The Elasticity of Taxable Income in the Presence of Intertemporal Income Shifting

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Abstract

Knowing the elasticity of taxable income (ETI) is crucial for understanding the effects of taxation on taxpayer behavior and consequently on tax revenues. Previous research finds that high-income individuals are the most sensitive to tax policy changes. However, these individuals have more opportunities to defer income to future tax bases by altering the composition of their compensation than lower-income individuals. This paper considers the taxable income elasticity when individuals can shift income across tax bases and thereby defer taxation. We decompose the elasticity of taxable income into a real response as well as an income shifting response. We measure the tax rate on deferred income by the expected tax gain from deferring income using stock options as developed by Hall and Liebman (2000). Our results demonstrate that income shifting is an important component of previous estimates of the ETI. Because shifted income is taxed at future dates, income shifting decreases the welfare loss from personal income taxation associated with previous estimates.

Keywords: elasticity of taxable income, income shifting, deferred income, executive compensation, tax policy.

JEL Codes: G30, H24, H31, J33.

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1. Introduction

The elasticity of taxable income (ETI) is an important parameter for understanding the behavioral implications of tax policy changes. Feldstein (1999) showed that under certain conditions, the ETI is a sufficient statistic for the deadweight loss of taxation. Given the importance of this elasticity, there is an extensive body of research that has estimated its magnitude. While much of this research has estimated relatively low elasticities, some studies find that the ETI is significantly larger near the top of the income distribution.[1] In other words, higher income households exhibit greater responsiveness to tax changes. This finding is relevant for our study which focuses on executive compensation. Bebchuk and Grinstein (2005) and Frydman and Saks (2010) document that there has been a dramatic growth in compensation of executives largely driven by increases in stock options and other incentive-based pay that give executives the ability to defer some portion of their current pay into the future. In an earlier paper, Gorry et al. (2017) we find that executives respond to tax changes by changing the form of their compensation. By substituting from cash towards equity-based compensation, executives can defer taxation on their income in high tax years. This ability to defer income taxation has implications for the overall elasticity of taxable income.

Given that estimates of the ETI play a central role in our understanding of the welfare effects of taxation, it is important to understand how this ability of executives to time their compensation influences estimates of ETI and the resulting welfare effects of taxation. Studying the 1993 tax increase, Goolsbee (2000) found significant reductions in taxable income in response to the tax change. However, he showed that much of this change in taxable income was a short-run response in executives choosing to exercise their stock options in advance of the tax

[1] For a summary of this research, see Saez, Slemrod, and Giertz (2012).

change rather than from a long-run reduction in taxable income. In contrast, Gorry et al. (2017) find that executives not only change the timing of option exercise in response to tax changes but also that they change the form of their compensation in response to taxes. That is, the share of deferred income in total income responds significantly to current tax rates. In particular, if current tax rates are high, then the share of stock options in the compensation package increases significantly, while the share of salary and other cash compensation decreases. This result implies that there are more substantial long-run responses beyond the exercising of stock options documented by Goolsbee (2000).

These long-run and short-run responses of taxable income can be thought of as income-shifting responses. In other words, executives respond to anticipated tax rates by shifting incomes to periods of lower tax burdens. In addition to income shifting responses, executives may also have other real responses, in terms of reduced labor supply, both at the extensive and intensive margin. In this paper, we decompose the overall elasticity of taxable income into an income shifting response as well as a real response.

To capture these two responses, we first adapt the theory developed in Devereux, et al. (2014), Piketty, et al. (2014), and Harju and Matikka (2016) to measure ETI when there are opportunities to shift income to other tax bases. While we use a static theoretical framework, income deferral is a dynamic process.[2] To address this issue, we used the approach in Hall and Liebman (2000) and Gorry et al. (2017) to measure total expected tax rates on current and deferred income for executives in each year. Using measured differences between the tax rates on current and future income allows us to estimate ETI and decompose the total elasticity into

[2] There are many motives for an individual to defer current year income. First, stock options allow the individual to avoid capital gains taxes on future returns. In addition, this gain could be greater if tax rates vary over time (generating an option value to realize income in low tax years) or are progressive (allowing the individual to shift income to years when the earn less).

real responses (reductions in total reported income due to a reduction in labor supply) and income shifting across tax bases and over time.

We then use data from COMPUSTAT to distinguish between these two effects. We find that in the specification that accounts for income shifting, the overall ETI is higher than in previous studies, and is estimated at 2.24. This estimate compares to an estimated elasticity of 0.80 for our sample when not accounting for income deferral. Decomposing this overall response, the income shifting response is estimated to be 1.93 and the real response only 0.31. In other words, much of the behavioral response to taxation comes from the income shifting response, rather than the real response.

Finally, we assess how our ETI estimates, which account for income shifting, change our understanding of the change in welfare from a change in the tax rate. Accounting for income shifting implies that the reduction in welfare from an increase in taxes is almost half the size of the reduction in welfare implied by ETI without accounting for income shifting, because some of the income shows up in later periods.

We are not the first to note that income shifting has implications for the welfare loss of taxation. Slemrod (1998) pointed out that if current revenue loss is made up for by tax revenues in future years then the deadweight loss associated with a particular elasticity of taxable income would be misleading. His suggested approach is to look at the present discounted value of government revenue to get a more comprehensive understanding of the effects of taxation. This idea has been further developed by Saez (2004) and Chetty (2009).

Income shifting responses have been documented in papers by Gordon and Slemrod (2000) and Devereux, et al. (2014). The focus of these papers has been the shifting of income across the corporate and personal tax bases in the United States and the United Kingdom, respectively.

Gordon and Slemrod (2000) show that following the Tax Reform Act of 1986, taxable income shifted out of the corporate sector and towards the individual sector. Devereux, et al. (2014) document the income shifting by small business owners from the corporate base to the personal tax base. Our paper studies income shifting across the current tax base and the deferred tax base. In other words, by shifting income to a different form, such as from salaries to stock options in the current period, individuals reduce their current tax base and defer taxation to a different time period. Therefore, by developing measures of current and future tax rates applicable to the current and future tax base, one can estimate the elasticity of taxable income in the presence of income shifting, using the static approach developed in Devereux, et al. (2014), Piketty, et al. (2014), and Harju and Matikka (2016).

