TAXES, CAPITAL STRUCTURE CHOICES, AND FIRM VALUE

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ABSTRACT

We use a multitude of reforms across 29 OECD countries from 1981 through 2009, which affected statutory corporate or personal tax rates, as natural experiments to estimate the market value of the tax benefits of debt financing. We report time-series evidence that tax reforms are followed by large changes in firm value. However, the impact of tax reforms on value is greatly mitigated by the presence of leverage. Consistent with a tax story, the value of debt tax savings is greater among top tax payers, highly profitable firms, and in countries where tax laws are more strongly enforced. The results are robust to a battery of endogeneity tests.

JEL Classifications: G3; G32; F3

Keywords: Taxes; Capital structure choices; Firm value

Acknowledgements: We thank Najah Attig, John Graham, Kate Holland, Yeejin Jang, E. Han Kim, Vikram Nanda, Bill O'Brien, Abraham Ravid, and seminar participants at the NBER 2014 Summer Institute, the 2014 Conference on Financial Economics and Accounting at Georgia State University, the 2015 American Finance Association meetings, Aalto University, the Hanken School of Economics, Penn State, Purdue University, Saint Mary's University (Halifax), the University of Illinois at Chicago, and Virginia Tech for comments.

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The Modigliani and Miller (1963) model of capital structure has formed the basis of Finance pedagogy for over half a century. Despite this, the actual magnitude of the tax benefits of debt financing has long been the topic of considerable theoretical and empirical dispute.[1] According to Fama (2011), currently, "[T]he big open challenge in corporate finance is to produce evidence on how taxes affect market values and thus optimal financing decisions" (p. 8).

In this paper, we respond to this challenge. We exploit tax reforms affecting statutory corporate or personal tax rates in the OECD countries to directly estimate the market value attached to the tax benefits of debt financing. The sample comprises over 300 reforms affecting corporate and/or personal tax rates across 29 OECD countries and spanning more than three decades.[2] A major benefit of our approach (which differentiates us from most prior studies) is that we isolate shocks directly affecting the tax benefits of debt financing. This allows us to attach a clear tax interpretation to our results.

We document that the impact of tax reforms on value is mitigated by the presence of leverage. For example, in the presence of leverage, the positive value impact of a reform reducing the corporate tax rate is in part offset by a decline in the present value of debt tax shields. Importantly, we find that the mitigating effect of leverage on the effect of tax changes on firm value is economically large. In support of a tax interpretation of our results, we document that debt tax shields are more valuable for firms subject to a higher effective tax rate and for

[1] Empirical work includes Masulis (1980); McConnell and Schlarbaum (1981); Bradley, Jarrell, and Kim (1984); Fama and French (1998); and Graham (2000). Theoretical studies include Miller (1977), DeAngelo and Masulis (1980), and Green and Hollifield (2003), to cite a few. Extensions of those studies include Dotan and Ravid (1985) and Dammon and Senbet (1988). The latter two studies investigate how taxes, leverage, and investment interact.

[2] Some of these reforms occur at the local level, in which case the tax rate changes are small. Although we include all tax changes in the main analyses, we also examine large tax reforms in later tests.

more profitable firms. We further document that debt tax shields are less valuable in countries with high levels of tax evasion and in countries whose laws enable more stealing by insiders. In contrast, debt tax shields are more valuable in countries with low levels of tax evasion and in countries where stealing by insiders is relatively more difficult.

Our main tests use change regressions specifications. Those regressions include an array of variables to control for the impact of tax reforms on capital structure decisions, investments, factor demand and growth, and, ultimately, future expected cash flows. We take several additional steps to mitigate endogeneity concerns.

First, we include country-year fixed effects to control for unobserved shocks that might coincide with tax reforms and similarly affect all firms in a given country at a given point in time. Thus, in our models identification comes from the differential response to a given tax reform as a function of a firm's leverage ratio.

Second, we include interactions between the changes in the tax rates and each of our control variables. These interactions mitigate the concern that tax changes might affect firms through a channel other than leverage (such as firm-level investment and growth).

Third, we show that the results are robust to using a *narrow* event window in an event study setting. By narrowing the window around which value changes are measured, we are able to filter out a number of possible non-tax related events. This mitigates the possibility that the results might be due to events (other than the tax reforms) that affect firms through a leverage channel. We also show that the results are not driven by the specific methodology employed, nor do they appear to be driven by possible biases in the estimation process.

While we study a simple question in this paper, our results are especially important to the corporate finance literature. Perhaps of greatest importance is the economic magnitude of the

documented benefits associated with debt tax shields. In particular, we find evidence that following a negative δT_c (i.e., a cut in the corporate tax rate), the value of $1 of debt declines by approximately $\$1 \cdot \delta T_c$.

Our paper also relates to recent studies that estimate the benefits of debt financing. In a seminal paper, Graham (2000) simulates the benefit functions of interest tax deductibility and employs those to estimate the tax savings associated with each incremental dollar of interest payments. He estimates a *tax* benefit of debt financing of approximately 7% to 10% of firm value, depending on whether personal taxes are considered. (He notes that a "traditional approach" instead yields an estimate equal to 13% of firm value.) Van Binsbergen, Graham, and Yang (2010) focus on firms that appear to be optimally levered to estimate the benefit and cost of debt functions for individual firms.[3] They estimate the *net* (of debt costs) benefit of debt to be on average around 3.5% of firm value. Using a different approach based on an extension of Modigliani and Miller (1958), Korteweg (2010) estimates the net benefits of debt to be 5.5% of firm value for the median firm. Thus, as summarized by Graham and Leary (2011), the more recent evidence suggests that capital structure choices appear to have only a modest impact on firm value for many firms. Using yet another approach based on shocks to the tax rates induced by tax reforms, we find the tax benefits of debt financing to be sizeable.

Our paper is also closely related to a study by Doidge and Dyck (2013), who focus on a reform that eliminated the tax benefits given to Canadian income trusts. (Prior to the reform, Canadian income trusts could avoid the payment of corporate taxes.) These authors document that income trusts using tax shields were affected less by the reform. Unlike our study, theirs

[3] Costs of debt include the costs of financial distress, debt overhang, and agency costs. These costs diminish the *net* benefit of debt financing.

focuses on a single reform affecting only Canadian income trusts. It is therefore not obvious whether their results generalize to other tax reforms.

Our paper is also related to studies of how corporations change their capital structure in response to tax reforms (Campello (2001); Desai, Foley, and Hines (2004); Givoly, Hahn, Ofer, and Sarig (1992); Gordon and MacKie-Mason (1991); Rajan and Zingales (1995); and Twite (2001)). In two recent studies, Faccio and Xu (2013) and Heider and Ljungqvist (2014) provide evidence that firms substantially rebalance their capital structure in response to tax reforms both internationally and across U.S. states. However, Bargeron, Denis, and Lehn (2014), who look at the introduction of corporate and individual taxes in the U.S. in the early 1900s, find little evidence of taxes as a primary determinant of capital structure choices. In this paper we investigate whether there appears to be a *value* to adjusting leverage in response to tax reforms.

The rest of the paper is organized as follows. Section 1 describes the empirical approach and the data. Section 2 presents the main results. Section 3 documents that the tax benefits of debt financing are more valuable for top tax payers. Section 4 presents the event study results and Section 5 presents the propensity score results. Section 6 discusses the economic magnitude of the results. Section 7 presents a number of robustness tests. Section 8 concludes.

1. Identification Strategy and Data

1.1. Identification Strategy

The starting point of our empirical approach is the observation that the market value of a leveraged firm (V_L) can be decomposed into (1) the market value of an unleveraged firm, (2) the present value of the tax gains (or losses) from leverage, and (3) the present value of other benefits and costs of debt. The market value of the unleveraged firm is equal to the present value

of its unleveraged expected cash flows ($E(OCF)$), net of the theoretical corporate taxes on those cash flows, discounted at the all-equity cost of capital. The tax gains (or losses) from leverage reflect the deductibility of interest payments from taxable income at the corporate level and the taxation of income from debt and/or equity at the personal level. In Miller (1977), for example, the tax gains (or losses) from a perpetual amount of debt, *D*, are equal to $D \cdot \left[1 - \frac{(1-T_C)\cdot(1-T_E)}{(1-T_D)}\right]$. ($T_C$ is the corporate (income) tax rate, T_E is the personal tax rate on income from equity, and T_D is the personal tax rate on interest income). Other benefits of debt include managerial commitment to operating efficiency, and monitoring by lenders. The other costs include financial distress costs, agency costs, and debt overhang.[4]

Within this framework, a change in the corporate tax rate (δT_C) is expected to impact firm value because it affects (1) the (after-tax) value of the unleveraged firm and (2) the value of the tax gains from leverage. A change in the personal tax rate on income from equity (δT_E) or debt (δT_D) is also expected to affect the value of the tax gains from leverage. The expected impact of tax rate changes on value varies across firms as a function of the level of outstanding debt. For example, *ceteris paribus*, while a tax increase results in a drop in firm value, this effect is expected to be less pronounced for highly-leveraged firms, as those firms are able to shield more income from corporate taxes.[5]

[4] Notice that the other benefits and/or costs of debt change around a tax reform only (1) if firms rebalance their capital structure and/or (2) if tax reforms overlap with other reforms (e.g., bankruptcy or governance reforms) that affect value through a leverage channel. Focusing on a narrow event window later in the paper enables us to filter out these contaminating events.

