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# Updating and critiquing HMRC's analysis of the UK's 50% top marginal rate of tax

IFS Working Paper W17/12

James Browne

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# Updating and critiquing HMRC's analysis of the UK's 50% top marginal rate of tax\*

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## Abstract

In April 2010 the UK's marginal rate of income tax above £150,000 was increased from 40% to 50%, affecting the highest-income 0.66% of the adult population (and 1% of income taxpayers). This would seem an ideal opportunity to obtain an estimate of the taxable income elasticity, but identification is impeded by forestalling (individuals bringing forward income to the year before the tax rate was increased) resulting from the reform being announced more than a year in advance.

This forestalling hampered an attempt by HMRC (the UK's tax authority) to estimate the revenue effects of the tax rise (HMRC, 2012) using incomplete data from the first year of the higher tax rate (2010–11). This analysis used an aggregate difference-in-difference approach. In this paper we update this analysis, using more complete data on the first year following the reform (2010–11) and an additional year of data (2011–12) that was unavailable when HMRC conducted their analysis. Using a similar method to HMRC (2012), we estimate an elasticity of around 0.31 based on the response in 2010–11, and 0.83 based on the response in 2011–12.

We next refine HMRC (2012)'s methodology for estimating how much of the forestalled income came from 2010–11 and how much from subsequent years. We find that all else equal, HMRC's method for estimating from which years forestalled income came – which suggests that around 70% came from 2010–11 – is likely to lead to overestimates of how much came from these initial post-reform years, and hence underestimate the underlying taxable income elasticity. An alternative method that better accounts for these issues suggests around 45% was unwound in 2010–11, and around one-sixth unwound in 2011–12, implying an elasticity of 0.58 based on the response in 2010–11 and 0.95 based on the response in 2011–12. These would both imply negative revenues from the increase in the top tax rate to 50%.

Finally, we show the sensitivity of HMRC (2012)'s estimates to changes in the specification of the model used to estimate the counterfactual incomes of the group affected by the 50% tax rate. We find that relatively small changes to the specification yield very different results, with higher taxable income elasticity estimates frequently in excess of unity. The range of reasonable central estimates that the UK's Office for Budget Responsibility could use to estimate the revenue effects of changes to the UK's top income tax rate is therefore wide.

However, it is important to sound three notes of caution here. First, if individuals anticipated (correctly) the 50% rate being reduced in later years (or were able to respond to the announcement made towards the end of the 2011–12 tax year that it would be reduced to 45% in 2013–14), they may also have delayed receiving income. We still obtain higher taxable income elasticity estimates than HMRC (2012) when we assume that individuals were able to delay as much income from 2011–12 to 2013–14 as they were able to bring forward from 2011–12 to 2009–10, but it may be the case that delaying income is easier than bringing it forward. If this were the case, more of the overall response to the 50% tax rate may represent temporary timing effects as opposed to underlying response, which would imply that the estimates of the underlying taxable income elasticity may be overestimates. Second, some behavioural responses, such as additional occupational pension contributions, or retention of income in businesses, while reducing income tax revenues in the short-term, generate at least some revenue in the longer-term. Third, the estimate of the counterfactual is very imprecisely defined, meaning that the estimates from the different specifications are not statistically significantly different from each other, or indeed from zero. The central estimates of HMRC (2012) are therefore still very much within the margin of error of our estimates. There is therefore still significant uncertainty in both directions around HMRC's estimates of the taxable income elasticity of high earners, and hence the revenue effects of the 50% rate.

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Browne's work on this paper was conducted while he was at the IFS. This paper does not represent the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the authors.

## I. Introduction

In April 2010, the marginal rate of income tax above £150,000 was increased from 40% to 50% in the UK, affecting the highest-income 0.66% of the adult population. When the policy was announced in 2009, the government at the time estimated that this would raise about £2.5 billion a year, under an assumption that the taxable income elasticity of this group was 0.35 (the pre-behavioural yield was about £6 billion). As the top income tax rate had previously remained unchanged for more than twenty years prior to this, the introduction of the 50% tax rate would seem an ideal opportunity to obtain an estimate of the taxable income elasticity (a summary measure of the responsiveness of those affected) – and therefore assess the initial costing. However, because the increase in the tax rate was announced more than a year before it took effect, those affected by the reform had an incentive, and in many cases, the opportunity to bring forward income from 2010–11 and beyond in to 2009–10 – a phenomenon termed ‘forestalling’. This means that the most obvious approach to estimating the long-run impact of the tax change on taxable incomes, and hence government revenues – by examining the change in the incomes of those affected between 2009–10 and 2010–11 – will not yield an unbiased estimate of the underlying taxable income elasticity, as it would conflate the long run impact of the reform and temporary forestalling.

An initial evaluation of the 50% tax rate was undertaken by Her Majesty's Revenue and Customs (HMRC) utilising an aggregate difference-in-difference estimator, ad-hoc adjustments to account for forestalling, and income information from promptly filed income tax returns for 2010–11 (HMRC, 2012). The resulting estimate of the taxable income elasticity is 0.48, substantially higher than the 0.35 assumed when the policy was announced and costed, but in-line with estimates based in large part on the last major change to the UK's top rate of tax in the 1980s (Brewer, Saez and Shephard (2010)).

In this paper we update, extend, and critique HMRC's work in several ways. First, we use more complete data for 2010–11 than was available to HMRC at the time they undertook their analysis, and examine the impact of the tax rise on incomes and tax revenues in 2011–12, the second year of the higher tax rate. Second, we test the sensitivity of estimates of the underlying taxable income elasticity to varying the precise assumptions and methods used by HMRC to predict counterfactual incomes (in the absence of reforms) and strip out forestalling effects. In doing this we critique some of the modelling choices made by HMRC, and suggest and test refinements of this method. These lead to central estimates of the underlying taxable income elasticity that are on the whole higher than those obtained by HMRC itself. Taken at face value, these would suggest that the 50%

reduced revenues, and that the 45% tax rate – which replaced the 50% rate in April 2013 – remains above the revenue-maximising rate.

But two major caveats to this apply. First, as with HMRC's original estimates, standard errors are large. Therefore the estimated elasticities are consistent with the true elasticity being much larger or smaller, implying that we cannot rule out the 50% tax rate either substantially increasing or reducing the income tax paid by those affected by this tax rate. Second is the potential that some of the fall in income observed was in anticipation of the rate being reduced from 50% at some point in future or in response to the announced reduction in the rate towards the end of the 2011–12 tax year. If people anticipated the subsequent reduction to 45% and therefore *delayed* income realisation, the underlying taxable income elasticity could be substantially lower. We show that assuming that people could delay as much income from 2011–12 to 2013–14 as they could bring forward from 2011–12 to 2009–10 still yields higher taxable income elasticity estimates than the central estimate of HMRC (2012), but it is possible that delaying income is easier than bringing it forward. If this was the case, the underlying taxable income elasticity would be lower.

