summary Statistics for the Estimation Sample

	All	Corporate Taxable Profit				
		<=0	[0, 50k]	[50k, 300k]	[300k, 1,500k]	>=1,500k
Tax variables:						
Trading turnover (in mil)	3.23	3.87	1.03	1.62	11.30	155
	(528)	(579)	(588)	(81)	(219)	(1,220)
Corporate taxable profits (in k)	160.90	0	15.93	115.18	589.06	19200
	(13,200)	-	(14.22)	(62.25)	(295.01)	(166,000)
Corporate taxes (in k)	31.14	0.02	2.75	24.43	155.76	3,559.91
	(1,336.33)	(23.46)	(3.01)	(14.92)	(96.68)	(16,500)
Double taxation relief (in k)	480.85	0.03	0.49	4.84	82.69	8683.41
	(22,200)	(1.55)	(48.25)	(13.89)	(112.31)	(94,500)
Accounting variables:						
Directors' salary (in k)	154.53	214.90	40.66	115.17	369.47	999.08
	(652.73)	(835.71)	(193.33)	(321.70)	(666.33)	(2,137.92)
Number of employees	302	388	65	92	165	1331
	(3,662)	(4,420)	(874)	(709)	(1,058)	(8,345)
Number of directors	7	9	6	6	10	22
	(7)	(9)	(6)	(5)	(8)	(16)
Number of observations	8,410,741	3,107,826	3,628,199	1,429,332	192,449	52,935

Notes: summary statistics are constructed using 2001-2008 data. The taxable profit bands are in nominal terms, where all monetary values are in real 2005 British Pound (GBP) with 1 GBP = 1.55 USD as of June 2012. Standard deviations are shown in parentheses.

Table 3. Elasticity of Corporate Taxable Income around £300k

Year	Increase in 1-MTR (%-points)	$\widehat{e}$
(1)	(2)	(3)
2001	0.170	0.134 (0.019)
2002-2006	0.186	0.132 (0.016)
2007	0.170	0.134 (0.017)
2008	0.117	0.167 (0.021)

Notes: the table presents estimates of the elasticity of corporate taxable income with respect to the marginal net-of-statutory tax rate around £300k. Standard errors are shown in parentheses and estimates in bold are significant at the standard 1% level.

Table 4. Elasticity of Corporate Taxable Income around £10k

Year	Increase in 1-MTR (%-points)	NCDR (%-points)	Full Sample	New Entries	Exisiting Firms
(1)	(2)	(3)	(4)	(5)	(6)
2001	0.150	0	**0.366** (0.056)	- -	- -
2002-2003	0.271	0	**0.556** (0.140)	**0.475** (0.156)	**0.558** (0.142)
2004-2005	0.271	0.190	**0.528** (0.145)	**0.230** (0.072)	**0.538** (0.150)

Notes: the table presents estimates of the elasticity of corporate taxable income with respect to the marginal net-of-statutory tax rate around £10k. NCDR refers to the non-corporation distribution rate. Column 4 shows the results for the full sample while column 5 and 6 show the results for new and existing companies, respectively. Our sample starts from year 2001 so we can only distinguish new entries and existing firms from 2002 onwards. Standard errors are shown in parentheses and estimates in bold are significant at the standard 1% level.

Table 5. Decomposition of the Elasticity of Corporate Taxable Income

Year	$t_{c,basic}$	$t_{c,high}$	$t_{p,basic}$	$t_{p,high}$	Estimated Elasticity of			
					Corporate Taxable Income $\widehat{e}$	Total Taxable Income $\widehat{x}$	Share of Income Declared as Profit	
							$\widehat{z}_{basic}$	$\widehat{z}_{high}$
2002	0.2375	0.428125	0.387	0.518	**0.574** (0.142)	**0.309** (0.078)	0.052 (0.043)	0.042 (0.034)
2003	0.2375	0.428125	0.407	0.538	**0.574** (0.142)	**0.309** (0.078)	0.059 (0.048)	0.051 (0.042)
2004	0.2375	0.428125	0.407	0.538	**0.547** (0.147)	**0.199** (0.064)	0.077* (0.046)	0.067* (0.040)
2005	0.2375	0.428125	0.407	0.538	**0.547** (0.147)	**0.199** (0.064)	0.077* (0.046)	0.067* (0.040)