Other papers that have estimated significant income shifting effects across tax bases and over time, using periods of tax reform to identify the behavioral response, are le Maire and Schjerning (2013), Kleven and Schultz (2014), Harju and Matikka (2016), Pirttilä and Selin (2011) and Kreiner, Leth-Petersen and Skov (2016). For the United States, Goolsbee (2000) shows that in anticipation of the 1993 tax hike, executives responded by realizing income in low-tax years through the exercising of options. Parcell (1995) and Sammartino and Weiner (1997) similarly document the large shift of taxable income into 1992 from 1993 in response to the tax hike on high income earners enacted in 1993. Kreiner, et al. (2016) also document intertemporal shifting of wage and salary income in response to a large tax reform in Denmark, which reduced the marginal tax rate on earnings from 63 percent to 56 percent between 2009 and 2010. They find that individuals in the 95th-99th percentile shifted 15 percent of their average monthly income to 2010, while for the top one percent of wage earners, the number was 30 percent.[3]

In Section 2, we describe a theoretical framework that separates the real responses from income shifting, and we describe our empirical specification that accounts for this income shifting by connecting this theoretical model to the empirical specifications in the existing ETI studies. In Section 3, we describe how to measure the total tax rates on current and deferred income and discuss the measured rates. Section 4 discusses the data that we use and presents our results. Section 5 concludes.

2. ETI and Income Shifting: Theoretical Foundation

This section applies the framework developed in Devereux et al. (2014), Piketty et al. (2014), and Harju and Matikka (2016) to measure the elasticity of taxable income when there are opportunities for executives to shift income to other tax bases. While income deferral is inherently dynamic, the static framework provides us with the key equations to estimate the taxable income elasticity if we can measure the expected tax rate on deferred income, τ_D. We consider measurement of this tax rate in the next section.

a. Basic Static Model of Income Shifting

[3] They suggest that this type of income shifting likely happened with the cooperation of the employer. Although this is not illegal in Denmark, such cooperation would be illegal in the United States.

We assume that there are two personal tax bases available for the individual. Total income earned in each year is given by $Y = Z + N$, where Z is taxable income and N is income that the individual defers to a future year. Deferral can occur using stock options or tax-deferred retirement accounts to move current income into the future. Let α be the share of income that the worker chooses to defer. We assume that the current tax rate for income earned is given by τ and the expected tax rate on deferred income is given by τ_D. Executives can legally shift income to future years with the use of stock options, and the expected tax gain of doing so will be measured by the difference in the tax rates: $\tau - \tau_D$.

Following Harju and Matikka (2016), we assume that the utility for individual i takes the following form:

$$u_i(c, Y, \alpha) = c - \theta_i(Y) - \phi_i(\alpha)\,, \tag{1}$$

where c is period consumption, θ_i is individual $i's$ disutility of earning income Y, and ϕ_i is individual $i's$ cost of deferring income to a future period. This cost could include time preference or any additional risk that such shifting entails. Individuals want to maximize their utility by choosing their income, consumption, and share of income to defer. Deferral in our setup can be thought of as the benefit of shifting income across tax bases net of any costs.

With this setup the individual budget constraint can be written as:

$$c = (1 - \tau)(1 - \alpha)Y + (1 - \tau_D)\alpha Y + R, \tag{2}$$

Here c captures the total value of after tax earnings where R is virtual income that adjusts income to account for non-linearity in the tax schedule – that is virtual income from paying lower rates on income taxed at less than the marginal rate under consideration. Substituting the budget constraint into the utility function implies that the individual chooses total income Y and the share of deferred income α to maximize utility. This problem generates the following first-order conditions:

$$(1-\tau)(1-\alpha)+(1-\tau_D)\alpha=\theta_i'(Y), \tag{3}$$

and

$$(\tau-\tau_D)Y=\phi_i'(\alpha). \tag{4}$$

Equation (3) gives the first-order condition with respect to income and states that marginal take home pay, given share α is deferred, is equal to the marginal disutility of earning additional income. Equation (4) is the first-order condition with respect to α and states that the tax gain from deferring income should equal the marginal cost of shifting additional income. Note that when $\alpha = 0$, the model reduces to the standard ETI framework for wage income, in which the ETI is a sufficient statistic for the cost of taxation.

Next, we can derive the elasticity of current taxable income in the presence of deferral. To do so, we follow Devereux, et al. (2014), and Piketty, et al. (2014), and Harju and Matikka (2016). For this exercise consider a change in τ given by $d\,\tau > 0$. Note that because the measured tax rate on deferred income depends on the current tax rates, we cannot hold τ_D fixed as done in previous papers. Traditionally, the elasticity of taxable income is defined as:

$$\epsilon_Z=\frac{1-\tau}{Z}\frac{\partial Z}{\partial(1-\tau)}\ . \tag{5}$$

To derive this elasticity, we first take the derivative of $\ln Z_{ti}$ with respect to the current tax price, which yields the following expression:

$$\frac{\partial Z_{ti}(1-\tau_{ti})}{\partial(1-\tau_{ti})Z_{ti}}=\epsilon_Y\frac{\partial(1-\tau_{ti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{ti})}+\epsilon_{1-\alpha}\left[\frac{\partial(1-\tau_{ti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{ti})}-\frac{\partial(1-\tau_{Dti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{Dti})}\right] \tag{6}$$

and

$$\epsilon_Z=\epsilon_Y+\epsilon_{1-\alpha}\left[1-\frac{\partial(1-\tau_{Dti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{Dti})}\right]. \tag{7}$$

This setup implies that the elasticity of taxable income can be separated into two separate components. First, ϵ_Y represents how much income changes in response to a change in the tax rate. Second, $\epsilon_{1-\alpha}$ denotes the elasticity of the wage tax base with respect to the net of tax rate, capturing the individual income shifting effect when the tax rate changes. These two elasticities combine to generate the overall behavioral response that has typically been measured in the empirical literature as ϵ_Z. Our equation (7) varies from the work of Harju and Matikka (2016), in which they derive ETI as simply the summation of ϵ_Y and $\epsilon_{1-\alpha}$. They can derive this specific relationship because their tax bases are taxable wage income and dividends. Hence, the tax on dividends is independent of the tax rate on wage income. With this independence, $\frac{\partial(1-\tau_{Dti})}{\partial(1-\tau_{ti})} = 0$, leaving $\epsilon_Z = \epsilon_Y + \epsilon_{1-\alpha}$. However, as measured in the following section, the deferred tax rate in our model is not independent of the current tax rate. Thus, the elasticity of taxable income is the combination of the real response of income to changes in the tax rate, the income shifting response, and the sensitivity of the deferred tax rate to changes in the current tax rate.