[5] Consider two firms with the same operating income of $100. (Assume for simplicity that $T_E = T_D$). Firm A is unleveraged. Firm B, which is leveraged, pays annual interests of $100, which are tax-deductible. If the corporate tax rate is 10%, firm A pays $10 (10% of its taxable income of $100) in corporate income taxes, while firm B pays $0. If the corporate tax rate increases to 50%, *ceteris paribus*, firm A pays income taxes of $50, while firm B pays no income taxes. As such, the value of the unleveraged firm should drop more than the value of a highly-leveraged firm.

With this in mind, the backbones of the basic regression models that we test are the following:

$$\frac{\delta V_L}{A} = \alpha + \beta \cdot \delta T_C \cdot \frac{E(OCF)}{A} + \gamma_1 \cdot \delta T_C \cdot \frac{D}{A} + \varepsilon \qquad (1)$$

$$\frac{\delta V_L}{A} = \alpha + \beta \cdot \delta T_C \cdot \frac{E(OCF)}{A} + \gamma_1 \cdot \delta T_C \cdot \frac{D}{A} + \gamma_2 \cdot \delta T_D \cdot \frac{D}{A} + \gamma_3 \cdot \delta T_E \cdot \frac{D}{A} + \varepsilon \qquad (2)$$

The only difference between the two models is whether personal taxes are considered. The following are expected to hold: (1) $\beta<0$, (2) $\gamma_1>0$, (3) $\gamma_2<0$, and (4) $\gamma_3>0$. Using δV_L as the dependent variable is potentially problematic, as the results would likely be dominated by the largest firms in the sample. To deal with this problem, we scale both the dependent and the independent variables by lagged total assets, *A*.

Following Equations (1) and (2), we estimate the market value of interest tax shields using change regression specifications. In those specifications, annual changes in value are regressed on contemporaneous changes in tax rates, interacted with the degree of leverage at the beginning of the year, along with several firm-level control variables. The inclusion of firm-level controls accounts for the fact that we rely on a relatively simple valuation model. While in our specifications we use (current) earnings before interest and taxes (divided by lagged total assets) to proxy for expected cash flows, we recognize that tax reforms might affect future cash flows through a growth channel. For example, following a tax reducing reform, firms might have greater incentives to invest; as a consequence, their earnings would subsequently increase. Therefore, we use an array of variables (e.g., changes in earnings, changes in property, plant and equipment, changes in R&D expenses, etc.) to capture the impact of reforms on future investments and expected cash flows. (These controls are described in Section 1.2).

Further, to the extent that the tax benefits of debt financing are indeed valuable, we would expect leverage to change in response to tax reforms. Indeed, Faccio and Xu (2013) and Heider and Ljungqvist (2014) provide evidence that firms rebalance their capital structure following tax reforms. (Presumably, firms change their capital structure up to the point where the *new* marginal tax benefits of debt financing equal the marginal costs.) Therefore, in all models we control for changes in leverage that occur (possibly) in response to tax reforms.

Our identification strategy relies on the assumptions that (1) no event other than the tax rate changes that we focus on generates the different changes in value that we observe across firms with different leverage, and (2) the change in value indeed occurs through a leverage channel. We undertake several steps to minimize possible concerns with this identification strategy.

First, we include country-year fixed effects to control for any country-level observable and unobservable shocks that might correlate with the tax reforms and similarly affect the value of all firms in a given country. Second, we include interactions between the changes in tax rates and each of our control variables. Generally speaking, these interactions control for the possibility that the tax reforms might affect different firms differently. More importantly, these interactions control for the possibility that tax changes might affect firms through a channel other than leverage. Third, we show later in the paper that the results are also robust to using a *narrow* event window in an event study setting. By narrowing the window around which value changes are measured, we filter out a number of possible non-tax related events and further mitigate the possibility that the results might be due to events (other than the tax reforms) that might affect firms through a leverage channel. A benefit of this approach is that it does not require us to

compile a comprehensive list of all possible value-relevant events that could contaminate our results. (Compiling such a list would be quite a formidable task.)

In all specifications, standard errors are double clustered at the country-year level and firm level. Clustering at the country-year level accounts for the correlation in the responses of different firms to each given tax reform, and clustering at the firm level accounts for serial correlation.

1.2. Data

Tax data come from Faccio and Xu (2013). As a starting point, we employ the OECD's *Tax Database* and the World Bank's *World Development Indicators* to obtain data on corporate and personal tax rates. We verify and supplement those data with news articles from *Factiva*, email exchanges with foreign tax authorities, countries' official websites and other country-specific data sources, Deloitte's, KPMG's and PricewaterhouseCoopers's tax reports, the University of Michigan's *World Tax Database*, and Worldwide-Tax.com. These searches yield data for a sample of 29 OECD countries and cover the 29-year period spanning from 1981 through 2009. (The sample period varies across countries depending on data availability).

Corporate Tax Change (δT_c) is the annual change in the top marginal statutory corporate income tax rate. This variable includes national and regional corporate income taxes. *Interest Tax Change* (δT_D) is the annual change in the highest marginal tax rate applied to residents' personal interest income from corporate bonds. *Dividend Tax Change* (δT_E) is the annual change in the net top statutory tax rate on dividend income to be paid at the shareholder level. This variable takes into account any gross-up provisions and reliefs available at the shareholder level.

The sample contains 190 changes in corporate tax rates, 103 changes in the personal tax rates on interest income, and 205 changes in the personal tax rates on dividend income. These reforms span across 307 unique country-years, as there are a number of instances in which multiple types of tax rates change at the same time in a given country. This leaves a sample of 252 country/years in which no tax rate change occurs.

The sample includes 137 tax rate changes equal to or greater than 500 basis points. Of those larger tax reforms, 32 involve changes in the corporate tax rates, 42 involve changes in the personal tax rates on interest income, and 63 involve changes in the personal tax rates on dividend income. These larger reforms are fairly evenly distributed across countries, with the exceptions of Mexico and New Zealand, each of which accounts for more than 10 large (mostly personal tax) reforms. Tax reforms are also fairly evenly distributed through time, with the exception of 1987-1988, in which we again observe more than 10 large reforms. We check and confirm that our results are robust to excluding those countries and years. Overall, there appears to be a sufficient degree of identifying variation in tax rate changes, both across and within countries and through time.

Firm-level data are taken from *Worldscope* and *Datastream*. Throughout the paper, financial companies (SIC codes: 6***) and regulated utilities (SIC codes: 49**) are excluded from the analyses. With the exception of Section 4, all analyses use the change in the market value of assets, net of capital issuance ($dVni_t/A_{t-1}$) as a measure of the change in firm value ($\delta V_L/A$). $dVni_t/A_{t-1}$ is computed as the annual change in the market value of equity minus the annual change in the book value of equity (which captures net equity issuances), all divided by lagged book assets.

We are unable to control for changes in the market value of outstanding debt, as most firm debt is not publicly traded. This prevents us from using the methodology proposed by Clayton and Ravid (2002) to estimate the market value of debt. The analysis in Section 4 uses the five-day *Cumulative Stock Return* as the dependent variable. The five-day *Cumulative Stock Return* is the sum of daily stock returns during the (-2, +2) day interval surrounding a corporate tax reduction news event, multiplied by the firm's market value of equity and divided by the firm's book value of total assets.

E_t/A_{t-1} $(E(OCF)/A)$ is earnings before interest and taxes divided by lagged total assets. $Leverage_{t-1}$ (D/A) is lagged interest-bearing debt divided by lagged total assets. $Ln(Sales_t)$ is the natural log of (net) sales. $(M/B)_{t-1}$ is the lagged market-to-book ratio, defined as total assets minus book equity plus market equity, all divided by total assets. dE_t/A_{t-1} is the change in earnings before interest and taxes divided by lagged total assets.[6] $dNPPE_t/A_{t-1}$ is the change in net property, plant, and equipment divided by lagged total assets. dRD_t/A_{t-1} is the annual change in research and development expenditures divided by lagged total assets. $dDebt_t/A_{t-1}$ is the difference between the level of interest-bearing debt divided by lagged total assets. *Cyclical Industry* is an indicator that takes the value of 1 for any 2-digit SIC industry whose performance is perceived to be positively related to the overall business cycle and 0 for "counter-cyclical" industries. As in Faccio and Xu (2013), "counter-cyclical" industries are identified based on keyword searches. Those comprise agricultural production crops (2-digit SIC code: 01); agriculture production livestock and animal specialties (02); agricultural services (07); fishing, hunting, and trapping (09); food and kindred products (20); tobacco products (21); chemicals and

[6] The inclusion of this variable allows us to indirectly control for changes in non-debt tax shields such as depreciation or any other tax-deductible cost.

allied products (28); electric, gas, and sanitary services (49); wholesale trade-non-durable goods (51); food stores (54); health services (80); legal services (81); and educational services (82).

The sample includes 203,676 firm-year observations. As shown in Table 1, the average corporate tax rate is 38.41%, the average personal tax rate on interest income is 33.51%, and the average personal tax rate on dividend income is 26.34%. During our sample period, tax rates decline through time on average. The average firm has an E_t/A_{t-1} ratio of 1.37%. The average leverage is 23.92% and the annual growth of debt is 3.21% of total assets on average. The average annual growth in earnings, PPE, and R&D expenses (as a fraction of total assets) appear to be rather small. Finally, about three-quarters of the firms are classified as belonging to a cyclical industry.

[Table 1 goes about here]

2. Main Results

The main regression results are reported in Table 2. In Regression (1) we test a simple model with taxation only at the corporate level. Regression (2) is a test of the more general valuation model with taxation at the corporate and personal levels. The results are consistent with the predictions in Section 1.1. In particular, β (the coefficient of E_t/A_{t-1}*Corporate Tax Change*) is negative. This indicates that, following an increase in corporate tax rates, the value of more profitable firms drops by a larger amount.