In summary, although our central estimates of the taxable income elasticity are higher than those of HMRC (2012), the significant uncertainty around our estimates mean that one cannot be sure that the 50% tax rate did not raise or indeed cost substantial revenues.

The rest of this paper proceeds as follows. In Section II we describe the policy background. In Section III, we describe the data used in this analysis. Section IV summarises HMRC's approach and estimates. In Section V we update and extend HMRC's analysis, and test the sensitivity of estimated elasticities to specific changes in key assumptions. Section VI concludes. The paper is one of a series of papers examining the responsiveness of relatively high earners in the UK to income tax rates: other papers examine the extent of bunching around tax thresholds (Adam et al (2017)), and utilise panel approaches and the introduction of the 50% tax rate to estimate the taxable income elasticity of affected individuals (Browne and Phillips (2017)).

## II. Policy background

Prior to the 2010 reforms, the last time the rate of tax faced by those with the very highest incomes was changed was 1988 when the 60%, 55%, 50% and 45% rates of income tax were abolished. The highest 60% rate had applied to incomes above approximately £92,000 in 2017 prices.<sup>1</sup> Earlier reforms in 1979 substantially raised the thresholds for these rates, and had abolished additional higher rates of 65%, 70%, 75% and 83%. Using the variation in tax rates generated by both these reforms and earlier reforms in the 1960s and 1970s, which were generally announced with immediate effect, Brewer, Saez and Shepherd (2010) estimated a taxable income elasticity for the top 1% of UK adults – equivalent to an income above approximately £120,000-130,000 in today's terms – of 0.46. This would imply a revenue maximising effective marginal tax rate (incorporating not only income tax, but also National Insurance and potentially consumption taxes) of 56% for incomes above £150,000.<sup>2</sup>

The taxable income elasticity is not a constant or immutable parameter: it will depend both on how responsive individuals are to changes in the tax rate they face, which could change over time depending on the outside options they face, and on the structure of the tax system, in particular whether individuals can avoid paying high rates of income tax by shifting income into tax shelters or other less heavily-taxed bases. Since the 1980s, efforts to broaden the UK's tax base, for example by eliminating tax relief on mortgage interest and life assurance premiums, would tend to have reduced the taxable income elasticity. On the other hand, the increasing globalisation of the world economy might have increased the opportunity for those with high incomes in the UK to work in other countries. But the stability in the top income tax rate between the late 1980s and 2010 meant that there were no more up-to-date estimates of the taxable income elasticity of high income individuals.

The 50% tax rate was announced by the Labour government that was in office from 1997 to 2010, and implemented shortly before it was replaced by a coalition government led by the Conservative party. Unfortunately, there are several features of this reform that impede estimation of the long-run taxable income elasticity. First, the increase in the top tax rate from 40% to 50% was announced more than a year in advance, enabling those potentially affected to bring forward income from 2010–11 and future years to 2009–10 to avoid paying the higher tax rate. It is clear from the data that many such individuals took advantage of this 'forestalling' opportunity, as they are often wont to do (see Parcell (1995) for similar responses to pre-announced reforms in the early 1990s in the United States). Secondly, when the new tax rate was announced, the government stated that it was a 'temporary' measure, potentially inducing people to delay receiving income in 2010–11 and 2011–12 until after the tax rate had been lowered again. Indeed, a reduction in the rate to 45% was announced shortly before the end of the 2011–12 tax year, to be applied from 2013–14 onwards. Thus, there is no year in which the level of taxable income reported by the affected group reached its expected long-run level.

Other tax changes introduced around the same period are a third factor that may affect changes in taxable incomes of those affected by the 50% rate in 2010–11. For example, a restriction on the amount individuals can contribute to private

<sup>1</sup> Adjusted for inflation using the CPI.

<sup>2</sup> The revenue-maximising rate is calculated assuming a Pareto parameter of 1.70 (which is similar to that based on SPI data from 2007–08, the last year for which data is available and unaffected by temporary responses to the 50% tax rate, and published summary statistics for SPI data from 2013–14). See Saez, Slemrod and Giertz (2012) for formula for calculating revenue maximising tax rate. The extent to which this revenue maximising rate should incorporate consumption taxes depends on the nature of the behavioural response to reforms. If behavioural responses to higher income tax rates take the form of shifting income to other time periods or tax bases or tax-favoured forms of income, consumption tax revenues may not be (fully) affected by taxes on earnings, which would affect the necessary calculations and imply a higher revenue-maximising overall tax rate..

pensions was implemented in 2011–12 (the annual amount individuals could contribute to a pension was reduced from £255,000 to £50,000), with measures introduced in 2010–11 aimed at preventing people significantly increasing their pension contributions in that year, prior to the new restriction taking effect. These measures would, other things being equal, increase the taxable incomes of those who would otherwise have wanted to make a pension contribution of more than £50,000. The introduction of a small band of income between £100,000 and approximately £113,000 where the effective income tax rate was 60% (described as 'the withdrawal of the personal allowance', where the personal allowance is the amount of taxable income on which no income tax is charged) may have affected the incomes of those with slightly lower incomes who are the natural comparison group. There was also a one-off tax on bank payrolls in 2009–10 that would have the effect of weakening the incentive for those working in the banking sector to have bonuses paid in 2009–10 rather than 2010–11, potentially limiting the extent of forestalling.

Despite these issues, the coalition government asked HMRC to analyse tax receipts from 2010–11 in order to investigate the response to the higher tax rate among those affected, and this was published alongside the 2012 Budget, in which (partly as a result of the high level of responsiveness observed) it was also announced that the rate would be reduced from 50% to 45% from 2013–14. We describe the methodology used in this analysis in section IV of this paper, update it to take account of more recent data, and show the sensitivity of the results to variations in that methodology.

### **III. Taxpayer data**

The paper makes use of two main sources of data: the Survey of Personal Income (SPI), a large repeated cross section of tax records, and "Self-Assessment" (SA) tax return form data.