b. Welfare

Next, we consider the welfare implications of deferring income. Feldstein (1999) argues that the elasticity of taxable income is a sufficient statistic for understanding the excess burden of income taxation. However, Slemrod (1998) points out that the ability to shift income to different tax bases by realizing income in a different year means that estimated ETI can be misleading if revenues are made up in future years. Following Chetty (2009), who considers the case in which tax avoidance is costly and hence may influence the excess burden, this section calculates the marginal excess burden assuming government revenues are rebated lump sum to individuals. This implies that the marginal excess burden is defined by the behavioral response to taxation.

Again, following Harju and Matikka (2016), we denote welfare with the following equation:

$$\mathrm{w} = [(1-\tau)(1-\alpha)\mathrm{Y} + (1-\tau_{\mathrm{D}})\alpha Y - \theta_i(Y) - \phi_i(\alpha)] + (1-\alpha)Y\tau + \alpha Y\tau_D. \#(8)$$

The bracketed first term is individual utility, and the second and third terms represent government revenue from the income tax base and deferred income tax base respectively.

Now, we consider how a change in the current income tax rate, τ, influences welfare if we assume no income shifting. Because the individual is making optimal choices with respect to the tax rate, the envelope theorem applies to the individual's utility, so only the first- order effects from the tax change have any effect on welfare. This observation implies that the change in welfare from a change in the tax rate can be expressed as:

$$\frac{\partial w}{\partial \tau} = -Y\left[\frac{\tau}{(1-\tau)}\epsilon_Z\right]. \tag{9}$$

This expression is the marginal excess burden when there is no option to defer income, and the elasticity of taxable income is a sufficient statistic for the deadweight loss. However, when the individual has the option to defer income, the marginal excess burden also depends on the size of deferral elasticity, $\epsilon_{1-\alpha}$, the size of the real elasticity, ϵ_Y, (which differs from ϵ_Z when deferral is possible), the difference in the net of tax rates, $\tau_D - \tau$, the relative size of the tax bases, α, and the levels of each of the tax rates. We can express the change in welfare with income shifting as:

$$\frac{\partial w}{\partial \tau} = Y\frac{\partial(1-\alpha)}{\partial(1-\tau)}(\tau_D - \tau) - \frac{\partial Y}{\partial(1-\tau)}[(1-\alpha)\tau + \alpha\tau_D]. \tag{10}$$

To complete the derivation of the welfare equation from equation (10), we have to be able to define ϵ_{1-a}. Because $Z = Y(1-a)$:

$$\epsilon_Z = \frac{1-\tau}{Y}\frac{\partial Y}{\partial(1-\tau)} + \frac{1-\tau}{(1-\alpha)}\frac{\partial(1-\alpha)}{\partial(1-\tau)}, \tag{11}$$

or

$$\epsilon_Z = \epsilon_Y + \frac{1-\tau}{(1-\alpha)}\frac{\partial(1-\alpha)}{\partial(1-\tau)}. \qquad (12)$$

Combining equation (7) and equation (12), we get the following:

$$\epsilon_{1-\alpha} = \frac{\frac{1-\tau}{(1-\alpha)}\frac{\partial(1-\alpha)}{\partial(1-\tau)}}{\left[1-\frac{\partial(1-\tau_{Dti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{Dti})}\right]}. \qquad (13)$$

As before, if we assume that $\frac{\partial(1-\tau_{Dti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{Dti})}$ is small, then $\epsilon_{1-\alpha} \approx \frac{1-\tau}{(1-\alpha)}\frac{\partial(1-\alpha)}{\partial(1-\tau)}$. Using this, we can rewrite equation (10) as

$$\frac{\partial w}{\partial \tau} \approx -Y\left[\frac{(1-a)}{(1-\tau)}(\tau-\tau_D)\epsilon_{1-a} + \frac{[(1-a)\tau + a\tau_D]}{(1-\tau)}\epsilon_Y\right]. \qquad (14)$$

Thus, the size of $\epsilon_{1-\alpha}$ relative to the overall income elasticity determines how much of the elasticity is due to income shifting. The overall idea is that income shifting is costly from a welfare perspective only to the extent that there is a large difference between the tax rates in the two tax bases, $\tau - \tau_D$. If the tax rates are similar, shifting income only has a small welfare effect while larger differences will tend to leave the overall welfare cost closer to the estimated level without the possibility of shifting.

c. Empirical Specification

Finally, we develop our empirical specification to estimate the elasticity of taxable income as a combination of the real response to tax changes and the income shifting response. Based on the simple model we presented above, taxable income depends on the tax rate on current income and the potential tax savings from deferring income, which depends on the relative current and deferred tax prices.

$$\ln Z_{ti} = \epsilon_Y \ln(1-\tau_{ti}) + \epsilon_{1-\alpha}[\ln(1-\tau_{ti}) - \ln(1-\tau_{Dti})] + \ln \eta_{ti} + \ln \varepsilon_{ti} \,. \quad (15)$$

In this specification, η_{ti} is the individual's potential income in a world with no taxes.

By substituting equation (7) into equation (15), we obtain an alternative specification:

$$\ln Z_{ti} = \epsilon_Z \ln(1-\tau_{ti}) - \epsilon_{1-\alpha} \ln(1-\tau_{Dti}) + \psi\epsilon_{1-\alpha} \ln(1-\tau_{ti}) + \ln \eta_{ti} + \ln \varepsilon_{ti} \,, \quad (16)$$

Here $\psi = \left[\frac{\partial(1-\tau_{Dti})(1-\tau_{ti})}{\partial(1-\tau_{ti})(1-\tau_{Dti})}\right]$, which is the sensitivity of the deferred tax rate to changes in the current tax rate. We can then estimate an approximation of the elasticity of taxable income, ϵ_Z, which we call $\widehat{\epsilon_Z}$. As long as ψ is small, $\widehat{\epsilon_Z}$ is a valid approximation of ϵ_Z, and equation (16) can be written as:

$$\ln Z_{ti} = \widehat{\epsilon_Z} \ln(1-\tau_{ti}) - \widehat{\epsilon_{1-\alpha}} \ln(1-\tau_{Dti}) + \ln \eta_{ti} + \ln \widehat{\varepsilon_{ti}} \,, \quad (17)$$

where $\ln \widehat{\varepsilon_{ti}} = \ln\left[\varepsilon_{ti}(1-\tau_{ti})^{\psi\epsilon_{1-\alpha}}\right]$.