Notes: the table presents estimates of three different elasticities for companies with taxable profits between £10k and £50k. The elasticity of corporate taxable income refers to the one with respect to the marginal net-of-statutory tax rate and is estimated using the full sample with profits between £2k and £40k. The elasticity of total taxable income is computed from the elasticity of corporate taxable income for companies bunching at the first personal tax kink. The elasticity of profit share refers to the one with respect to the difference between the personal and corporate tax rate and is computed following eq. (18). Standard errors are shown in parentheses and estimates denoted in bold and * are significant at the standard 1% and 10% level, respectively.

A Sensitivity Analysis of Parametric Assumptions

We examine the sensitivity of the estimation strategy to alternative order of polynomial, income range included for estimation and windows around the kink point for bunching around £300k.[17] First, while the main regression specification estimates the counterfactual distribution of corporate taxable income using companies with taxable profits between £250k and £350k, we explore alternative specification of estimation range by including companies with taxable profits around [225k, 375k] and [275k, 325k]. Table A.1 summarises the estimated excess mass b and implied elasticity of corporate taxable income e under these alternative estimation range. As illustrated, the wider the estimation range is, the larger the implied elasticity of corporate taxable income. This is because a wider estimation range includes more observations farther away from kink and under-estimates the counterfactual distribution to the right of the kink point. This in turn yields a somewhat larger elasticity estimate, although the difference with the baseline result is not statistically significant.

Second, while the main specification excludes company counts with profit between £290k and £304k, we estimate the counterfactual using alternative excluded ranges that are wider and asymmetric: [£285k, 304k] and narrower and symmetric: [£293k, 307k] and [£295k, 305k]. For the same reason that we explain above, large elasticity estimates are associated with wider excluded range. Lastly, while the main specification uses 5th order polynomials, we also estimate the counterfactual using 3rd-7th order polynomials. As illustrated, the estimation strategy is insensitive to using lower order polynomials. Beyond 5th order polynomials, the counterfactual are slightly affected by using higher order polynomials as they underestimate the amount of excess mass at the kink point. Intuitively, the 5th order polynomials appear to be sufficiently flexible to capture the patterns in the company frequencies and provide a robust estimate of counterfactuals.

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[17]Implications from sensitivity analysis for bunching around the £10k tax kink are qualitatively the same, which are not repeated here.

Table A.1. Bunching at £300k with Alternative Regression Specifications

Polynomial Order	Estimation Range	Excluded Range	Excess mass b	Implied Elasticity e
basic result				
5	[250k, 350k]	[290k, 304k]	**7.356**	**0.132**
			(1.121)	(0.016)
varying estimation range:				
5	[225k, 375k]	[290k, 304k]	**8.681**	**0.156**
			(0.693)	(0.012)
5	[275k, 325k]	[290k, 304k]	**4.886**	**0.088**
			(1.740)	(0.031)
varying excluded range:				
5	[250k, 350k]	[285k, 304k]	**7.831**	**0.140**
			(1.134)	(0.020)
5	[250k, 350k]	[293k, 307k]	**6.483**	**0.116**
			(0.840)	(0.015)
5	[250k, 350k]	[295k, 305k]	**5.824**	**0.104**
			(0.740)	(0.013)
varying polynomial order :				
3	[250k, 350k]	[290k, 304k]	**8.334**	**0.149**
			(0.854)	(0.015)
4	[250k, 350k]	[290k, 304k]	**7.430**	**0.133**
			(1.089)	(0.020)
6	[250k, 350k]	[290k, 304k]	**6.419**	**0.115**
			(0.921)	(0.017)
7	[250k, 350k]	[290k, 304k]	**6.436**	**0.115**
			(0.939)	(0.017)

Notes: the table presents estimates of the excess mass and the elasticity of corporate taxable income with respect to the marginal net-of-statutory tax rate around £300k in 2002-2006 using alternative regression specifications. Standard errors are shown in parentheses and estimates in bold are significant at the standard 1% level.

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