The SPI is the main source of data we use to obtain a measure of aggregate incomes above £150,000 and between £100,000 and £150,000. It is based on a sample of tax records drawn from both those required to fill in a tax return, and those whose tax is deducted fully at source. High-income individuals are oversampled, and sample weights are included to allow grossing up to population-level aggregates. These data are now available for 1995–96 to 2007–08, and for 2009–10 and 2010–11 but at the time HMRC undertook their analysis these data were not yet available for 2010–11.<sup>3</sup>

The second source of data is the universe of tax records of those required to fill in a tax return. This data includes total and taxable income, by source, and information on deductions and tax allowances claimed. The rules governing who has to submit an SA return have changed over time, but at present approximately 20% of all taxpayers do so, though this contains almost all of those with incomes above £150,000, and a large majority of those with incomes between £100,000 and £150,000. We use the SA data to fill in the years where the SPI data is not available at the time of writing (2008–09 and 2011–12). However, as not all taxpayers, even at very high income levels, are obliged to fill in tax returns, this is not a perfect substitute for the SPI data. In 2008–09, we scale up incomes from the SA data in 2008–09 under the assumption that the SA data captures the same

<sup>3</sup> Since this analysis was completed, SPI data have also been made available for 2013–14 (but not intervening years). Given this data will be affected by 'reverse forestalling' associated with the reduction in the top rate of tax from 50% to 45%, and data from the previous and subsequent years are not available (making estimating the extent of this behaviour difficult), we do not utilise 2013–14 data in this paper.

proportion of overall income (as estimated by the SPI) in that year as in the previous year. Aggregate incomes from the SA data in 2011–12 are complemented with estimates provided by HMRC of the incomes of those in the relevant groups who do not fill in an SA form. When HMRC undertook their analysis, scaled-up SA data also had to be used for 2010–11, which we show has a significant effect on the estimates they obtained.

We also use the SA data to track the incomes of specific individual over time, which is not possible in the SPI as it does not contain the same individuals in each year. This allows us to identify a group of individuals whose income prior to 2009–10 was relatively stable. HMRC (2012) used the behaviour of this group in the run up to and aftermath of the reforms – i.e. in 2009–10 and 2010–11 to estimate how quickly forestalling in response to the 50% was unwound, and therefore strip out forestalling effects from their underlying elasticity estimates.

#### IV. HMRC's analysis of the 50% tax rate

In order to obtain estimates for the taxable income elasticity and the amount of revenue raised by the 50% income tax rate, it is necessary to estimate what would have happened to the taxable incomes of those who were affected by the higher tax rate in the absence of any changes. HMRC (2012) creates this counterfactual by using data on income growth among the group with slightly lower incomes (those with incomes between £115,000 and £150,000 in 2010–11 prices) and known stock market growth to predict income growth among the affected group would have been in the absence of the change in the tax rate. Formally, using data from the SPI from 1995–96 to 2007–08 and SA records for 2008–09 they estimate the equation

$$GTY150+_t = a_1 GTY115\_150_t + a_2 GAVEP_t + e_t \quad (1)$$

where:

$GTY150+_t$  = Percentage change in income for the group with incomes more than £150,000 (in 2010–11 prices) in year  $t$ ,

$GTY115\_150_t$  = Percentage change in income for the group with taxable incomes between £115,000 and £150,000 (in 2010–11 prices) in year  $t$ ,

$GAVEP_t$  = Percentage change in the average of quarterly closing prices of the FTSE All Share Index in year  $t$ .

HMRC's estimates of this equation are in Table 1 below.

TABLE 1  
*Estimates of equation (1) from HMRC (2012)*

Coefficient	Estimate	Standard error	p-value
$a_1$	1.116	0.132	0.000
$a_2$	0.382	0.093	0.002

Source: HMRC (2012).

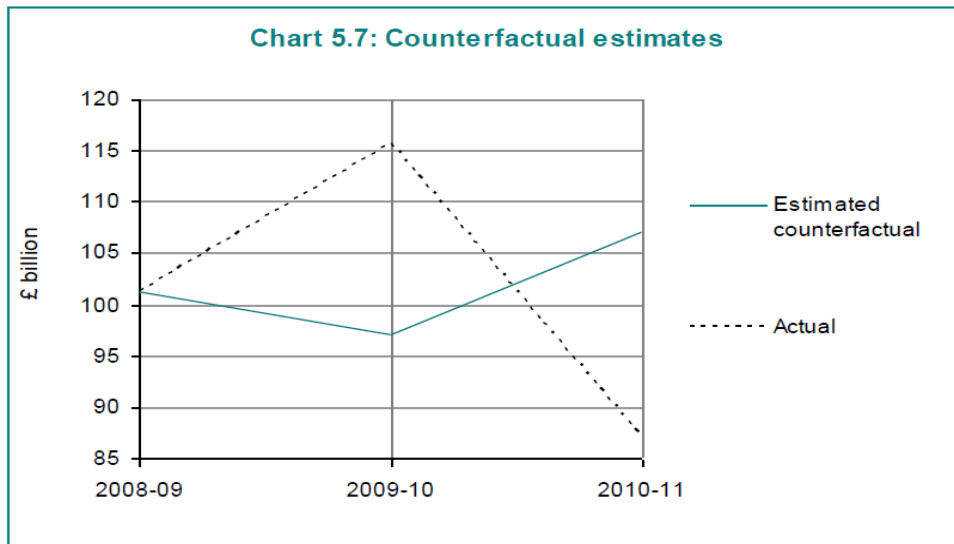
HMRC (2012) then apply these estimates to data from 2009–10 and 2010–11 to obtain a prediction for what would have happened to the incomes of the group affected by the additional tax rate in the absence of any changes in tax rates. The chart below from HMRC (2012) shows their estimates of the counterfactual incomes in 2009–10 and 2010–11, and also shows their estimates of the actual incomes in those years at the time of the report. The extent of forestalling (bringing forward income to 2009–10 from subsequent years) can be clearly seen – the amount of income observed for the affected group in 2009–10 is around £18 billion



higher than would have been predicted from the counterfactual equation. This is HMRC's estimate of the total amount of income brought forward to 2009–10 in order to avoid the higher tax rates subsequently charged. Furthermore, incomes in 2010–11 are significantly lower (around £21 billion less than the counterfactual), partly as a result of income being brought forward from 2010–11 to 2009–10 but partly also the result of an underlying behavioural response to the higher tax rate.

HMRC (2012) then estimate how much of the income fall in 2010–11 simply reflected income that had been shifted to 2009–10 to calculate the size of the underlying behavioural response, or put another way, how much of the £18 billion of income brought forward to 2009–10 came from 2010–11 and how much from later years. HMRC (2012) uses a simple but essentially ad-hoc method based on examining the behaviour of those who exhibited 'stable' income from three different sources (dividends, employment and other), where 'stable' was defined as varying by less than 30% over the three years from 2006–07 to 2008–09. For those whose income from that source in 2009–10 was less than twice the average for the three previous years, it was assumed that all of this additional income was foretelling that was brought forward from 2010–11. For those whose income in 2009–10 was more than twice one 'normal' year's income, it was assumed that an amount equal to the average income from 2006–07 to 2008–09 had been brought forward from 2010–11, with the remainder coming from subsequent years. Using this information, HMRC (2012) assume that 45% of the dividend income and 85% of employment income brought forward in to 2009–10 came from 2010–11. HMRC assumed that an 85% proportion applied to income sources other than dividends and employment income.