Equation (15) (and equation 17)) can be estimated by applying either a first difference or a fixed-effects approach and using firm-performance measures for η_{ti}. However, the decision of which model to use is subject to assumptions about how compensation changes. If the executive compensation error term in equation (15) follows a random walk, then a fixed-effects model would display autocorrelation, so that a first-differences model is more appropriate. If the basic approach to executive compensation is based on an already known value to the firm η_{ti}, with marginal deviations from this compensation base driven by performance, then a fixed-effects model would be appropriate, as first differences would introduce autocorrelation. In our empirical specification, we account for this possibility by estimating a fixed-effects model and clustering over year and executive firm dummy variables to control for possible autocorrelation.

In contrast to the standard ETI models, the first term in equation (15) allows us to estimate the real response to changes in the tax rate, while the second term in equation (15) allows us to estimate income shifting response, the elasticity of the compensation tax base with respect to the relative tax prices on current and deferred income. Finally, we can compare our elasticity of the real behavioral response with the elasticity estimated without income shifting to understand the importance of the option to defer income in altering the elasticity of taxable income.

3. Defining Current and Deferred Tax Rates

Estimating the elasticity of taxable income in the presence of income shifting requires us first to construct measures of the tax rates on current and deferred income. However, taxes paid on future income are not directly measured because taxation occurs in the future when income is realized. To address this issue, we apply a methodology based on the work of Hall and Liebman (2000) and Gorry, et al. (2017) to measure the tax gain to income deferral.

For our analysis, we consider the marginal pre-tax payment that the firm wants to make to the individual. Then, because the individual and firm can coordinate on the form of payment, it is important to consider the total tax implications for both the firm and individual when constructing appropriate tax rates. To construct our measure of taxes on current and deferred income, we assume that on the margin the individual will save the earned income over a period of n years and that the saved income will appreciate at the rate of return net of corporate taxes, $r(1-\tau_C)$. Finally, for our measure, we assume that tax rates are constant, so that expected taxes in the future are identical to the current tax rates.

With the assumptions outlined above, the tax rate on deferred income, τ_D, is the same as the current statutory marginal income tax rate, τ_p. All income, including the gains, are taxed as ordinary income.

Next, we need to construct the total tax rate paid on income earned in the current period. Because the individual is saving the marginal income over a n -year horizon, we account for both the taxes paid on the initial income in addition to the present value of any capital gains paid on the return. Moreover, the Omnibus Budget Reconciliation Act of 1993, Section 162(m) of the Internal Revenue Code, limits the deductibility of any non-performance-based compensation over $1 million. This limitation, often called the million-dollar rule, leads to variation among taxpayers with cash compensation over and under a million dollars. For taxpayers with current income less than $1 million, the tax rate on current income is given by:

$$\tau = \tau_p + \tau_{CG}\left(1 - \tau_p\right)\left[1 - \left(1 + r(1 - \tau_C)\right)^{-n}\right]. \tag{18}$$

Under Section 162(m), cash compensation over one million dollars is no longer deductible by the firm, so the worker faces an additional marginal burden from the corporate tax, τ_C. Hence, for executives who are subject to the million-dollar rule, the tax rate on current income is:

$$\tau = \tau_p + \tau_C + \tau_{CG}\left(1 - \tau_p\right)\left[1 - \left(1 + r(1 - \tau_C)\right)^{-n}\right]. \tag{19}$$

Figure 1 shows the average (mean) marginal current and deferred tax rates for executives in each year of our data.[4] As the deferred tax rate is the same for those above and below $1 million, there is a single deferred tax rate in each year. The current tax rate, τ, for those earning above a million dollars is significantly higher than the current tax rate for those earning below $1 million. Following the passage of Section 162(m) in 1993, as well as the tax hike in both personal and corporate income tax rates, there is a significant increase in current and deferred income tax rates. Thus, for earnings exceeding one million dollars, the incentive to defer income is higher for executives. It is also important to note that even for executives under the million-dollar threshold, the current tax rate is above the deferred tax rate because of the higher capital gains

[4] We describe the data used to construct these measures in more detail in the next section.

tax rate. This relationship implies that there is still a tax advantage to deferral for executives with compensation under $1 million, but the tax gain is much smaller when income is not subject to the million-dollar rule.

4. Empirical Analysis

a. Data

To estimate the real response to taxation as well as the income shifting response, we use data on executive compensation from the COMPUSTAT database for the period 1992-2005.[5] Accessed through the Wharton Research Data Services, the data maintained by Standard and Poor's in the Execucomp sub-database includes information on top executives' salary, bonus, option and stock awards, non-equity incentive plans, pensions, and other compensation items found on corporations' annual proxy statements.

Execucomp collects data on up to nine executives per firm per year, though most companies report data for only the top five executives. The executives are identified by name and individual identification variables. In addition, there is a unique executive-company variable, which links each executive to the specific company at which he or she worked in each year. Therefore, one can track executives and their compensation over time. Executives are an interesting group to study because they are the most likely to have the option to defer taxation by choosing

[5] One reason we stop our sample period in 2005 is that executive compensation began to be reported differently after 2005. In 2006, the Financial Accounting Standards Board established a new accounting standard which requires companies to value their employee stock options. Previously companies had a choice between expensing the options or disclosing the valuation. Only a few companies chose the expense method. FAS123R now requires companies to expense their stock options. In EXECUCOMP, this new FASB standard has led to a new format for reporting executive compensation, so that the old way of reporting data has been discontinued and information on old compensation formats is no longer being continued. (http://financialresearch.blog2blog.nl/Wharton/)

compensation in non-cash forms. Saez, Slemrod, and Giertz (2012) conclude that the behavioral response to changes in marginal tax rates is likely to be concentrated at the top of the income distribution, with less evidence of any response for the middle- and upper-middle-income individuals. Therefore, our paper re-estimates the ETI for this important group of individuals when their ability to shift income across years is explicitly accounted for.