Further, the impact of an increase in corporate tax rates on value is less pronounced as leverage increases, as γ_1 (the coefficient of $Leverage_{t-1}$*Corporate Tax Change*) is greater than 0. At the same time, the benefits associated with the deductibility of interest payments at the corporate level are at least partly offset by the disadvantage associated with the taxation of interest payments at the personal level (so that $\gamma_2<0$). The taxation of dividend income at the

personal level, however, further increases the overall tax benefits of debt ($\gamma_3 > 0$). While personal taxes on dividend income matter at the margin, it is perhaps not surprising that they do not appear to matter as much as corporate tax rates or personal tax rates on interest income. One explanation relates to the relatively small (and declining) number of dividend paying firms studied during our sample period (Fama and French (2001), Denis and Osobov (2008)).

Importantly, because of the inclusion of country-year fixed effects, the results cannot be explained by omitted shocks that might affect all firms in a given country-year in the same way. In principle, another possible concern with the results is that the tax reforms might affect firms through a channel other than leverage. The inclusion of interactions between the changes in tax rates and each of our control variables mitigates this possibility.

Among these alternative stories, perhaps the most obvious concern is that tax reforms might affect value through a "growth channel." More specifically, firms with different growth profiles may respond to tax reforms differently. To the extent that leverage is correlated with growth, our result may merely reflect this alternative channel. To minimize this concern, we include interactions between our firm-level growth variables (dE_t/A_{t-1}, $dNPPE_t/A_{t-1}$, and dRD_t/A_{t-1}) and each tax change variable. Across all four regression specifications shown in Table 2, this produces a total of 24 interactions between these three firm-level growth variables and the tax change variables. Only three of these interactions are statistically significant, while the other 21 interaction terms are not statistically significant at conventional levels. Overall, this appears to provide little support for a growth-based story.

We also investigate the possibility that the results might instead reflect the different response of firms (with different leverage ratios) to economic shocks that might coincide with tax reforms. If this channel is behind our results, we would expect the coefficient of the

leverage*tax change interactions to be larger for firms in industries that are sensitive to economic cycles (cyclical industries). For this purpose we focus on triple interactions: *Leverage*Tax Change*Cyclical Industry*. An important benefit of the cyclical industry indicator is that it accounts for future growth as well. Across all four regression specifications in Table 2, only one of the eight triple interactions is significant at the 10% level or better, providing little support for the hypothesis that our results reflect a different response of firms to economic shocks. Of the remaining interaction terms, none of the interactions between the market-to-book ratio and the tax change variables is statistically significant, while a number of the interaction terms between firm size and tax changes are significant. Importantly, the *Leverage*Tax Change* interactions that are the focus of this paper are statistically significant *after* controlling for this battery of interactions.

[Table 2 goes about here]

In Regressions (3)-(4) we assess the robustness of our results to changes in the sample composition. In particular, Regression (3) includes only country-years in which a reform affecting corporate tax rates occurs. The coefficient of the $Leverage_{t-1}$*Corporate Tax Change* interaction is positive and significant in this specification as well. Regression (4) includes only country-years in which either a reform affecting corporate tax rates or a reform affecting personal tax rates occurs. The results are very similar to those in Regression (2).

3. Top Tax Payers

Tax reforms should have different effects on firms as a function of each firm's marginal tax rate. Therefore, in this section we investigate whether the value of debt tax shields is greater

(1) for firms subject to a higher marginal tax rate and (2) in countries in which stealing (including tax evasion) is more difficult.

The evidence in Table 3 indicates that the firms that should respond more to tax changes do exhibit a higher value response to tax reforms. In Regression (1), we use a firm's effective tax rate, measured as the ratio of taxes paid over pre-tax income, as a proxy for the firm's marginal tax rate. Using this proxy, we find that the value of interest tax shields is higher for firms with above-median effective tax rates. In Regression (2), similar conclusions are reached when we use firm profitability (ROA) as a proxy for a firm's tax status. In Regression (3) we document that reforms that increase tax rates on dividend income matter marginally more for highly leveraged dividend-paying firms, although not significantly so.

[Table 3 goes about here]

Taxes should have less impact on firm value in countries with high levels of tax evasion. In particular, if firms could evade taxes at no cost, taxes (and tax reforms) would have no impact on firm value; the same would apply to tax sheltering devices such as debt. To investigate whether this is the case, we split countries into two groups based on the prevalence of tax evasion using the *World Economic Forum*'s assessment of the prevalence of tax evasion in a country in 2002. This index is built from a survey of corporate executives' assessments of the prevalence of tax evasion in their countries.[7] As predicted by a tax story, we find that tax reforms have little impact on value overall or through debt tax shields in countries with high levels of tax evasion. In contrast, tax reforms have a large impact on value in countries with low levels of tax evasion (Regressions (1) and (2) of Table 4).

[Table 4 goes about here]

[7] To investigate tax evasion *within* the U.S., Guedhami and Pittman (2008) employ data compiled by Transactional Records Access Clearinghouse. Those data include IRS sanctions against firms for tax evasion and tax fraud.

Taxes (and debt tax shields) should also have less impact on value in countries where insiders shelter income from taxation through outright stealing (Desai, Dyck, and Zingales (2007)). To investigate whether this is the case, we employ Djankov, La Porta, Lopez-de-Silanes, and Shleifer's (2008) index of anti-self-dealing, which measures the legal protection of minority shareholders against diversion of corporate wealth by insiders through self-dealing transactions. Less protection means that it is easier for insiders to steal, and this incentive to steal should be stronger when corporate tax rates are higher. Consistent with this story, we find that tax reforms and debt tax shields have a significant impact on value only in countries that highly restrict the ability of insiders to steal. Conversely, when stealing is easier, tax reforms and tax sheltering devices appear to have no impact on firm value.[8]

Importantly, the results in this section mitigate the concern that our evidence may reflect something other than tax benefits, while providing support to a tax explanation of our findings.

4. Event Study

In the previous regression analyses we included country-year fixed effects to control for changes in any omitted country-level factors that might affect all firms in a given country at a given point in time. A more subtle concern is that the results might reflect omitted shocks that might occur in the year of a tax reform *and* that might affect various firms *differently* (specifically, through a leverage channel). To mitigate this concern, we employ an event study methodology. As is standard in event studies, we focus on a *narrow* event window surrounding a tax reform news event. Selecting a narrow window enables us to filter out other value-relevant

[8] Although the tax evasion index and the anti-self-dealing index are positively correlated (ρ=0.62), there is still a fair amount of divergence between them. For example, nine countries involving 11,002 observations are classified as either high tax evasion and high anti-self-dealing countries or low tax evasion and low anti-self-dealing countries.

events unrelated to taxes. To the extent that no other country-wide event occurs in the few days surrounding news releases about a tax reform, this would eliminate the possibility that something other than the tax reform affects value through a leverage channel.

Of course, this methodology has some limitations. In particular, we can focus only on tax reforms introduced as surprises. Further, we must be able to identify an event date. Finally, by focusing on a narrow window we neglect the impact of any information related to the tax reform that is disseminated outside the event window.

With these caveats in mind, we undertake an event study of the price change observed around large corporate tax rate reductions. In particular, we focus on changes (reductions) in the top statutory corporate tax rate of at least five percentage points. We focus on relatively large reforms in order to isolate events that should have a meaningful effect on firm value. (Presumably, very minor tax reforms are less likely to have detectable impacts on value.) We focus on tax reductions because those represent the vast majority of tax reforms. We focus only on reforms affecting corporate tax rates for two reasons. First, corporate tax rates (as opposed to personal tax rates) have historically formed the basis of pedagogy in finance. Second, identifying the exact news disclosure dates of the tax reforms through news searches is a painfully lengthy undertaking. For example, a preliminary unrestricted search of all tax reforms in *Factiva* using the keywords "(tax w/5 reform) or (tax rate w/5 change)" during the period 1981-2009 returns 266,304 news articles. Focusing on one specific type of reform makes the identification process less challenging. Imposing these constraints allows us to focus on an initial sample of 28 country-years in which a large corporate tax rate reduction occurred.[9]

For each of those 28 large corporate tax reductions, we conduct keyword searches in *Factiva* to identify the date of (1) the first rumor about the tax rate reduction in the press, (2) a

[9] By comparison, there are only four large corporate tax rate increases in the sample.

major "official" statement made by government officials about a specific proposal of a reduction in the corporate tax rate, and (3) the final approval of the law introducing a tax rate reduction. These keyword searches yield a sample of 58 announcements related to 23 specific tax reforms. The date and a brief description of each announcement is reported in Panel A of Table 5.

[Table 5 goes about here]

For each firm in those countries with available stock price data, we compute a five-day *Cumulative Stock Return* (in US$ terms) over the interval beginning two days prior to and ending two days after the tax change news, $\sum_{t=-2}^{+2} R_{i,t}$. To be consistent with the analysis in the previous tables, we continue to scale the independent variables by the book value of total assets. Because of this scaling, the dependent variable also needs to be scaled by the book value of assets for equations (2)-(6) to hold. This is easily accomplished by multiplying ($\sum_{t=-2}^{+2} R_{i,t}$) by the firm's market value of equity and dividing it by the book value of total assets. As with the prior analyses, an implicit assumption is that the value of debt is unaffected by the corporate tax reforms. This is necessarily true for the sub-sample of firms that are not financially distressed (at a minimum).

As shown in Panel B of Table 5, firm value increases on average around news of tax reductions. For the average firm, we document a 0.46% increase in value. As expected, among different types of events, the first rumor of a tax cut (*Rumor*) is associated with the largest increase in value (1.40%), while the final approval of the new tax law (*Law*) accompanies an average return of 0.78%, which is marginally greater than the price response following official announcements to cut taxes (*Intention*).