FIGURE 1



Source: HMRC (2012)

Taken together, HMRC (2012) estimates that of the £18 billion of income that was brought forward to 2009–10, £12.3 billion came from 2010–11 and £5.7 billion from subsequent years. Put another way, of the £20 billion by which the aggregate income of those with incomes above £150,000 trailed the counterfactual level in 2010–11, £12.3 billion was estimated to have been the result of income having been brought forward to 2009–10, with £7.7 billion representing the underlying behavioural response to the 50% tax rate. This results in an estimate of

the taxable income elasticity of 0.48,<sup>4</sup> which would imply that while the 50% rate of tax would have increased the sum of income tax and National Insurance Contributions (NICs) revenues by about £0.5 billion compared to the 40% rate in 2013–14, it would have been a little above the revenue-maximising income tax rate (assuming no positive or negative spillover effects onto other taxes such as capital gains tax or VAT).<sup>5</sup>

## V. Updating and critiquing HMRC's analysis

In this section, we first re-estimate the model of HMRC (2012) using more up-to-date data, then refine their methodology for estimating how quickly forestalling unwound in 2010–11 and 2011–12. We also show the sensitivity of their estimates to changes in the specification of counterfactual equation (1), highlighting the level of uncertainty surrounding these counterfactual estimates.

### V.1. Updating the HMRC analysis to account for more up-to-date data

As previously discussed, one concern with the estimates used by HMRC (2012) was that their data for 2010–11 was incomplete as it was based on those people paying tax by self assessment who filed their tax returns promptly; i.e. it did not include those filing late, or not paying via self-assessment. HMRC did scale up their data to try to account for this based on the fraction of total revenue that the equivalent group of prompt filers contributed in the previous year, 2009–10. But if the fraction of people filing promptly or subject to self assessment among either those with incomes greater than £150,000, or between £100,000 and £150,000, changed compared to previous years, such an approach may not be valid.

We now have access to data for a representative sample of all taxpayers (including those not filing their tax returns promptly) from the 2010–11 version of the SPI, data from SA tax records in 2011–12, and information provided by HMRC on the total income of those with incomes between £115,000 and £150,000 and over £150,000 respectively who were not subject to self assessment in 2011–12. Using this updated information, we can examine how HMRC's early data compares to the full outturns for 2010–11 and extend the series to 2011–12.

Both the initial HMRC figures and the updated ones show a large fall in the incomes for the group affected by the 50% rate in 2010–11 (indeed, the fall in the updated data is slightly larger at 28% rather than 25%). However, whereas the data available to HMRC showed a 6% increase in the incomes of the comparison group with slightly lower incomes, the updated data shows a fall of 4%. This reflects the fact that a higher proportion of the control group filed a tax return promptly in 2010–11 than in 2009–10, partly as a result of HMRC's efforts to improve compliance with requirements to file tax returns following changes to the tax system introduced in 2010–11.

The fact that the incomes of the comparison group fell (rather than increased) in 2010–11 suggests that at least some of the fall in the treatment group's income may have occurred anyway (given the strong correlation between the incomes of the two groups). This would tend to reduce estimates of the total and underlying behavioural response to 50% tax rate. Figure 2 also shows that in 2011–12 the incomes of both the treatment and control groups grew by around 7%. If the analysis of HMRC (2012) that most of the forestalled income had come from

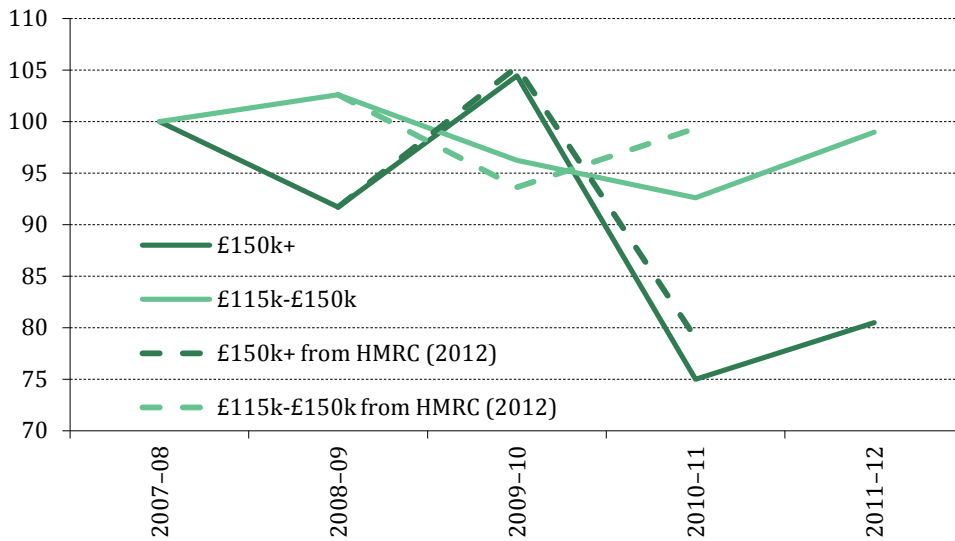
<sup>4</sup> This is calculated by dividing the underlying percentage change in income (around 8%) by the percentage change in the net-of-tax rate (around 17%).

<sup>5</sup> HMRC (2012) reports a figure of £1.1 billion for an elasticity of 0.48 (Table 5.3) using adjusted data from 2010–11. Using data from (summary tables for) the 2013–14 SPI, a figure of £0.5 billion is obtained. Figures of £0.25 billion and £0.4 billion are found using projected SPI data (based on actual data for 2013–14) for 2014–15 and 2015–16, respectively.

2010–11 was correct, one would have expected the incomes of the treatment group to have rebounded more strongly in 2011–12 as this forestalling unwound. That they did not suggests that more of the forestalled income came from 2011–12 (and potentially beyond) and less from 2010–11 than initially estimated. More of the (smaller) total fall in incomes seen in 2010–11 would therefore be the result of underlying behavioural response to the tax rise rather than temporary forestalling effects.

FIGURE 2

Growth in taxable income for groups with incomes > £150k,  
and £115k-£150k, 2007–08 to 2011–12 (2007–08=100)



Note: Thresholds and aggregate income amounts adjusted for RPI inflation except in 2011–12.

Source: Authors' calculations using SPI from 2007–08 and 2009–10 to 2010–11 and scaled data from SA tax returns for 2008–09 and 2011–12.

The first stage of updating the analysis is to re-estimate equation (1). We take a slightly different approach to HMRC (2012) here in that we use nominal rather than inflation-adjusted thresholds to define our treatment and comparison groups (i.e.  $GT_{Y150+t}$  is the growth in the incomes of the group with more than £150,000 nominal in year  $t$ ): this is because the higher tax rate applies above a nominal £150,000 threshold in both 2010–11 and 2011–12 and thus this is the correct definition of the treatment group. Our revised estimates can be found in Table 2 below. We see that our coefficient estimates are somewhat smaller than those of HMRC (2012), and that the coefficient on stock market growth is no longer statistically significant.