Table 1 defines each of the variables that are used in our empirical analysis, and Table 2 provides summary statistics. We define the total income of executives in our data as the sum of salary, bonus, long-term incentive plans, options awarded, restricted stock grants, and all other annual income. Total income has more than doubled during our sample period. In real 1991 dollars, the average total compensation increased from an $866,987 in 1992 to $1,852,074 in 2005. There is also time-series variation in personal income tax rates over this period.

The tax rate for those with high incomes increased between 1992 and 1993. For those individuals reporting more than $140,000 and less than $250,000 in taxable income, the marginal rate went from 31 to 36 percent. For those earning more than $250,000, the rate rose from 31 percent to 39.6 percent. The next major change in federal tax rates accompanied the passage of the 2001 and 2003 tax acts, respectively. Tax cuts in these acts were gradually phased in and reduced the rate in the highest income tax bracket from 39.6 percent to 35 percent, and the rate on the second highest income bracket from 36 to 33 percent.

Aside from personal tax rates, our analysis shows that the capital gains tax rates are important in determining the tax advantage of deferring income. Moreover, the corporate tax rate affects the marginal tax rate facing an executive if their compensation is subject to the million-dollar rule. Capital gains tax rates have varied over time with a decrease in the tax rate from 28 percent to 20 percent in 1997. The capital gains tax rate was further decreased in 2003 to 15 percent. For firm marginal corporate tax rates, we use firm-specific corporate tax rates constructed by Graham (1996). In 1992, the maximum firm-specific corporate tax rate faced by a firm was below 35 percent. Since 1992, the top firm-specific corporate tax rate has ranged from 38 percent to 40 percent, significantly higher than the tax rate in 1992.[6] In our sample, about 35 percent of firms are missing a firm-specific corporate tax rate. To avoid dropping these observations, we apply the average firm corporate tax rate for each year to the observations with missing data.

We define taxable income as the sum of all cash compensation such as salary, bonus, LTIP and other income, as well as the value of options exercised. We define deferred income as the sum of the non-taxed components of an executive's compensation, such as stock option awards and restricted stock grants. Again, Table 2 provides summary statistics for each of these variables in addition to the individual components that make up the income variables.

Over the sample period, there was a substantial increase in the share of income that has been deferred. The share of options awarded increased from about 18 percent of total compensation in 1992 to 23 percent by 2005. There was an even larger increase in restricted stock grants, from 4 percent to 13 percent, over the same period. Figure 2 plots the share of deferred income, α, along with the share of salary in total compensation over the sample period. The share of deferred income begins at just above 20 percent and reaches a peak of just over 40 percent before declining slightly at the end of our sample. The grey areas mark the significant periods of tax reform, such as 1992 to 1993 and 2001 to 2003. As Figure 2 shows, without controlling for other factors, that following the tax hikes in the 1990s, there was an increase in the deferred income

[6] The statutory corporate tax rates (under current law) are 15 percent, then 25 percent, then 34 percent, then 39 percent, then 35 percent, then 38 percent, then 35 percent. The 39 and 38 percent rates occur because the federal corporate income tax imposes 5 percent and 3 percent surtaxes to eliminate the benefits of the progressive corporate tax schedule for firms with greater corporate taxable income. Graham (1996) does not include state corporate income taxes.

share and a decline in the salary share, but following the tax cuts of the 2000s, there is a slight decline in the share of deferred income.

b. Empirical Results

Because both the current tax rate and the deferred tax rate are endogenous, we estimate our model using two-stage least squares. Following the discussion in Section 3, the tax advantage to the executive and the firm of deferring taxation is the capital gains tax rate that is avoided in the future. Accordingly, the current tax rate (in present value terms) is the current personal income tax rate and capital gains taxes paid on the returns in subsequent years, as shown in equation (18). In addition, because cash compensation is subject to the Section 162(m) rule, our current tax rate includes the firm-specific corporate tax rate as described in equation (19). The deferred tax rate is simply the current personal marginal income tax rate.

Current tax rates are endogenous because higher taxable incomes can lead to higher personal income tax rates, we use as an instrumental variable the tax rate implied by the executive's permanent income. As in Goolsbee (2000), we calculate the permanent income tax rate as the personal income tax rate that would apply each year to the executive's mean *taxable* income across all years that an executive is in the sample (an executive's permanent taxable income).[7] We use this variable as an instrument for the current tax rate in each of our specifications. As an instrumental variable for the deferred tax rate, we apply the personal income tax rate in each year, but on average *total* income instead of taxable income as in Gorry et al. (2017). We do so

[7] We do not need to use an instrumental variable for the corporate or capital gains tax rate because those top rates are not endogenous in our model.

because the tax rate that could have been paid on the total compensation package had that compensation been entirely cash compensation is the relevant tax rate on deferred income.

Our specifications also include controls to account for the financial stability of a company as well as time trends. To control for variation across companies, we also control for a company's market value of its shares and the company's total value of assets. Finally, the regressions include executive fixed effects to account for differences across executives that may account for why some executives are paid more than others. We use robust standard errors that are clustered both by year and by firm-executive pair.

Table 3 presents our main results. In estimating income elasticities, the dependent variable in each specification is the log of real taxable income. All results are two-stage least squares where the tax rate on permanent income is used as an instrument, as in Goolsbee (2000). Column 1 reports the elasticity of taxable income for the standard specification that does not account for income shifting and where the independent variable is the individual tax price based on current federal tax rates. This specification is similar to Goolsbee (2000). Our estimated elasticity is 1.07, which is close to the short-run elasticity estimated by Goolsbee (2000). Note that while the central elasticity estimate in the existing research is considered closer to 0.5 (see, for example, Gruber and Saez (2002)), our focus on highly paid executives generates a higher elasticity that is consistent with some past studies. Therefore, our estimated elasticity is, not surprisingly, higher than that estimated, on average, in previous research.[8] This difference suggests that there is a large behavioral response of reported taxable incomes to the marginal tax rate among top executives.