Given our focus on large changes in tax rates, these numbers may appear small. There are several reasons for this. First, although we focus on the release of new information related to a

specific tax change, that information typically relates to *partial* rather than full events. Second, the typical firm is leveraged so that its income is, at least in part, shielded from taxation. With those caveats in mind, we nevertheless find that corporate tax changes do affect equity prices.

We further document that a tax cut has a larger impact on the value of firms with low leverage, and its impact progressively declines as leverage increases. This is consistent with the previously documented positive sign on the interaction between the *Corporate Tax Change* variable (which has a negative sign in the event study, as we focus only on tax cuts) and leverage. To the extent that no other shocks coincide with the tax reforms in a systematic manner in these narrow event windows, this evidence indicates that the results reflect tax savings from interest tax shields.

Table 6 presents some regression results using the five-day *Cumulative Stock Return* computed in Table 5 as a dependent variable. Regression (1) confirms a positive sign for the interaction between leverage and corporate tax reforms, after controlling for a number of firm-level attributes. Regression (2) repeats the specification in Regression (1) using only the first "news event" for each reform, which should be the most important news release for each reform. The results are consistent with those in Regression (1). Regression (3) shows that the results are robust to controlling for possible reform-specific omitted variables though the inclusion of reform fixed effects.

[Table 6 goes about here]

5. Propensity Score Matching

We next assess the robustness of our results to the use of a propensity score matching methodology (Rosenbaum and Rubin, 1983). As in the previous section, we continue to focus on large tax-reducing reforms (those resulting in a reduction in the corporate tax rate of at least five

percentage points). Given the set of firms that undergo a large tax reform, we use the propensity score matching procedure to identify a control sample of firms with low leverage but characteristics that are otherwise similar to those of highly-leveraged firms undergoing the same reform (the treatment group).

The propensity score is estimated as a function of all the firm-level control variables in Table 2. We then compare the two groups with respect to change in value relative to the year-end prior to the tax reform. As the set of control firms is designed to be nearly identical to the treatment group in terms of observables (with the exception of leverage), the average change in firm value should be similar between the two groups if debt tax shields did *not* affect value. To ensure that any differences between the two sets of firms are small, we require that the difference between the propensity scores does not exceed 1% in absolute value.[10]

The results are reported in Table 7. There, we compare the change in value for firms with above-median leverage to that of control firms with below-median leverage. Both sets of firms are taken from the same country and year. The results indicate that the change in value during the year of the reform is significantly greater for firms with low leverage. Highly-leveraged firms are instead only marginally affected by the tax reform. These results are in line with our earlier evidence, including the event study results. We therefore conclude that our earlier results do not appear to be driven by the specific econometric methodology used.

[Table 7 goes about here]

[10] We find log sales to differ statistically between the treatment and the control groups of firms. However, we note that the difference is rather small in economic magnitude.

6. Economic Significance

To estimate the value of debt tax shields, we rely on both the event study and the propensity score results. The event study provides a lower bound for the economic significance of the results. This occurs because, despite our best effort, our collected news announcements may not capture all means through which information about a tax reform is disseminated. At the same time, a major benefit of the event study is that using a narrow event window enables us to exclude a number of (unspecified) contaminating events that might broadly overlap with tax reforms (i.e., occur in the same year as tax reforms) and potentially affect value through a leverage channel.

With this in mind, we employ the results in Panel B of Table 5 to assess the economic magnitude of the tax benefits of debt. The tax reforms covered in the event study result in an average reduction in the corporate tax rate, δT_C, of 8.06 percentage points. The value of firms with below-median leverage increases by an average of 0.79% during the five-day interval surrounding these tax reforms. By comparison, the value of firms with above-median leverage increases by an average of 0.14%. These observed changes in firm value reflect the changes in the net (of debt costs) benefits of debt financing.

To illustrate the theoretical benchmark of the change in firm value, Figure 1 shows the marginal benefit and the marginal cost curves for a firm in a country undergoing a corporate tax reform. (For simplicity, we are assuming a linear marginal cost function). The corporate tax rate is reduced from Tc_0 to Tc_1. As a consequence, the optimal amount of debt changes to the point where the marginal cost is equal to the new marginal benefit. The rectangular area D_0*(Tc_1-Tc_0) measures the gross (of debt costs) tax benefits of debt lost as a consequence of the tax reform. Considering the change in the cost of debt due to leverage adjustment, the dotted trapezium

represents the change in value that is expected around the time of the reform, i.e., the change in the net of debt costs tax benefits of debt financing. Given the assumption of a linear marginal cost function, the change in the net of debt costs tax benefits of debt financing should be equal to $D_0*(Tc_1-Tc_0)+(D_1-D_0)*(Tc_1-Tc_0)/2 = D_0*(\delta Tc)+(\delta D)*(\delta Tc)/2$.

Now consider two firms. One is a firm with "above median" leverage (H). The other is a firm with "below median" leverage (L).[11] The difference in the change in value (scaled by total assets) between the two sets of firms should be close to $[D^H_0*(\delta Tc)+(\delta D^H)*(\delta Tc)/2]/A-[D^L_0*(\delta Tc)+(\delta D^L)*(\delta Tc)/2]/A = -0.0233$.[12] Recalling that on average we were able to identify 2.52 (i.e., 58/23) news releases for each reform, the *aggregate* change in value corresponding to each reform is roughly -0.0164 (-0.0065*58/23). Given that we are dealing with partial events in the event study, it is perhaps not surprising that the economic magnitude of the event study results is lower than the theoretical benchmark.

We also use the propensity score results in Table 7 to estimate the economic magnitude of the tax benefits of debt. The propensity score results could potentially overstate the economic significance. This would, for example, happen if the tax reforms coincide with other events that affect firm value through a leverage channel. At the same time, a benefit of using a longer event window is that we are more likely to capture the full impact of reforms on value.

Keeping this in mind, we find that the tax reforms covered in Table 7 result in an average reduction in the corporate tax rate, δT_C, of 6.71 percentage points. The value of high-leverage

[11] The mean leverage ratios in the above-median leverage and below-median leverage groups are 0.3762 and 0.0835, respectively.

[12] Ignoring the difference between the changes in the costs of debt for the two (sets of) firms yields an estimate of the theoretical *gross* (of debt costs) benefits of debt financing of -0.0236. This figure is very close to -0.0233, the change in the net benefits of debt. This is because the "above median" leverage and the "below median" leverage firms in the sample rebalance their capital structure by a similar amount.

firms decreases by an average of 0.0199 during the one-year interval following these tax reforms. By comparison, the value of low-leverage firms increases by an average of 0.0256. From earlier Equation (2), it follows that the difference in the change in value between the two sets of firms, -0.0455, should be close to the "theoretical benchmark" of -0.0178.[13] We find our estimate to be statistically indistinguishable from the theoretical benchmark (p-value of the difference = 0.19).

Thus, the evidence reported in this section indicates that, following a δT_C reduction in the corporate tax rate, the market value of the tax benefits of \$1 of permanent debt financing on average drops between \$0.70 $\cdot \delta T_c$ (i.e., -0.0164/-0.0233) and \$2.56$\cdot \delta T_c$ (i.e., -0.0455/-0.0178). We therefore conclude that the tax savings associated with the deductibility of interest payments are sizeable (i.e., in line with theoretical predictions).

7. Robustness Tests

In this section we investigate the robustness of our results to changes in the estimation approach, changes in the sample, and the inclusion of additional controls.

7.1. Differences in the All-Equity Cost of Capital across Firms

In our tests, we relied on the presumption that the all-equity cost of capital is the same across all firms. We do so because the estimation of the cost of capital presents substantial empirical challenges. In this section we allow the cost of capital to vary across firms in different industries. We do so by re-estimating Equation (2) in Table 2 separately for each Fama-French industry. In addition to utilities and the financial industry, tobacco and "everything else"

[13] With reference to the issue highlighted in the previous footnote, considering the observed changes in D in the year of the tax reform in the propensity score sample, the theoretical benchmark of the net (of debt costs) benefits of debt financing is estimated to be equal to -0.0179.

industries drop out of the analysis due to lack of observations. Table 8 summarizes the results using a Fama and MacBeth (1973) approach. More specifically, within each industry we first run the regression model of value change on the interaction between lagged leverage and tax changes, as well as control variables. We then compute the average of the coefficients on the three leverage*tax change interaction terms across all of the industry-level specifications from the first step and test their statistical significance based on standard errors computed from these industry-level coefficients. As the results in Table 9 show, our earlier conclusions are unchanged if we allow the all-equity cost of capital to vary across industries. Importantly, our earlier conclusions do not appear to be driven by assuming the same discount rate across firms.

[Table 8 goes about here]

7.2. Results by Reform

Because the dataset contains a number of corporate tax cuts, we can estimate not only the mean treatment effect, but also the impact of each individual reform on firm value. To do so, we run separate firm-level regressions of the change in firm value for each large reform resulting in a reduction in the corporate tax rate of five percentage points or more. (Those regressions cannot include interaction terms due to perfect multicollinearity.) We run these regressions for 25 large reforms involving countries in which we have at least 12 firms. The results are reported in Table 9. In these regressions, the coefficient of interest is that of $Leverage_{t-1}$. Given that we are focusing on tax cuts, this coefficient is expected to be negative. For only six of the 25 tax cuts in the sample, the coefficient of $Leverage_{t-1}$ is in conflict with our hypothesis. Thus, also from this standpoint, the glass of evidence appears to be quite full.