TABLE 2

Re-estimating equation (1)

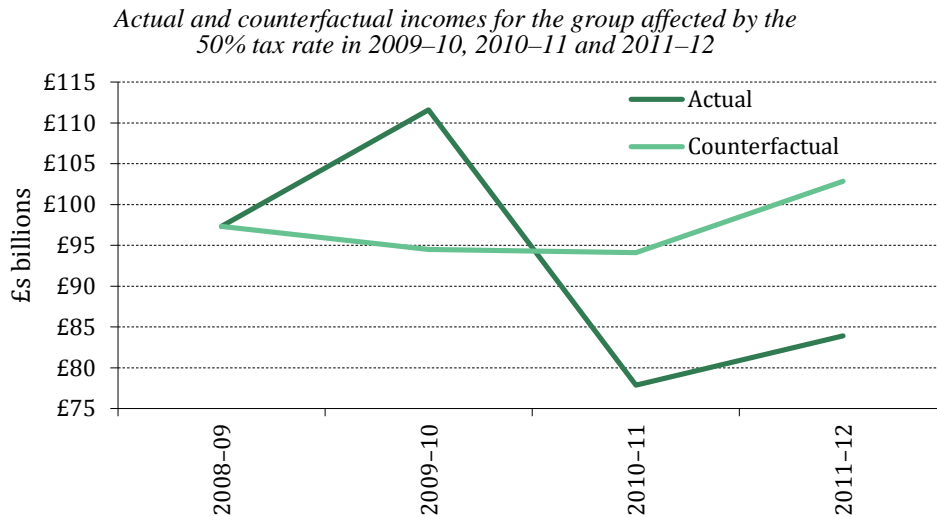
Coefficient	Estimate	Standard error	p-value
$a_1$	0.898	0.173	0.000
$a_2$	0.292	0.180	0.137

Source: Authors' calculations using SPI data from 1996–97 to 2007–08 and SA data from 2008–09.

In Figure 3, we apply these estimates of equation (1) to the new data to estimate a new counterfactual income for the group with incomes above £150,000 in 2009–10, 2010–11 and 2011–12, and compare this to the actual incomes of this group in

these three years. The difference between these two represents the estimated impact of the policy on reported incomes in each year. Incomes of the treatment group in 2009–10 are estimated to be £17.1 billion higher than they would be in the absence of the policy - similar to the estimate obtained by HMRC (2012). (It is reassuring that re-estimating the model does not significantly affect the estimate of the policy impact in this year: we saw in Figure 2 that the data changes in 2009–10 were minimal, meaning that we can be relatively confident that differences in our results for later years are the result of data revisions rather than modelling differences). In 2010–11, incomes are estimated to be £16.2 billion lower than in the absence of the 50% rate, rather less than the £21 billion estimated by HMRC.

FIGURE 3



*Source:* Actual – as for Figure 2. Counterfactual – authors’ calculations using regression coefficients from Table 2 and SPI and scaled SA data.

Retaining HMRC’s estimate that around 70% of the income brought forward to 2009–10 came from 2010–11, would imply that the underlying response to the higher tax rate acted to reduce the income of the affected group by £4.3 billion in 2010–11. This would imply a much lower taxable income elasticity of 0.31 rather than the 0.48 estimated by HMRC. However, even if the remaining 30% of forestalled income had come entirely from 2011–12, this would imply that the underlying response to the 50% tax rate reduced the incomes of the affected group by £13.8 billion in 2011–12. This would imply a taxable income elasticity of 0.83, which would seem to be an implausibly large increase in the behavioural response from one year to the next.

We argue that a more plausible explanation is that less of the income brought forward to 2009–10 came from 2010–11 and more came from 2011–12 and later than HMRC had estimated. In the next sub-section, we use the SA data from 2010–11 and 2011–12 to critique HMRC (2012)’s approach to the unwinding of forestalling, and suggest alternatives.

## V.2. Testing the sensitivity of elasticity estimates to the specific assumptions used when estimating from which year forestalled income came from

As already mentioned, HMRC (2012) estimates the extent of forestalling by examining the behaviour of those with ‘stable’ incomes from particular sources of income in the years prior to the announcement of the 50% tax rate. Stability is defined as having an income from a particular source that varies by no more than 30% during the 3 years between 2006–07 and 2008–09. If income from that source

in 2009–10 was less than twice the average for the previous three years, all of the forestalled income was assumed to have come from 2010–11; if it was more than twice the average, an amount equal to the average was assumed to come from 2010–11 with the rest coming from 2011–12 and beyond.

First, note the ad-hoc, arbitrary and somewhat unsatisfactory nature of these assumptions: there is no particular reason for defining stability in the particular manner HMRC did. In Table 3, we therefore test the sensitivity of estimates to defining stability using different bandwidths (10%, 30% and 50%) and different periods of time (2,3 and 4 years). We see that in practice these estimates are relatively insensitive to changes in the definition of stability used.

TABLE 3

*Proportion of forestalling in 2009–10 estimated to come from 2010–11 under different definitions of 'stability' using methodology of HMRC (2012)*

Number of years of stable income	Bandwidth used to define stability		
	10%	30%	50%
2 years	66%	67%	67%
3 years	69%	70%	70%
4 years	71%	72%	72%

*Source:* Authors' calculations using SA302 data from 2005–06 to 2011–12.

A second, and more fundamental, criticism is that the method takes no account of behaviour in 2010–11 and beyond. For instance, if one brought forward income equivalent to 100% of the pre-reform average from 2010–11 to 2009–10, one would expect no income from that source to be declared in 2010–11 (because it had all been brought forward). However, the methodology used by HMRC (2012) does not verify that this is the case. In fact, the incentive is to bring forward only income that would otherwise have taken the individual's taxable income above £100,000,<sup>6</sup> and individuals may be able to bring forward only part of their income forward from any given year. If this were the case, less of the income brought forward into 2009–10 would have come from 2010–11 (and thus more from subsequent years), increasing the size of the underlying taxable income elasticity one would obtain from a given total level of behavioural response in 2010–11. We therefore also test the sensitivity of results to a method which takes into account the amount of income individuals reported in 2010–11 and 2011–12: specifically, we assume that the difference between 'normal' and actual income from a source in 2010–11 is assumed to have come from 2010–11 (or the entire amount of forestalled income if that is less than this difference); and similarly for 2011–12 for any remaining forestalled income. Of course, this assumption is also arbitrary, but seems more plausible than one which ignores post-reform behaviour.