In Column 2, we take the same approach as the first column, but we use our measured tax rate on current income as the independent variable instead of the marginal personal income tax

[8] In a recent paper, Weber (2014) suggests that the central elasticity estimate is 0.85.

rate used in typical estimates of the ETI. The measured tax rate on current income depends on the capital gains tax rate and the firm-specific corporate tax rate for some individuals in addition to the personal tax rate. We use the personal tax rate applicable to the executive's permanent income as an instrument for the current tax rate because the endogeneity concern is specific to the executive's personal income tax rate, and not to the corporate tax rate or the capital gains tax rate. With this specification, we still estimate a significant and positive elasticity with a coefficient of 0.81.

In Column 3, we also include the negative logged tax price of deferred income, consistent with equation (17). In this specification, the estimated elasticity of current taxable income with respect to the deferral tax price is 1.9, but it is only statistically significantly different from zero at the 10 percent level. In this specification, the coefficient on the instrumented current tax price is now higher with a magnitude of 2.2 and still statistically significantly different from zero at the 1 percent level. Harju and Matikka (2016) note in this specification, the coefficient on the current tax price still has the traditional elasticity interpretation. In other words, it measures the total behavioral response to tax changes, capturing the combination of both the real and the income shifting responses.

In the fourth specification, we replicate the third specification, but we include the relative current and deferred tax prices rather than simply adding the deferred tax rate. This specification arises from our theory that motivates ϵ_Y and $\epsilon_{1-\alpha}$. Note that ϵ_Y is simply the difference between the two coefficients in the previous specification, and we find that it is not estimated precisely. Now, the own current tax price elasticity captures the real response, while the tax price differential captures the income shifting response. In this specification, the estimated own tax price elasticity is still positive, but not statistically significantly different from zero. However, the income-shifting response is significant at the 10 percent level as in the previous specification. The estimated coefficient on the instrumented differential tax prices is negative and statistically significantly different from zero, suggesting that income shifting is a significant factor and that the relative tax advantage to deferring taxation significantly influences the choice of how much income to report as current taxable income. As discussed in Section 2, this specification can be viewed as a decomposition of the total behavioral response from tax changes, the estimate of which was statistically significantly different from zero at the one percent level, as the third column shows.

We also control for rates of return on the firm stock, capital gains taxes, and firm-specific corporate tax rates independently of the constructed tax variables.[9] The main results remain similar in the presence of these additional controls, with the estimated coefficient on the deferred tax rate reduced to 1.46 and the estimated coefficient on the current tax rate at 0.59.

c. Welfare Implications

To put these results in context, we now evaluate the welfare implications associated with our estimated elasticities using the formulas developed in Section 2. To understand the results and control for variation over time, we consider how the elasticities would predict welfare in 2005, the last year in our sample. To compute welfare, equation (9) considers the conventional case without income shifting, while equation (14) computes welfare when income shifting is considered. To compute welfare from equation (14), in addition to the estimated elasticities, we need information on the current tax rate, τ, the deferred tax rate, τ_D, and the share of income deferred by an individual, α. By contrast, the standard welfare equation only uses the estimated

[9] We do not report these estimates here.

elasticity and the tax rate. For all welfare calculations in this section, we set the income variable $Y = 1$, which is equivalent to computing the change in welfare as a fraction of total income earned in a year. This assumption provides a rough sense of magnitudes independent of income and implies that the welfare calculations can be interpreted as being at the margin rather than over the entire range of income earned.

To obtain a sense of the magnitudes of different variables in 2005, Table 4 reports average values of the tax rates and the share of income deferred from our sample. Note that for an individual in the top tax bracket of 35 percent in that year, we would calculate of tax rate on deferred income of 0.35 and a tax rate on current income of 0.377 if their taxable income was below one million dollars and 0.566 if above. The tables show that for all executives, the deferred tax rate is slightly lower than 0.35, indicating that some individuals in our sample are not in the top tax bracket. The average tax rate on current income is in between the numbers for those who have above and below $1 million in taxable income.

The final three columns of Table 4 show results for different subgroups. First, we consider individuals with total income under $1 million who would not be subject to the million-dollar rule even if all of their income was taxed in the current period. Second, we consider individuals with taxable income over $1 million, who are all subject to the million-dollar rule. Finally, we consider the individuals with total income over $1 million and taxable income under $1 million. We find that the average amount of income deferred increases as we move across the three groups. The first group has a standard incentive to defer. The group with taxable income over $1 million has a strong incentive to defer, but may not be able to avoid the million-dollar rule fully because of other costs. The final group is one that fully avoids the million-dollar rule by deferring a large percentage of income.

To explore the welfare implications of income shifting we first consider some computed examples using statutory tax rates from 2005. For all calculations, we take the income elasticities used for the case of income shifting from column (4) and the elasticity for no income shifting from column (2) of Table 3, so that both elasticities reflect the same tax rates on current income. Essentially, we compare how the change in welfare with a change in tax rates differs with our estimated elasticities with income shifting from what one may have thought given traditional estimates without income shifting. We report the results from our hypothetical examples in Table 5. The first column reports calculations using the average α for all executives, when the current income is not subject to the million-dollar rule. Recall that in computing $\frac{\partial w}{\partial \tau}$, we set $Y = 1,$ so that results can be interpreted as the change in welfare over total income. Here, the change in welfare is -0.238 with income shifting and -0.484 without income shifting. Accounting for shifting reduces the implied change in deadweight loss from taxation almost in half. The remaining two columns compare results for the groups with total income under $1 million and total income over $1 million. The group with total income under $1 million just changes the hypothetical value of α to 0.224, so the results are very similar. For the group with taxable income over $1 million, the current tax rate is higher, generating larger welfare effects. The welfare numbers are not much different when accounting for shifting as these individuals do not shift enough income to avoid the high tax rates.

Finally, Table 6 explores the distribution of estimated welfare changes for individuals in our sample in 2005. Given that we can calculate the share of income that each individual defers and have different marginal tax rates for each individual in the sample, we can calculate the implied welfare effect for each individual in our sample. With our panel data, we just focus on the distribution in 2005, so that we avoid issues of having multiple observations per individual.