[Table 9 goes about here]

7.3. Firms with Positive Earnings

Our simple discounted cash flow model is applicable to the extent that expected operating cash flows are positive. To simplify the estimation of expected operating cash flows, we rely on the assumption that *current* operating cash flows provide a good estimate of expected (future) operating cash flows. While this may be reasonable on average, an obvious problem arises for those firms that have negative current operating cash flows. For those firms, our simple valuation model predicts a negative firm value. We address this issue to some extent in Section 3, where we show that tax reforms (and debt tax shields) have a larger impact on value among highly profitable firms as compared with less profitable ones. In this section, we further assess any possible biases in our estimation by excluding firm-years with negative E_t/A_{t-1} from the sample. The results are reported in Regression (1) of Table 10. The results show that, for this subsample, the impact of tax reforms affecting corporate and personal tax rates on dividend income is greatly mitigated in the presence of leverage. These results are consistent with a tax story.

[Table 10 goes about here]

7.4. Capital Gains Taxes

In our analyses so far we have not incorporated the taxation of capital gains. Neither the OECD's *Tax Database* nor the World Bank's *World Development Indicators* (the sources used as our starting point for assembling the other tax data) report data on capital gains taxes. However, Becker, Jacob, and Jacob (2013) compiled capital gains tax rates data for 25 OECD countries for the period of 1990-2008. We verify and supplement those data with news articles from *Factiva*, the University of Michigan's *World Tax Database*, the Tax Foundation, internet sources, and

other country-specific data sources. Those sources allow us to gather data going back to 1981 for 20 OECD countries and extend the coverage to 28 OECD countries.[14]

We use those data to integrate our earlier analyses with capital gains tax reforms (in addition to reforms affecting personal and corporate income tax rates). As the results in Regression (2) of Table 10 show, capital gains tax reforms do not appear to affect firm value. This could be due to investors being able to offset capital gains with capital losses, thus deferring taxation even while selling stocks. Importantly, the tax deductibility of interest at the corporate level remains significant after controlling for this additional type of taxation.

7.5. Business Cycle

In this section we attempt to address the concern that the different change in value (following tax reforms) experienced by firms with different leverage may not reflect debt tax shields. Rather, it might reflect the different responses of firms, with different degrees of leverage, to macroeconomic shocks that may coincide with tax reforms. This concern is partially mitigated by including the triple interactions of the "cyclical" industry indicator with leverage and tax changes in the main regression model in Table 2. (In that model, we find little evidence that the coefficient of the leverage*tax change interactions is larger for firms in industries that are expected to be more cyclical.) To further address this concern, we add an interaction between *GDP growth* and *Leverage*. *GDP growth* is the per capita GDP growth obtained from the World Bank. As the results in Regression (3) of Table 10 show, firms with different leverage indeed respond differently to macroeconomic shocks. However, we continue to find evidence consistent with a tax savings story after controlling for other events that could affect firm value through a leverage channel.

[14] Notably, many countries have a capital gains tax rate of 0%.

7.6. Leverage and Earnings Growth in the Longer Term

In our tests so far we control for changes in leverage and earnings that occur in a given year, e.g., in the year of a tax reform. However, capital structure rebalancing could take longer than one year. Also, a change in current earnings may inadequately reflect expected operating cash flow.

We therefore conduct a robustness test by controlling for changes in borrowing (and changes in earnings) that occur in the year of and two years following a reform. The choice to look two years into the future is motivated by Fama and French's (1998) argument that "two years is about as far ahead as the market can predict" (p. 823). Specifically, we include in our models (1) $dDebt_{t+2}/A_{t-1}$, the difference between the level of interest-bearing debt at the end of year t+2 and the level of interest-bearing debt at the end of year t-1, all scaled by lagged total assets; and (2) dE_{t+2}/A_{t-1}, the change in EBIT from year t-1 to year t+2, divided by total assets as of the end of year t-1. Importantly, as the results in Regression (4) of Table 10 show, both the magnitude and the statistical significance of the key regression coefficients are only marginally affected by making this change to the regression specification.[15]

8. Conclusions

Using shocks to tax benefits of debt induced by tax reforms, we estimate the market value of debt tax savings. In line with a simple tax story, we document that, in the time-series, the impact of reforms on value differs across firms as a function of leverage. For example, while an

[15] We do not include these controls in the main specification for two reasons. First, adding future realized changes in corporate choices to the control variables implicitly assumes that the market has perfect foresight. This assumption may not be warranted. Second, the inclusion of future realized capital structure changes introduces a survivorship bias.

increase in corporate tax rates negatively affects firm value, this effect is substantially mitigated in the presence of high leverage.

A battery of other tests corroborates a tax explanation of our results. In particular, the impact of tax reforms differs across firms depending on their tax status; following an increase in corporate tax rates, debt tax shields are more valuable for high corporate tax payers and more profitable firms. The impact of tax reforms also varies across countries in intuitive ways. For example, we find that tax reforms have a lower impact on value in countries with high levels of tax evasion. In those countries, the market value of debt tax savings is (perhaps not surprisingly) also lower. Similarly, reforms have a smaller impact on value in countries where insiders can easily shelter income from taxation by other means (such as stealing).

The results are not driven by unobserved country-level shocks that might equally affect the value of all firms in a given country, which are accounted for through the inclusion of country-year fixed effects. The results also do not appear to occur through channels other than leverage (such as firm-level growth, for example). Further and perhaps most importantly, they are also robust to narrowing the event window for measuring value changes so as to theoretically filter out events other than the tax reforms.

By using tax reforms as shocks to tax benefits of debt, we are able to provide a clear answer to a core question in the profession of corporate finance: What is the market value of debt tax shields? We find debt tax savings to be highly valued by the market. In particular, following a δT_c cut in the corporate tax rate, the value of \$1 of debt declines by approximately $\$1 \cdot \delta T_c$ (i.e., firm value declines between $0.70 \cdot \delta T_c$ and $2.56 \cdot \delta T_c$, depending on the estimation methodology employed) within the same year.

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Table 1: Summary Statistics

Corporate Tax (change) is the (annual change in the) top marginal statutory corporate income tax rate. Interest Tax (change) is the (annual change in the) highest marginal tax rate applied to residents' personal interest income from corporate bonds. Dividend Tax (change) is the (annual change in the) net top statutory tax rate on dividend income to be paid at the shareholder level. $dVni_t/A_{t-1}$ is the change in the market value of assets (net of issuances, scaled by lagged book assets), defined as the annual change in the market value of equity minus the annual change in the book value of equity, all divided by lagged book assets. E_t/A_{t-1} is earnings before interest and taxes divided by lagged total assets. $Ln(Sales_t)$ is the natural log of net sales. $(M/B)_{t-1}$ is the lagged Market-to-Book ratio, defined as total assets minus book equity plus market equity, all divided by total assets. dE_t/A_{t-1} is the change in earnings before interest and taxes divided by lagged total assets. $NPPE_t/A_t$ is net property, plant, and equipment, all divided by total assets. $dNPPE_t/A_{t-1}$ is the change in NPPE divided by lagged total assets. dRD_t/A_{t-1} is the annual change in research and development expenditures divided by lagged total assets. Leverage is interest-bearing debt divided by total assets. Cyclical Industry is an indicator that takes the value of 1 for any 2-digit SIC industry whose performance is perceived to be positively related to the overall business cycle and 0 for "counter-cyclical" industries. $dDebt_t/A_{t-1}$ is the difference between the level of interest-bearing debt at the end of year t and the level of interest-bearing debt at the end of year t-1, all scaled by total assets as of the end of year t-1.

Variable	Number of observations	Mean	Median	Standard deviation
Corporate Tax	203,676	0.3841	0.3930	0.0668
Interest Tax	203,241	0.3351	0.3500	0.1064
Dividend Tax	203,676	0.2634	0.2720	0.1087
Corporate Tax change	203,676	-0.0050	0.0000	0.0174
Interest Tax change	203,241	-0.0031	0.0000	0.0264
Dividend Tax change	203,676	-0.0100	0.0000	0.0557
$dVni_t/A_{t-1}$	203,676	0.0908	0.0058	1.6761
E_t/A_{t-1}	203,676	0.0137	0.0621	0.2779
$Ln(Sales_t)$	203,676	12.1754	12.2885	2.3590
$(M/B)_{t-1}$	203,676	1.9724	1.2839	2.5969
dE_t/A_{t-1}	203,676	0.0154	0.0070	0.2548
$dNPPE_t/A_{t-1}$	203,676	-0.0001	-0.0010	0.0628
dRD_t/A_{t-1}	203,676	0.0021	0.0000	0.0204
$Leverage_{t-1}$	203,676	0.2392	0.2047	0.2122
Cyclical Industry	203,676	0.7784	1.0000	0.4153
$dDebt_t/A_{t-1}$	203,676	0.0321	0.0000	0.1720

Table 2: Leverage and the Impact of Tax Reforms on Value

The dependent variable is $dVni_t/A_{t-1}$, the annual change in the market value of assets (net of issuances, scaled by lagged book assets). All other variables are defined in Table 1. "Corporate tax reform years" are years in which the corporate tax rate changes. "Corporate or personal tax reform years" are years with a change in at least one of the corporate tax rate, the personal interest tax rate, or the personal dividend tax rate. All regression models include country-year fixed effects. *T*-stats based on standard errors adjusted for two-way clustering, i.e., at the country-year and at the firm level, are shown in the parentheses below the coefficient estimates. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