Table 4 shows estimates of the proportion of income forestalled from 2010–11 and 2011–12 using this methodology. (As in Table 3, we also show the sensitivity of our results to different definitions of 'stability'; we again find that this makes little difference to our results). We see that, using this methodology, the proportion of forestalling that came from 2010–11 is much smaller: by noting that those who brought income at least one year's normal income forward to 2009–10 did not in all cases report zero income from that source in 2010–11, we estimate that just under half of the forestalling of income to 2009–10 came from 2010–11 compared to around two-thirds using HMRC's methodology. Furthermore, of the remaining

<sup>6</sup> Remember that an effective 60% marginal income tax rate was introduced between £100,000 and around £113,000 in 2010–11 also, meaning that there was an incentive for individuals with high incomes to bring forward enough income to 2009–10 such that their income was below £100,000 in 2010–11 (as this income would have been subject to the 40% marginal tax rate in 2009–10).

forestalling to be unwound after 2010–11, we estimate that only one third unwound in 2011–12, with the rest remaining to be unwound in later years. Applying these estimates of forestalling to obtain an estimate of the underlying impact of the increase in the tax rate using the estimates from our regression above, we obtain a taxable income elasticity estimate of 0.58 for 2010–11 and 0.95 for 2011–12.

TABLE 4

*Proportion of forestalling in 2009–10 estimated to come from 2010–11 and 2011–12 under different definitions of 'stability' using our methodology*

Number of years of stable income	Bandwidth used to define stability					
	10%		30%		50%	
	2010–11	2011–12	2010–11	2011–12	2010–11	2011–12
2 years	45%	18%	44%	18%	45%	19%
3 years	45%	16%	46%	17%	45%	18%
4 years	43%	14%	45%	16%	45%	16%

Source: Authors' calculations using SPI data from 1996–97 to 2008–09 and 2010–11 and SA data from 2008–09 and 2011–12.

Using a more realistic assumption about how quickly forestalling unwound does not therefore affect the result that the size of the underlying behavioural response appears to have been somewhat larger in 2011–12 than in 2010–11. Although it is possible that this is a reflection of reality – it may be the case that some individuals took more than 2 years to respond to the announcement of a higher tax rate – an alternative explanation is that some of the observed reduction in income in 2011–12 is the result of income being delayed to subsequent years in anticipation of the tax rate being reduced in the near future. How much income was shifted in this way cannot be reliably estimated in the absence of data from later years (i.e. 2012–13 and 2013–14, the last year of the 50% rate and the first year of the 45% rate respectively). If we make a reasonable but ultimately arbitrary assumption that individuals were able to delay as much income from 2011–12 to 2013–14 as they were able to bring forward from 2011–12 to 2009–10, our estimated taxable income elasticity in 2011–12 falls from 0.95 to 0.80 – a sizeable reduction, but still much higher than our estimate of 0.58 based on the 2010–11 data.

These taxable income elasticity estimates are summarised in Table 5 below.

TABLE 5

*Taxable income elasticity estimates under different assumptions about how quickly forestalling unwinds*

Forestalling assumption	Year		
	2010–11	2011–12	2011–12 with reverse forestalling
HMRC (2012)	0.31	0.83	0.55
Our assumptions described in text	0.58	0.95	0.80
Arbitrary assumption described in text	0.53	0.65	0.40

Note: HMRC (2012) assumption involves 70% of forestalling unwinding in 2010–11 and the remainder in 2011–12. Our assumptions involve 45% of forestalling unwinding in 2010–11 and a further one-sixth in 2011–12. The arbitrary assumption is that half of the forestalling comes from 2010–11 and half from 2011–12 in the case without reverse forestalling, and involves 62% of the forestalling coming from 2010–11 and the remainder from 2011–12 in the case with reverse forestalling.

Source: Authors' calculations using SPI data from 1996–97 to 2008–09 and 2010–11 and SA data from 2008–09 and 2011–12.

We see that under our favoured assumption about forestalling, the taxable income elasticity is significantly higher than that found by HMRC (2012) of 0.48, but that it is possible to obtain a lower estimate than this if one assumes that forestalling

unwound more quickly than we estimate it did based on the behaviour of those with stable incomes, and that there was a substantial amount of 'reverse forestalling' from 2011–12 to 2013–14. For instance, we could assume that all the forestalling in 2009–10 came (equally) from 2010–11 and 2011–12. This reduces our estimate of the underlying taxable income elasticity to 0.53 in 2010–11 and 0.65 in 2011–12. If we also allow for reverse forestalling in the same manner as before (i.e. assuming that as much income is delayed from 2011–12 to 2013–14 as was brought forward from 2011–12 to 2009–10), the taxable income elasticity for 2011–12 falls to 0.4.

### **V.3 Testing the sensitivity of estimates to the specification of the counterfactual regression**

Another potential sensitivity to the results in HMRC (2012) is to the specification of equation (1). Indeed, HMRC (2012) show a number of alternative specifications of the counterfactual estimation that produce significantly different results. As well as their main specification (equation 1), they estimate what they term an 'alternative regression' which uses a different measure of stock market growth, substituting the change in the average of quarterly closing values of the FTSE All Share index with the calendar year change in the level of the FTSE 100 (an index of the share prices of the 100 largest companies by full market value listed on the London Stock Exchange). HMRC (2012) show that using this model to estimate the counterfactual incomes of the group affected yields a higher value of counterfactual incomes in both 2009–10 in 2010–11 (in other words, less forestalling in 2009–10, and a larger response to the policy in 2010–11). This largely arises because share values fell substantially during 2008, meaning that comparing the average quarterly closing prices in 2008–09 and 2009–10 shows a smaller increase than the increase in the FTSE 100 index over the 2009 calendar year. HMRC (2012) also show results with a simpler counterfactual where incomes of the affected group increase by 3% a year in nominal terms. Both of these alternative specifications yield significantly higher taxable income elasticity estimates: 0.71 and 0.82 respectively.

Therefore, in this sub-section, we, like HMRC (2012), show the sensitivity of our estimates to the measure of stock market growth included in the model. We also show the sensitivity of estimates to the inclusion of a constant term in the regression. It is not clear what HMRC (2012)'s justification was for not including a constant was – there is no reason why we would necessarily expect growth in the incomes of the group affected by the 50% rate to be zero when growth in the incomes of the group with slightly lower incomes and stock market growth were both zero, so it seems illogical to constrain the model in this way. It turns out that the estimate of the counterfactual is highly sensitive to the inclusion of the constant term.

Table 6 shows four separate sets of estimates for equation (1): including and excluding a constant term; and using two different definitions of stock market performance.<sup>7</sup> The table explains why we get such different results when we include a constant. In the models with a constant,  $a_1$ , the coefficient on the income growth of the group with lower incomes, is smaller and the constant term (i.e. the growth in the incomes of the group with incomes above £150,000 we would expect

<sup>7</sup> The two definitions are: the change in the average of quarterly closing values of the FTSE All Share Index between years (the same measure used by HMRC in their main specification and that we have used so far in this paper); and the calendar year change in the FTSE All Share index (this is slightly different to HMRC's 'alternative regression' where they use the calendar year change in the FTSE 100, but since the value of the FTSE All Share index is dominated by the 100 largest companies, the two series are highly correlated).



when growth in the incomes of the group with slightly lower incomes and stock market growth is zero) is positive. This means that the predicted income for those with more than £150,000 in 2009–10 and 2010–11 is higher when including a constant in the regression than when not.