Table 6 reports the mean welfare, the values at various percentiles in the distribution, and the standard deviation of values. We compute the welfare equations with elasticities from income shifting in the left panel and without income shifting in the right panel.

The mean welfare change in the full sample is -0.777 with income shifting, compared with -0.905 for estimates for which income shifting is not accounted for. While this reduction is much smaller than in the hypothetical example, the median values are similar to those in the example with the welfare cost being about half the size when income shifting is accounted for. The distributional table shows that with income shifting, the top of the distribution has *larger* welfare changes than the group without income shifting. This effect arises for individuals who have taxable income over $1 million, yet still have low values of α. In each group, there is very little variation in computed tax rates, so the distributional effects arise as different individuals have different rates of deferral. For individuals facing high current tax rates who do not defer much income, welfare costs can be higher than those computed due to having higher overall elasticities in the estimates.

4. Conclusion

Estimating the elasticity of taxable income is crucial for understanding the welfare costs of taxation. Most estimates of this elasticity for individuals have focused on a static environment in which individuals do not have the ability to defer income. However, for many executives, an important subset of high-income taxpayers, the growing use of stock options means that deferred income has become a much more prominent feature of compensation for high-income individuals. Generally, the failure to account for deferred income implies that estimates of the

ETI overstate the welfare consequences of personal income taxation, as deferred income generates tax revenue when it is realized in the future. When accounting for income shifting, we find a much larger overall response, but that most of the response is due to income shifting rather than real behavioral changes. Overall, our paper finds that the change in deadweight loss in response to a change in taxes is nearly half as large when income shifting is accounted for.

At the time of writing this paper, the Tax Cuts and Jobs Act has been passed, which removes the exemption for incentive based pay under the old Section 162 (m) effective as of December 31, 2017. The new rule extends the $1 million deduction limit to all pay, including stock options, severance benefits and deferred compensation. Over the course of the next several years, it will be interesting to document the implications of this change on the form of executive compensation, given that firms no longer have a tax advantage to paying out compensation as stock options, while executives can still benefit from the option of being able to defer income, and taxation.

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Figure 1

Average Annual Current and Deferred Tax Rates For Executives Earning Above or Below $1 Million Dollars in Salary and Bonus

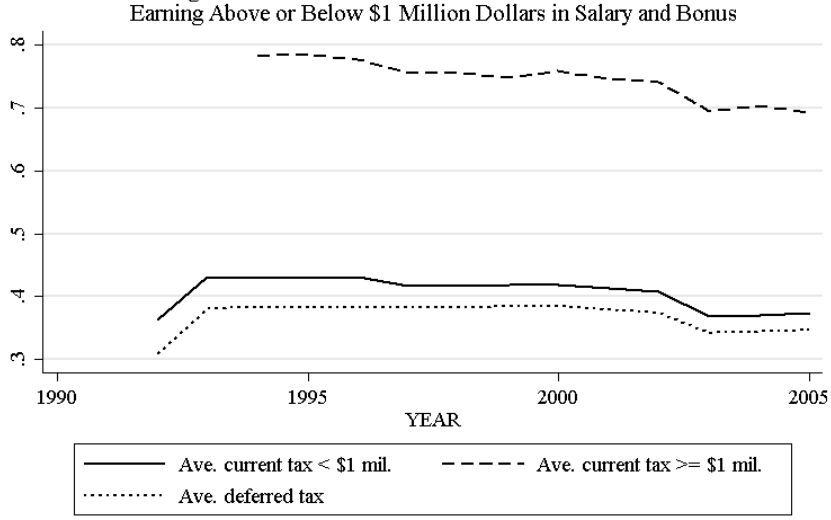

Figure 2

Share of Salary and Deferred Income Awarded out of Total Income

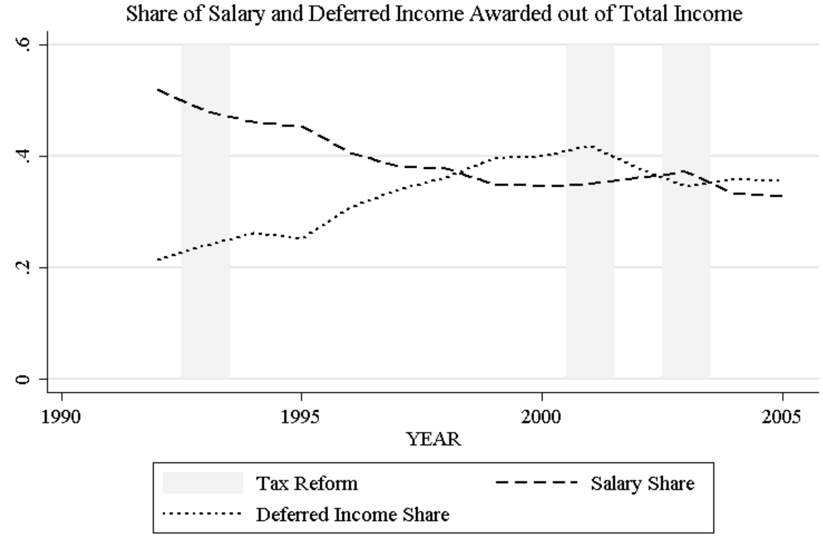

Table 1: Definition of variables

Name	Definition
ytax	Real taxable income
ydef	Real deferred income
α	Share of deferred income
τ_D	Calculated tax rate on deferred income
τ_p	Federal marginal tax rate on taxable income
τ	Calculated marginal tax rate on current income
τ_C	Firm-specific corporate tax rate
τ_{CG}	Capital gains tax rate
ρ	Federal marginal tax rate on permanent income
θ	Top federal marginal tax rate within a year
Mkt. Value	Market value of shares
Assets	Total assets

Table 2: Summary Statistics

	Observations	Mean	Standard Deviation	Min	Max
Real total income	77,968	1,601,486	3,775,331	-0.08	232,000,000
Current tax rate	91,142	0.46	0.12	0.14	0.82
Deferred tax rate	91,142	0.37	0.03	0.10	0.40
Tax rate on permanent total income	91,177	0.38	0.03	0.10	0.40
Tax rate on permanent taxable income	91,226	0.38	0.03	0.10	0.40
Corporate tax rate	91,294	0.31	0.07	0.00	0.39
Capital gains tax rate	91,294	0.22	0.05	0.15	0.28
Real taxable income	91,294	1,137,059	3,569,377	-0.08	206,000,000
Deferred income	91,294	744,428	3,020,451	0.00	230,000,000
Real salary	91,294	279,666.60	195,559.10	-0.08	5,202,671
Real bonus	91,294	252,232.70	672,173.70	-0.76	88,600,000
Real LTIP	91,294	72,478.89	502,415.30	0.00	62,800,000
Real options exercised	91,294	511,311.30	3,215,232	-76,815.73	202,000,000
Real restricted grants	91,294	136,002.60	716,429.70	0.00	38,500,000
Real options (Black-Scholes value)	91,294	608,425.60	2,832,007	0.00	230,000,000

Notes: The data are from 1992-2005. All dollar values are in real 1991 dollars.