			Subsample including only:	
			Corporate tax reform years	Corporate or personal tax reform years
	(1)	(2)	(3)	(4)
E_t/A_{t-1}*Corporate Tax change	-27.174**	-24.824**	-26.302*	-24.010*
	(-1.99)	(-1.96)	(-1.88)	(-1.93)
$Leverage_{t-1}$*Corporate Tax change	5.150*	8.202**	8.729**	9.390**
	(1.83)	(2.31)	(1.90)	(2.03)
$Leverage_{t-1}$*Interest Tax change		-8.831**		-8.725**
		(-2.10)		(-2.16)
$Leverage_{t-1}$*Dividend Tax change		3.273*		3.713*
		(1.65)		(1.80)
$Ln(Sales_t)$	-0.029***	-0.025***	-0.035***	-0.031***
	(-4.32)	(-4.04)	(-3.58)	(-4.03)
$(M/B)_{t-1}$	-0.086***	-0.093***	-0.087**	-0.084**
	(-2.80)	(-2.93)	(-2.35)	(-2.27)
dE_t/A_{t-1}	0.231*	0.255*	0.098	0.157
	(1.84)	(1.88)	(0.66)	(1.02)
$dNPPE_t/A_{t-1}$	-1.817***	-1.795***	-2.521***	-2.306***
	(-6.63)	(-6.65)	(-6.37)	(-6.95)
dRD_t/A_{t-1}	4.640***	4.998***	4.711***	5.400***
	(4.52)	(4.82)	(3.64)	(4.48)
$Leverage_{t-1}$	0.024	0.029	0.102	0.055
	(0.24)	(0.26)	(0.64)	(0.37)
E_t/A_{t-1}	-0.768***	-0.761***	-0.753***	-0.710***
	(-3.80)	(-3.88)	(-3.13)	(-3.25)
$dDebt_t/A_{t-1}$	0.633***	0.636***	0.697***	0.637***
	(3.69)	(3.78)	(2.69)	(3.07)
$dDebt_t/A_{t-1}$*Corporate Tax change	7.275	8.708	9.968	8.912
	(0.67)	(0.88)	(0.85)	(0.74)
$dDebt_t/A_{t-1}$*Interest Tax change		-6.853		-6.794
		(-0.59)		(-0.61)
$dDebt_t/A_{t-1}$*Dividend Tax change		4.620		4.708
		(0.88)		(0.95)
E_t/A_{t-1}*Corporate Tax change	-10.683	-11.797	-13.545	-13.885
*Cyclical Industry	(-0.99)	(-1.06)	(-1.23)	(-1.25)
$Leverage_{t-1}$*Corporate Tax change	2.988	2.670	2.771	2.468
*Cyclical Industry	(1.52)	(1.26)	(1.08)	(1.01)
$Leverage_{t-1}$*Interest Tax change		1.190		1.223***
*Cyclical Industry		(1.09)		(3.60)
$Leverage_{t-1}$*Dividend Tax change		-0.577		-0.667
*Cyclical Industry		(-0.93)		(-1.07)
$dDebt_t/A_{t-1}$*Corporate Tax change	3.980	4.280	-0.072	3.964
*Cyclical industry	(0.34)	(0.33)	(-0.01)	(0.31)
$dDebt_t/A_{t-1}$*Interest Tax change		-1.101		-1.272
*Cyclical industry		(-0.09)		(-0.11)

$dDebt_t/A_{t-1}$*Dividend Tax change		2.733		2.584
*Cyclical industry		(0.41)		(0.40)
$Leverage_{t-1}$*Cyclical Industry	0.205**	0.202**	0.267*	0.220
	(1.99)	(1.97)	(1.68)	(1.59)
E_t/A_{t-1}*Cyclical Industry	0.471**	0.476**	0.437*	0.428*
	(2.35)	(2.36)	(1.79)	(1.90)
$dDebt_t/A_{t-1}$*Cyclical industry	-0.022	-0.017	-0.123	-0.040
	(-0.12)	(-0.09)	(-0.45)	(-0.18)
Cyclical Industry	-0.104**	-0.106***	-0.136**	-0.118**
	(-2.54)	(-2.61)	(-1.96)	(-2.03)
$Ln(Sales_t)$*Corporate Tax change	-0.375**	-0.576***	-0.465***	-0.657***
	(-2.81)	(-2.83)	(-2.98)	(-3.28)
$(M/B)_{t-1}$*Corporate Tax change	1.834	1.251	1.839	1.475
	(1.31)	(0.76)	(1.26)	(0.88)
dE_t/A_{t-1}*Corporate Tax change	-0.572	-3.152	-3.237	-4.887
	(-0.13)	(-0.64)	(-0.71)	(-0.97)
$dNPPE_t/A_{t-1}$*Corporate Tax change	-9.095*	-6.686	-20.050***	-14.318**
	(-1.88)	(-1.22)	(-3.10)	(-2.45)
dRD_t/A_{t-1}*Corporate Tax change	45.756	45.471	47.829	53.474
	(1.47)	(1.23)	(1.52)	(1.44)
$Ln(Sales_t)$*Interest Tax change		0.343		0.340
		(1.31)		(1.34)
$(M/B)_{t-1}$*Interest Tax change		0.666		0.661
		(0.74)		(0.74)
dE_t/A_{t-1}*Interest Tax change		5.951		5.683
		(1.45)		(1.40)
$dNPPE_t/A_{t-1}$*Interest Tax change		-5.217		-5.179
		(-1.32)		(-1.46)
dRD_t/A_{t-1}*Interest Tax change		7.730		6.373
		(0.30)		(0.25)
$Ln(Sales_t)$*Dividend Tax change		0.437*		0.413*
		(1.82)		(1.76)
$(M/B)_{t-1}$*Dividend Tax change		-0.877		-0.809
		(-1.53)		(-1.39)
dE_t/A_{t-1}*Dividend Tax change		1.430		0.850
		(0.59)		(0.35)
$dNPPE_t/A_{t-1}$*Dividend Tax change		2.970		1.288
		(0.70)		(0.34)
dRD_t/A_{t-1}*Dividend Tax change		35.025		37.408
		(1.46)		(1.56)
Country-Year Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	203,676	203,241	113,617	139,788
Adjusted R^2	0.078	0.082	0.071	0.072

Note: All Tax change variables drop out of the models naturally due to the inclusion of Country-Year Fixed Effects.

Table 3: Leverage and the Impact of Tax Reforms on Value: Top Tax Payers

The dependent variable is $dVni_t/A_{t-1}$, the annual change in the market value of assets (net of issuances, scaled by lagged book assets). High effective tax rate means the effective tax rate is above median (among all firms in the sample). The effective tax rate is taxes paid over pre-tax income. High ROA means ROA is above median (among all firms in the sample). Dividend Payer is 1 if the firm pays cash dividends in a given year, 0 otherwise. All other variables are defined in Table 1. All regression models include country-year fixed effects. The regression models also include the interactions between each of the control variables and corporate and personal tax changes, although their coefficients are omitted for brevity. *T*-stats based on standard errors adjusted for two-way clustering, i.e., at the country-year and at the firm level, are shown in the parentheses below the coefficient estimates. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

Top tax payer is a firm with:	High effective tax rate	High ROA	Dividend Payer
	(1)	(2)	(3)
E_t/A_{t-1}*Corporate Tax change	-36.652***	-33.393***	-33.666***
	(-3.08)	(-2.79)	(-2.83)
$Leverage_{t-1}$*Corporate Tax change	6.442**	3.689	10.619***
	(2.01)	(1.03)	(2.71)
$Leverage_{t-1}$*Corporate Tax change	9.012***	12.518***	
*Top Payer	(8.02)	(5.70)	
$Leverage_{t-1}$*Interest Tax change	-9.067**	-8.463**	-7.987*
	(-2.06)	(-2.01)	(-1.77)
$Leverage_{t-1}$*Dividend Tax change	3.399*	3.379*	2.607
	(1.70)	(1.79)	(1.21)
$Leverage_{t-1}$*Dividend Tax change			0.968
*Top Payer			(1.52)
$Ln(Sales_t)$	-0.029***	-0.034***	-0.027***
	(-4.16)	(-5.05)	(-3.54)
$(M/B)_{t-1}$	-0.095***	-0.100***	-0.092***
	(-2.96)	(-3.16)	(-2.85)
dE_t/A_{t-1}	0.266*	0.285**	0.261*
	(1.93)	(2.13)	(1.86)
$dNPPE_t/A_{t-1}$	-1.800***	-1.768***	-1.837***
	(-6.63)	(-6.58)	(-6.78)
dRD_t/A_{t-1}	5.133***	5.344***	5.013***
	(5.00)	(5.23)	(4.90)
$Leverage_{t-1}$	0.121	0.103	0.098
	(0.97)	(0.83)	(0.77)
E_t/A_{t-1}	-0.424***	-0.545***	-0.379***
	(-3.37)	(-4.04)	(-2.92)
$dDebt_t/A_{t-1}$	0.717***	0.622***	0.720***
	(4.02)	(3.49)	(4.04)
Top Payer	0.070***	0.211***	-0.000
	(2.76)	(7.12)	(-0.02)
Cyclical Industry	-0.074**	-0.078**	-0.074**
	(-2.03)	(-2.18)	(-2.05)
Other interactions (see Table 2)	Yes	Yes	Yes
Country-Year Fixed Effects	Yes	Yes	Yes
Number of Observations	203,185	199,632	200,670
Adjusted R^2	0.081	0.084	0.080

Table 4: Leverage and the Impact of Tax Reforms on Value: Heterogeneous Effects by Country Legal Institutions

The dependent variable is $dVni_t/A_{t-1}$, the annual change in the market value of assets (net of issuances, scaled by lagged book assets). Low Tax Evasion refers to lower than median tax evasion among all sample countries. Strong Anti-self-dealing Protection refers to greater than median Anti-self-dealing index. All other variables are defined in Table 1. All regression models include country-year fixed effects. The regression models also include all the control variables and interactions in Table 2, although their coefficients are omitted for brevity. *T*-stats based on standard errors adjusted for two-way clustering, i.e., at the country-year and at the firm level, are shown in the parentheses below the coefficient estimates. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