TABLE 6  
*Alternative regression estimates*

Coefficient	Change in quarterly average FTSE All Share closing price		Calendar year change in FTSE All Share	
	No constant	With constant	No constant	With constant
$a_1$	0.898*** (0.173)	0.737* (0.342)	0.922*** (0.157)	0.820** (0.304)
$a_2$	0.292 (0.180)	0.328 (0.198)	0.290 (0.147)	0.303* (0.157)
Constant	N/A	0.029 (0.052)	N/A	0.019 (0.049)

Source: Authors' calculations using SPI data from 1996–97 to 2007–08 and 2009–10 to 2010–11 and SA data from 2008–09 and 2011–12.

This is confirmed when we use these regression models to estimate what the total income of the group affected by the 50% income tax rate would have been in the absence of the policy in different years in Table 7. We show the results of each alternative specification of the counterfactual regression under the different assumptions about how quickly the estimated forestalling unwinds outlined in the previous sub-section. In each panel, the first line shows the results under HMRC (2012)'s main specification as re-estimated by us (with coefficients set out in Table 2). We then show results for the specification where we include a constant term, and finally those for the specifications where we change the measure of stock market growth used, both under the model with and without a constant term.

The third column of the table shows our estimates of the total level of forestalling under the different specifications. We see that the HMRC-style specification we have used up to now gives the highest estimate of forestalling (£17 billion), as this gives the lowest estimate for the counterfactual incomes of the £150,000 plus group in 2009–10.<sup>8</sup> Changing the specification by either including a constant term or using the calendar year change in the FTSE All Share Index has a roughly equal effect on the estimate of forestalling, reducing it to around £13 billion. Making both of these changes to the specification of the regression for estimating the counterfactual reduces it further to £10.1 billion.

The alternative specifications also predict a higher level of counterfactual income in 2010–11 and 2011–12, and thus for a given level of actual income, a greater impact of the 50% tax rate in these years.<sup>9</sup> The most striking finding from

<sup>8</sup> This is because, as stated previously, the absence of a constant term means that  $a_1$  (the coefficient on the income growth of the group with slightly lower income) is larger, and hence lower counterfactual incomes are predicted when the incomes of the group with income between £115k and £145k fall, as they did in 2009–10. In relation to the stock market variable, the increase in the average quarterly closing values of the FTSE All Share Index was smaller than the calendar year change: the positive relationship between stock market performance and incomes means a smaller increase in stock prices translates into lower counterfactual incomes.

<sup>9</sup> This is, in part, because the higher counterfactual income levels in 2009–10 carry forward into subsequent years (the regression predicts growth rates not income levels). In addition, the inclusion of a constant term leads to higher counterfactual income growth in 2010–11, as the income of the control group with incomes between £115k and £145k fell again that year, and the smaller  $a_1$  term reduces the impact of this fall on the incomes of the treatment group with incomes above £150k. Including a constant term has less impact on counterfactual income growth in 2011–12 (but still affects its level because of the impact on growth in the previous two years). Choice of stock-market variable has little impact on counterfactual income growth in 2010–11 as the two measures change similarly that year but has more impact in 2011–12 as the measures then diverge.



the table though is that the estimated taxable income elasticity is substantially higher than that estimated by HMRC (2012) under each of these alternative specifications of the counterfactual, irrespective of what one assumes about how quickly forestalling unwound. The model chosen by HMRC (2012) to estimate the counterfactual evolution of the incomes of the group affected by the 50% income tax rate gives a much lower prediction than alternative models that are equally (or arguably more) plausible. These higher elasticities suggest a revenue-maximising income tax rate of far below 40%, let alone 50%.<sup>10</sup>

TABLE 7

*Estimated amount of forestalling and taxable income elasticities under different counterfactual regression specifications*

Counterfactual regression model		Total forestalling (£ billion)	Taxable income elasticity estimate		
Stock market variable	Constant term?		2010–11	2011–12	2011–12 with reverse forestalling
<b>A: Using same assumptions about unwinding of forestalling as HMRC (2012)</b>					
Change in average of quarterly closing values	No	17.1	0.31	0.83	0.55
	Yes	12.9	0.97	1.36	1.20
Calendar year change	No	13.0	0.75	1.02	0.83
	Yes	10.1	1.14	1.36	1.23
<b>B: Using assumptions about unwinding of forestalling described in section V.2</b>					
Change in average of quarterly closing values	No	17.1	0.58	0.95	0.80
	Yes	12.9	1.13	1.45	1.35
Calendar year change	No	13.0	0.93	1.11	1.00
	Yes	10.1	1.26	1.41	1.34
<b>C: Using arbitrary assumptions about unwinding of forestalling described in section V.2</b>					
Change in average of quarterly closing values	No	17.1	0.53	0.65	0.40
	Yes	12.9	1.10	1.25	1.05
Calendar year change	No	13.0	0.89	0.89	0.78
	Yes	10.1	1.24	1.27	1.17

This result that fairly innocuous changes in the specification of the counterfactual lead to results with vastly different implications for the revenue effects of the 50% rate (and the revenue maximising rate) is somewhat worrying. But although the central estimates of the taxable income elasticity vary significantly depending on specification of the counterfactual, it is important to note that each counterfactual is based on a regression estimated on only twelve observations. Therefore, in the next subsection we estimate the uncertainty

<sup>10</sup> An elasticity of 1, for instance, would imply that a revenue maximising total effective tax rate of 37%, which given prevailing rates of NICs would imply a revenue maximising rate of income tax of less than 30%.

surrounding the specification of our counterfactual and hence the taxable income elasticity estimates.

### V.5 Quantifying the uncertainty around our counterfactual estimates

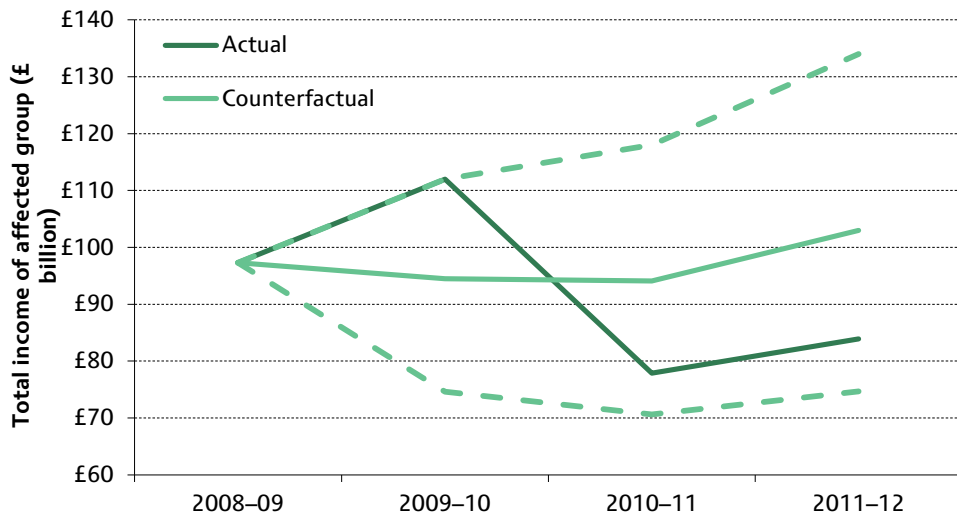
In order to examine the uncertainty surrounding our counterfactual estimates, we take 1000 draws from the error distribution of our HMRC-style equation (i.e. the model without a constant and using the change in the average quarterly closing price of the FTSE All Share index as the measure of stock market growth). Figure 4 shows the 95% confidence intervals that we obtain.