Table 3: Regression Results

Dependent variable: logarithm of real taxable income

	(1)	(2)	(3)	(4)
$\log(1-\tau_p)$	1.071***			
	(0.312)			
$-\log(1-\tau_D)$			1.927*	
			(1.126)	
$\log(1-\tau)$		0.801***	2.241***	0.313
		(0.250)	(0.860)	(0.448)
$\log(1-\tau) - \log(1-\tau_D)$				1.927*
				(1.126)
$\log(MktVal)$	0.402***	0.441***	0.513***	0.513***
	(0.024)	(0.028)	(0.055)	(0.055)
$\log(Assets)$	0.028	0.012	-0.017	-0.017
	(0.045)	(0.047)	(0.057)	(0.057)
Time	0.091***	0.109***	0.142***	0.142***
	(0.005)	(0.010)	(0.022)	(0.022)
Company-Executive FE	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
Observations	87,728	87,728	87,683	87,683
Number of clusters	17,472	17,472	17,453	17,453

Notes:

1. τ is the marginal current tax rate based on authors' calculations. All results use the permanent income tax rate on taxable income as an instrument for the current tax rate. The permanent income tax rate on taxable income is the tax rate applied to the average taxable income across an executive's career at a firm.
2. τ_p is the marginal income tax rate. All results use the permanent income tax rate on taxable income as an instrument for the current tax rate.
3. τ_D is the deferred tax rate defined as the federal marginal tax rate applicable to taxable income. All results use the permanent income tax rate on total income as an instrument for the difference between the deferred tax price and the current tax price.
4. τ_{CG} is the capital gains tax rate and τ_C is the firm-specific corporate tax rate. Return is the company's stock return on its common stock.
5. We present fixed-effects estimates with robust standard errors clustered by individual/company and year. These results are from a 2SLS estimation that instruments for the current and deferred tax rates. All specifications include a constant term.

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.

Table 4: Summary Statistics for 2005 Taxes and Income Shifting

	All Executives	Total Income under \$1 million	Taxable Income over \$1 million	Taxable Income under \$1 million, Total Income over \$1 million
τ	0.470	0.371	0.566	0.375
τ_D	0.346	0.342	0.350	0.346
α	0.355	0.224	0.380	0.553
Obs	5,288	2,028	2,687	832

Table 5: Hypothetical Welfare Results

	All Executives	Total Income under \$1 million	Taxable Income over \$1 million
τ	0.377	0.377	0.566
τ_D	0.35	0.35	0.35
α	0.355	0.224	0.38
Change in welfare with income shifting	-0.238	-0.250	-0.943
Change in welfare without income shifting	-0.484	-0.484	-1.043

Notes:
1. To control for changes in tax law, all results shown are for 2005.
2. The relevant tax rates are calculated using 2005 tax rates, with a personal marginal tax rate of 35%, a corporate tax rate of 35%, and a capital gains tax rate of 15%. The present value of the capital gains taxes are calculated using n=10 and r=0.05. DWL with income shifting is calculated based on equation (14), with elasticity values from column (4), Table 4. DWL without income shifting is calculated based on equation (9), with the elasticity value from column (2), Table 4. The deadweight loss reported is the unit (per dollar of income) deadweight loss at the margin.

Table 6: Distribution of Change in Welfare Losses from Sample in 2005

	Change in Welfare with Income Shifting				Change in Welfare with no Income Shifting			
	All Executives	Total Income under $1 million	Taxable Income over $1 million	Taxable Income under $1 million, Total Income over $1 million	All Executives	Total Income under $1 million	Taxable Income over $1 million	Taxable Income under $1 million, Total Income over $1 million
Mean	-0.777	-0.251	-1.295	-0.220	-0.905	-0.473	-1.325	-0.480
5th Percentile	-0.199	-0.206	-0.207	-0.185	-0.446	-0.445	-0.484	-0.449
25th Percentile	-0.228	-0.234	-0.245	-0.205	-0.484	-0.466	-0.487	-0.484
Median	-0.258	-0.252	-1.199	-0.219	-0.487	-0.484	-1.728	-0.484
75th Percentile	-1.240	-0.272	-2.165	-0.234	-1.728	-0.487	-2.129	-0.487
95th Percentile	-2.821	-0.296	-3.490	-0.262	-2.130	-0.500	-2.145	-0.500
SD	0.935	0.028	1.083	0.026	0.687	0.038	0.756	0.031

Notes:
1. To controlf for changes in tax law, all results shown are for 2005.
2. The values in the first column are for all executives in 2005. The values in the second column are for those with total income below $1 million in 2005, who would not be subject to the additional burden imposed by Section 162(m). The values in the third column are for those with taxable current income above $1 million in 2005, who would certainly be subject to the marginal burden from Section 162(m).
3. Panel A reports the number of observations in each group, as well as the average current tax rate, deferred tax rate, and deferred income share for each group.
4. Panels B and C report the summary statistics of deadweight losses among individuals within each group.The calculation with income shifting uses Equation 11 and the elasticity values for $\in_Y$ and $\in_{1-\alpha}$ are based on the results found in column (4), Table 4. The calculation without income shifting uses Equation 9 and the elasticity value for $\in_Z$ based on the results found in column (2),Table 4. The deadweight loss reported is the unit marginal deadweight loss, calculated using equations (9) and (14) divided by total income.