Good Institution is:	Low Tax Evasion		Strong Anti-self-dealing Protection	
	(1)	(2)	(3)	(4)
E_t/A_{t-1}*Corporate Tax change	-35.290*	-36.147**	-29.285	-30.170*
*Good Institution	(-1.88)	(-2.05)	(-1.55)	(-1.71)
$Leverage_{t-1}$*Corporate Tax change	11.174**	20.252***	10.473**	18.161***
*Good Institution	(2.28)	(3.11)	(2.04)	(2.74)
$Leverage_{t-1}$*Interest Tax change		-16.572***		-15.943***
*Good Institution		(-3.15)		(-2.85)
$Leverage_{t-1}$*Dividend Tax change		4.379*		9.540**
*Good Institution		(1.72)		(2.53)
E_t/A_{t-1}*Corporate Tax change	-6.870	-4.910	-11.199	-8.962
	(-0.99)	(-0.64)	(-1.52)	(-1.13)
$Leverage_{t-1}$*Corporate Tax change	-1.331	-2.889**	-1.017	-1.586
	(-1.12)	(-2.48)	(-0.75)	(-0.96)
$Leverage_{t-1}$*Interest Tax change		2.082		1.037
		(1.10)		(0.51)
$Leverage_{t-1}$*Dividend Tax change		0.568		-4.449
		(0.64)		(-1.52)
$Leverage_{t-1}$*Good Institution	0.322**	0.344**	0.353**	0.390***
	(2.28)	(2.34)	(2.43)	(2.58)
E_t/A_{t-1}*Good Institution	-0.985***	-0.951***	-0.866***	-0.840***
	(-4.78)	(-4.99)	(-3.67)	(-3.79)
Other controls (see Table 2)	Yes	Yes	Yes	Yes
Other interactions (see Table 2)	Yes	Yes	Yes	Yes
Country-Year Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	203,676	203,241	203,676	203,241
Adjusted R^2	0.078	0.082	0.078	0.082

Note: All Tax change variables, the Good Institution indicator, and their interaction terms drop out of the models naturally due to the inclusion of Country-Year Fixed Effects.

Table 5: Summary Statistics of Corporate Tax Reduction Event Tests

Panel A lists the dates, types, and other information about the news announcements on major corporate tax reductions in OECD countries during 1980 through 2009. Major corporate tax reductions are tax reductions of 5% or more. News type "rumor" indicates news about a possible upcoming tax reform without much detail. News type "intention" indicates news about a government's or legislator's stated intention to initiate a tax reform with fair amounts of detail. News type "law" indicates news about the passage of the tax law. Panel B provides summary statistics of the five-day cumulative stock returns for all firms, by news type and by book leverage. The five-day cumulative stock return is the sum of daily stock returns in the five-day window surrounding a tax reduction event (between day -2 and day 2), multiplied by the firm's market value of equity and divided by the book value of total assets. Leverage is total interest-bearing debt divided by total assets at the beginning of the reform year. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Description of news events around corporate tax changes

News Counts	Country	Year Tax Change Implemented	News Type	News Date	Old Tax Rate	New Tax Rate
1	Australia	1988	rumor	9/17/1987	49.00	39.00
2	Australia	1988	intention	2/14/1988	49.00	39.00
3	Australia	1988	law	5/26/1988	49.00	39.00
4	Australia	1988	law	5/29/1988	49.00	39.00
5	Australia	1993	rumor	2/10/1993	39.00	33.00
6	Austria	1989	law	3/7/1988	55.00	30.00
7	Austria	2005	rumor	3/7/2003	34.00	25.00
8	Austria	2005	rumor	1/9/2004	34.00	25.00
9	Austria	2005	law	3/23/2004	34.00	25.00
10	Belgium	2003	rumor	10/4/2001	40.17	33.99
11	Belgium	2003	intention	10/9/2001	40.17	33.99
12	Belgium	2003	intention	3/26/2002	40.17	33.99
13	Belgium	2003	law	12/11/2002	40.17	33.99
14	Denmark	1990	intention	5/12/1989	50.00	40.00
15	Denmark	1990	law	12/1/1989	50.00	40.00
16	Finland	1993	intention	9/25/1992	39.00	25.00
17	France	1992	intention	8/29/1990	42.00	34.00
18	France	1992	law	6/1/1991	42.00	34.00
19	Germany	1990	intention	6/22/1989	60.00	54.55
20	Germany	1990	intention	8/28/1990	60.00	54.55
21	Germany	2001	intention	12/7/1999	52.03	38.90
22	Germany	2001	intention	12/21/1999	52.03	38.90
23	Germany	2001	intention	2/9/2000	52.03	38.90
24	Germany	2001	law	7/14/2000	52.03	38.90
25	Germany	2008	intention	3/14/2007	38.90	30.18
26	Germany	2008	law	7/6/2007	38.90	30.18

27	Hungary	1995	rumor	10/26/1994	36.00	18.00
28	Hungary	1995	intention	10/28/1994	36.00	18.00
29	Italy	1998	intention	5/3/1996	53.20	41.25
30	Italy	1998	intention	9/13/1997	53.20	41.25
31	Italy	1998	intention	10/15/1997	53.20	41.25
32	Italy	1998	law	12/9/1997	53.20	41.25
33	Italy	2008	rumor	8/28/2007	37.25	31.40
34	Italy	2008	intention	9/25/2007	37.25	31.40
35	Italy	2008	law	9/28/2007	37.25	31.40
36	Italy	2008	law	12/5/2007	37.25	31.40
37	Japan	2000	intention	5/17/1998	48.00	42.00
38	New Zealand	1988	intention	11/19/1987	48.00	28.00
39	New Zealand	1988	intention	12/17/1987	48.00	28.00
40	New Zealand	1988	law	2/10/1988	48.00	28.00
41	Norway	1992	intention	5/21/1990	50.80	28.00
42	Norway	1992	intention	4/10/1991	50.80	28.00
43	Poland	2004	rumor	2/24/2003	27.00	19.00
44	Poland	2004	intention	4/10/2003	27.00	19.00
45	Poland	2004	intention	4/24/2003	27.00	19.00
46	Poland	2004	law	6/17/2003	27.00	19.00
47	Portugal	2004	intention	3/17/2002	33.00	27.50
48	Portugal	2004	intention	12/19/2002	33.00	27.50
49	Portugal	2004	intention	11/1/2003	33.00	27.50
50	Portugal	2004	law	11/21/2003	33.00	27.50
51	Slovakia	2000	intention	5/19/1998	40.00	29.00
52	Slovakia	2000	intention	11/1/1999	40.00	29.00
53	Slovakia	2000	law	11/24/1999	40.00	29.00
54	Slovakia	2004	intention	3/26/2003	25.00	19.00
55	Sweden	1990	intention	10/3/1989	60.10	53.00
56	United States	1987	intention	11/28/1984	49.82	44.18
57	United States	1987	intention	5/30/1985	49.82	44.18
58	United States	1987	law	6/24/1986	49.82	44.18

Panel B: Five-day cumulative stock returns (in %), total and by leverage

	Number of observations	Mean
All firms	13,194	0.46***
By types of event		
Rumor	725	1.40***
Intention	8,705	0.25***
Law	3,764	0.78***
By leverage		
Below median	6,597	0.79***
Above median	6,597	0.14**
Above - Below		-0.65***

Table 6: Leverage, Tax Changes, and Five-day Cumulative Stock Returns

The dependent variable is the five-day cumulative stock return (in %) around news events on major corporate tax reforms, as defined in Table 5. Major corporate tax reforms are corporate tax reductions of 5% or more. Tax change is the new tax rate of a reform minus the old tax rate. All variables are defined in Table 1 and the independent variables are measured in the year (or year-end) prior to the event dates. *T*-stats based on standard errors adjusted for two-way clustering, i.e., at the country-year and at the firm level, are shown in the parentheses below the coefficient estimates. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

	Full sample	Subsample of first "news events"	Full sample with reform FEs
	(1)	(2)	(3)
E_t/A_{t-1}*Tax change	-99.272	-149.439	-81.119
	(-1.29)	(-1.51)	(-1.16)
$Leverage_{t-1}$*Tax change	20.446*	27.575*	22.272***
	(1.65)	(1.77)	(2.85)
$dDebt_t/A_{t-1}$*Tax change	-14.099	33.774	-21.512
	(-0.41)	(1.57)	(-0.61)
$dDebt_t/A_{t-1}$	-0.372	3.121	-1.518
	(-0.14)	(1.45)	(-0.61)
$Log(Sales_t)$	0.176***	0.159*	0.188***
	(2.77)	(1.87)	(3.12)
$(M/B)_{t-1}$	0.651	0.223	0.623
	(1.24)	(0.30)	(1.16)
dE_t/A_{t-1}	-0.541	-0.253	-0.370
	(-0.33)	(-0.09)	(-0.23)
$dNPPE_t/A_{t-1}$	1.141	0.344	0.226
	(1.46)	(0.24)	(0.34)
dRD_t/A_{t-1}	-28.976*	-23.750	-26.111*
	(-1.90)	(-1.10)	(-1.79)
$Leverage_{t-1}$	1.194	1.190	1.786**
	(1.11)	(1.07)	(2.41)
E_t/A_{t-1}	-3.855	-9.484	-1.992
	(-0.51)	(-0.93)	(-0.30)
Cyclical Industry	-0.470*	-0.425*	-0.355
	(-1.65)	(-1.90)	(-1.36)
Tax change	-8.955	-16.253*	
	(-1.05)	(-1.73)	
Fixed Effects	None	None	Tax Reform Event
Number of Observations	11,252	5,421	11,252
Adjusted R^2	0.034	0.024	0.082