We see that the confidence intervals are indeed wide: we can only be 95% confident that there was any forestalling in 2009–10 at all as opposed to there being other exogenous factors leading to such a high growth in the incomes of the group with incomes of £150,000 or more. All else equal, this would imply that all the reduction in the income of this group in 2010–11 was attributed to an underlying impact of the policy. On the other hand, we cannot be confident that the incomes of the group affected by the 50% tax rate were any lower in 2010–11 than they would otherwise have been: the 95% confidence interval for the counterfactual that year is lower than the actual outcome.

Translating the uncertainty around the counterfactual into uncertainty around the taxable income elasticity yields a 95% confidence interval for the taxable income elasticity ranging from less than zero to around two, with some variation depending on the assumptions made around how quickly forestalling unwinds. Needless to say, this wide confidence interval encompasses the results from the other specifications, so despite the very different results we get from the different specifications, the estimates are not in fact statistically significantly different from each other.

FIGURE 4

*Confidence intervals around estimate of counterfactual incomes of affected group*



Source: Authors' calculations using SPI data from 1996–97 to 2007–08 and 2009–10 to 2010–11 and SA302 data from 2008–09 and 2011–12.

## VI. Discussion and conclusions

HMRC (2012) was the first paper to examine the revenue effects of the 50% tax rate introduced in 2010–11, and utilise this reform to estimate the taxable income elasticity for high income individuals in the UK. The main difficulty in doing this

is the significant amount of income brought forward into 2009–10 to avoid the higher tax rate – a phenomenon termed ‘forestalling’ –, which one needs to account for and strip out if one wants to estimate the longer run, ‘underlying’ degree of responsiveness of taxable income to tax rates.

HMRC utilised an ad-hoc method to estimate how much of an ‘overall response’ to the 50% rate in its first year of operation represented this underlying (as opposed to forestalling) response – after first estimating the overall response using a difference-in-difference approach on aggregated incomes data. Given the restricted amount of data available to HMRC researchers and the tight timescales they faced, this work represented a useful first examination of responses to the 50% tax rate. With more data now available, this paper has updated, extended and critiqued this analysis, as part of a broader programme of research on the responsiveness of those with relatively high incomes to income tax.

Simply making use of more recent data than was available to HMRC (2012) changes our impression of how individuals affected by the 50% tax rate responded to it. On the one hand, the incomes of the group with incomes just below £150,000 now appear to have fallen during 2010–11, suggesting that at least some of the reduction in income seen among the group affected by the 50% rate would have happened anyway in the absence of the higher tax rate. But we have also seen that the incomes of the group affected by the higher tax rate did not bounce back in 2011–12 in the way we would have expected if the reduction in income in 2010–11 was largely explained by forestalling of income from 2010–11 to 2009–10. Thus, simply applying HMRC (2012)’s method for estimating how much of the forestalling came from 2010–11 as opposed to subsequent years gives a much lower estimate of the taxable income elasticity based on the response in 2010–11, but a much higher estimate when we use the data from 2011–12.

Taken together then, this suggests that somewhat less of the income that was brought forward to 2009–10 came from 2010–11 and more from subsequent years. This is reinforced when we refine HMRC (2012)’s methodology for estimating how much of the income brought forward to 2009–10 came from 2010–11. To estimate how much of the income brought forward to 2009–10 came from 2010–11, HMRC (2012) examine the behaviour of those with stable income in the years prior to the reform, and assume that if income increased by less than one year’s ‘normal’ income from a particular source in 2009–10, this all came from 2010–11, and that if the increased their income from a particular source by more than one year’s ‘normal’ income, one whole year’s income came from 2010–11. This would imply that income would be zero in 2010–11 for those who brought forward more than one year’s income to 2009–10, but HMRC (2012)’s method does not verify that this is the case. When we adapt HMRC’s methodology to take into account individuals’ actual incomes in 2010–11 to estimate how much of the income brought forward came from 2010–11, we obtain an estimate that only 45% of the income brought forward to 2009–10 came from 2010–11, and around one-sixth came from 2011–12. Making this change to our re-estimate of HMRC (2012)’s model increases our estimates of the taxable income elasticity, and brings the estimates based on the response in 2010–11 closer into line with those based on the response in 2011–12. These estimates are higher than HMRC (2012)’s central estimate and would imply that the long-run yield from the higher tax rate would be negative. This result holds if we assume that individuals are able to delay as much income from 2011–12 to 2013–14 as they were able to bring forward from 2011–12 to 2009–10, but it is possible that it is easier to delay income than to bring it forward, which would lower our estimates of the underlying taxable income elasticity.

However, the main weakness of the approach used by HMRC (2012) is that their estimate of the counterfactual incomes of the group affected by the 50% tax rate is imprecisely defined and highly sensitive to the precise specification used. We have seen that adding a constant to the model or changing the measure of stock market growth used significantly increases the taxable income elasticity, in most cases to in excess of unity. Indeed, all our estimates are higher than the central estimate of HMRC (2012), at least when we use our refined methodology for estimating how much of the forestalling came from each year. That said, the imprecision with which the counterfactual is estimated means that these estimates are not statistically significantly different from each other, or indeed from zero: based on this methodology, the range of ‘reasonable’ estimates that the OBR could use in assessing costings of changes in the rate of income tax on those with very high incomes is wide indeed.

Given this level of imprecision, it is perhaps unsurprising that this aggregate difference-in-difference method has not been widely used in the literature examining taxable income elasticities either in the UK or elsewhere. In a companion paper (Browne and Phillips, 2017), we take the more standard approach of using individual-level panel data to approach the same problem. However, as we discuss in that paper, there are no easy ways of dealing with the issue of forestalling that was so pervasive around the time of the introduction of the 50% tax rate in the UK. The elasticity of taxable income of high income individuals in the UK – and hence the revenue effects of changing tax rates on them – remain highly uncertain.

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