Table 7: Leverage and the Impact of Tax Reforms on Value: Propensity Score Matching Results

This table reports the mean differences in firm characteristics and value changes ($dVni_t/A_{t-1}$) between high-leverage firms and matched low-leverage firms. Both sets of firms are taken from the same country and year. High-leverage firms are firms with leverage above the country median and low-leverage firms are firms with leverage below the country median. A corporate tax-reducing reform is defined as a reduction in the corporate tax rate of at least five percentage points. The control firms are matched by $Ln(Sales_t)$, $(M/B)_{t-1}$, dE_t/A_{t-1}, $dNPPE_t/A_{t-1}$, dRD_t/A_{t-1}, E_t/A_{t-1}, Cyclical Industry dummy, and $dDebt_t/A_{t-1}$. The matching process follows the propensity score matching procedure proposed by Rosenbaum and Rubin (1983). *P*-values are based on two-tailed T-tests. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

	High leverage (N=2,483)	Low leverage (N=2,483)	Diff. (High – low leverage)	*p*-value
Matching variables:				
$Ln(Sales_t)$	12.6836	12.7930	-0.1094	0.02
$(M/B)_{t-1}$	1.3723	1.4059	-0.0337	0.29
dE_t/A_{t-1}	0.0072	0.0061	0.0010	0.74
$dNPPE_t/A_{t-1}$	0.0001	0.0014	-0.0013	0.38
dRD_t/A_{t-1}	0.0019	0.0019	0.0000	0.91
E_t/A_{t-1}	0.0763	0.0751	0.0011	0.72
Cyclical Industry	0.7825	0.7757	0.0068	0.56
$dDebt_t/A_{t-1}$	0.0256	0.0290	-0.0034	0.44
Other variables:				
$Leverage_{t-1}$	0.3693	0.1029	0.2664	0.00
Value change:				
$(Vni_t - Vni_{t-1})/A_{t-1}$	-0.0199	0.0256	-0.0455**	0.03
(*p*-value)	(0.11)	(0.13)		

Table 8: Leverage and the Impact of Tax Reforms on Value: Industry-by-industry Regressions

For each of the Fama-French thirty industries (except tobacco, utilities, financial, and "everything else"), we run a regression of $dVni_t/A_{t-1}$, the annual change in the market value of assets (net of issuances, scaled by lagged book assets) on the interactions between leverage and corporate and personal tax changes. We run this same regression on the interactions between the change in debt and tax changes as well as firm-level control variables and country-year fixed effects. The table reports the average values and the test statistics of the regression coefficients on the three main tax interaction variables: $Leverage_{t-1}$*Corporate Tax change, $Leverage_{t-1}$*Interest Tax change, and $Leverage_{t-1}$*Dividend Tax change. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

Coefficient of:	$Leverage_{t-1}$ *Corporate Tax change	$Leverage_{t-1}$ *Interest Tax change	$Leverage_{t-1}$ *Dividend Tax change
Mean	7.883***	-8.461**	3.946**
T-stat	(2.71)	(-2.45)	(2.27)

Table 9: Reform-by-Reform Regressions

For each large corporate tax reducing reform, we run a regression of $dVni_t/A_{t-1}$, the annual change in the market value of assets (net of issuances, scaled by lagged book assets) on lagged leverage and control variables. Panel A reports the average values and the test statistics of the regression coefficients on lagged leverage, while Panel B reports these coefficients by reform. A large corporate tax reducing reform is a reform resulting in a reduction in the corporate tax rate of five percentage points or more. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Summary of the coefficients of $Leverage_{t-1}$

Mean coefficient of $Leverage_{t-1}$	-0.20**
T-stat	(-2.20)
Number of reforms with coefficients > 0	7
Number of reforms with coefficients < 0	18

Panel B: Coefficients on $Leverage_{t-1}$ for each reform

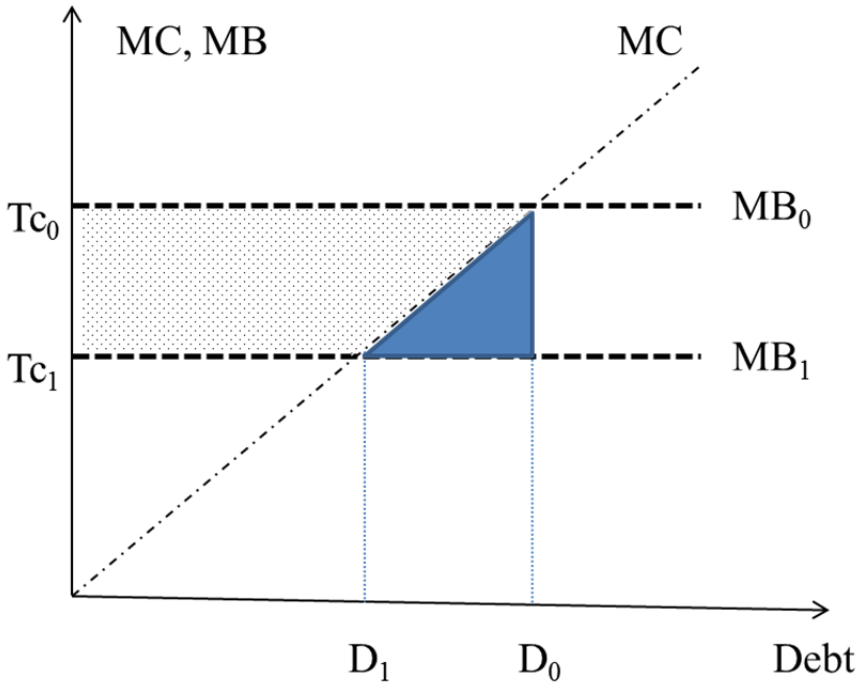
Corporate tax-reducing reform in:			Coefficient on
Country	Year	Number of obs.	$Leverage_{t-1}$
Australia	1988	64	-0.73
Australia	1993	150	-0.80
Austria	1989	31	-0.62
Austria	2005	53	-1.47
Belgium	2003	79	-0.11
Denmark	1990	79	-0.19
Finland	1993	67	-0.13
France	1986	131	-0.35
France	1992	378	-0.15
Germany	1990	247	0.32
Germany	2001	422	-0.42
Germany	2008	555	0.02
Italy	1998	101	-0.43
Italy	2008	195	0.31
Japan	2000	2,217	-0.45
New Zealand	1988	12	-0.15
Norway	1992	66	0.02
Poland	2004	75	1.09
Portugal	2004	48	-0.20
Sweden	1990	68	0.07
Sweden	1991	73	0.12
United Kingdom	1984	251	-0.33
United Kingdom	1986	331	-0.23
United States	1987	1,326	-0.06
United States	1988	1,340	-0.19

Table 10: Other robustness tests

The dependent variable is $dVni_t/A_{t-1}$, the annual change in the market value of assets (net of issuances, scaled by lagged book assets). All other variables are defined in Table 1. Regression (1) uses only firm-years with positive earnings. All regression models include country-year fixed effects. The regression models also include the firm control variables and the interactions between each of the control variables and corporate and personal tax changes, although their coefficients are omitted for brevity. In Regression (4), $dDebt_t/A_{t-1}$ is replaced by $(Debt_{t+2} - Debt_{t-1})/A_{t-1}$, the three-year change in debt scaled by lagged assets, and dE_t/A_{t-1} is replaced by $(E_{t+2} - E_{t-1})/A_{t-1}$, the three-year change in earnings scaled by lagged assets. *T*-stats are shown in the parentheses below the coefficient estimates. The *t*-stats are based on standard errors adjusted for two-way clustering, i.e., at the country-year and at the firm level. Indicators ***, **, and * equal significance at the 1%, 5%, and 10% levels, respectively.

	$E_t/A_{t-1}>0$	Capital Gains Taxes	Control for GDP Growth* Leverage	Control for Future Earnings Change*Tax Changes
	(1)	(2)	(3)	(4)
E_t/A_{t-1}*Corporate Tax change	-0.581	-32.067***	-25.014**	-40.826**
	(-0.04)	(-3.07)	(-1.99)	(-2.50)
$Leverage_{t-1}$*Corporate Tax change	4.981***	8.773**	7.592**	7.739**
	(3.51)	(2.32)	(2.13)	(2.00)
$Leverage_{t-1}$*Interest Tax change	3.331	-11.222**	-9.024**	-9.484**
	(0.88)	(-2.51)	(-2.05)	(-2.18)
$Leverage_{t-1}$*Dividend Tax change	3.844***	3.342	3.004	3.302*
	(2.59)	(1.58)	(1.56)	(1.75)
$Leverage_{t-1}$*Capital Gains Tax change		-0.200		
		(-0.13)		
$Leverage_{t-1}$*GDP Growth			-7.427**	
			(-2.00)	
Other controls (see Table 2)	Yes	Yes	Yes	Yes
Other interactions (see Table 2)	Yes	Yes	Yes	Yes
Country-Year Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	154,267	190,000	203,241	155,332
Adjusted R^2	0.137	0.085	0.082	0.084

Figure 1. Marginal benefit (MB) and marginal cost (MC) of a given amount of debt, D.



The figure shows the marginal benefit (and the marginal cost) curves for a firm in a country undergoing a corporate tax reform. (For simplicity, we are assuming a linear marginal cost function). The corporate tax rate is reduced from Tc_0 to Tc_1.