The Relation between Effective Tax Rates and Firm Profitability

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ABSTRACT

We examine the association between corporate effective tax rates (ETR) and pretax profitability. We show analytically that profitability can affect a firm's ETR in two ways. First, a firm's book-tax differences can vary with profitability (the tax avoidance effect). Second, if a firm's ETR is less than (greater than) the statutory tax rate, an extra dollar of income taxed at the statutory rate shifts the ETR upward (downward) toward the statutory rate (the income effect). We show empirically in a broad sample of Compustat firms that the negative association between profitability and ETRs arises due to the income effect. We also replicate Rego (2003) and reach the same conclusion. Finally, we show that tax avoidance is increasing in profitability. Furthermore, we find that the relation between tax avoidance and profitability is strongest for those firms engaging in the greatest level of tax avoidance.

Keywords: Cash tax avoidance; scaling bias; taxes; effective tax rates

JEL classifications: H25; H32; M41; M48

INTRODUCTION

We examine the association between corporate effective tax rates (ETR) and pretax profitability. Understanding the extent to which U.S. corporations avoid tax and the factors that explain the extent of corporate tax avoidance are among the most important and studied questions in tax research. Fundamental to the understanding of corporate tax avoidance is whether firms with higher profitability face higher or lower effective tax rates. The association between ETRs and profitability receives significant attention in the popular press, with numerous articles focused on whether or not corporations, particularly profitable ones, "pay their fair share" of tax.[1] The apparent maintained hypothesis of some policymakers is that corporations that are more profitable *should* pay more in tax, but do not.[2]

The evidence on the association between profitability and tax avoidance in the academic literature is mixed. Rego (2003) and Brown and Drake (2014) find that firms that are more profitable have lower ETRs. McGuire, Wang, and Wilson (2014) and Kubick, Lynch, Mayberry, and Omer (2015) report a positive and significant association between profitability and ETRs. Gallemore and Labro (2015) and Davis, Guenther, Krull, and Williams (2016) report no significant statistical association.

The ETR measure is equal to some measure of a firm's tax liability divided by its pretax financial accounting income. Early studies used a GAAP-based tax expense figure in the numerator and pretax financial accounting income in the denominator. More recently, studies use the Cash ETR developed by Dyreng, Hanlon and Maydew (2008), which is equal to a firm's cash

[1] See for example this Huffington Post story titled "This Study Shows How Low Corporate America's Taxes Really Are" (http://www.huffingtonpost.com/entry/gao-study-profitable-corporations-no-federal-taxes_us_570e6c62e4b0ffa5937dbadb), this US News article titled "GAO: Many Companies Paid No Federal Income Tax" (http://www.usnews.com/news/articles/2016-04-14/bernie-sanders-outraged-by-gao-study-that-finds-many-companies-paid-no-income-tax) or this Institute on Taxation and Economic Policy article called "The 35 Percent Corporate Tax Myth" (https://itep.org/the-35-percent-corporate-tax-myth/)

[2] In response to a GAO study of corporate ETRs, Sen. Bernie Sanders stated that "[t]here is something profoundly wrong in America when one out of five profitable corporations pay nothing in federal income taxes."

taxes paid divided by pretax income (*PTI*). The Cash ETR is often preferred over the GAAP ETR because it includes the effects of stock option exercises and excludes changes in a firm's valuation allowance for deferred tax assets. As with the majority of recent tax avoidance research, we focus on the Cash ETR.

In this study, we analytically derive the effect of profitability on firms' Cash ETRs to both understand whether the pervasive assumption that firms that are more profitable are more likely to avoid taxes is supported empirically and to reconcile the conflicting empirical results of previous studies. We show that a change in *PTI* can affect Cash ETR in two ways. First, book-tax differences (BTDs) underlying a firm's Cash ETR can vary with profitability, which we call the tax avoidance effect. If BTDs are increasing (decreasing) in *PTI*, then, *ceteris paribus*, a firm's Cash ETR will increase (decrease) with *PTI*.[3] Second, an extra dollar of income that is taxed at the statutory tax rate, but has no effect on book-tax differences, shifts the Cash ETR toward the statutory tax rate. We call this the income effect. One example of the income effect occurs when BTDs relate to fixed costs that do not increase as income increases. In this case, the association between *PTI* and the firm's Cash ETR depends on whether the ETR is above or below the statutory tax rate; when Cash ETR is above (below) it, an additional dollar of *PTI* will shift the ETR toward the statutory rate.[4]

We then empirically assess the extent to which the association between Cash ETR and *PTI* in a large sample of Compustat firms is driven by the tax avoidance effect and the income effect. We generate a sample of profitable firm-year observations spanning 1988 through 2016 with sufficient information to generate Cash ETR, BTD and return on assets (*ROA*) measures.

[3] In this study, BTDs equal the difference between cash taxes paid and the product of *PTI* times the statutory rate (as in Henry and Sansing, 2018). Positive BTD values mean that a firm is "disfavored" in that the firm paid more tax than it would have had the statutory rate been applied to *PTI*.

[4] Our derivation is identical if one uses a GAAP-based measure of tax paid, e.g., current or total income tax expense, instead of cash taxes paid.

Because our derivation suggests that the relation between *PTI* and ETR is different for them, we also partition our observations on whether the firm-year is tax-favored or tax-disfavored. We define a firm-year as being tax-favored when Cash ETR is less than the statutory tax rate. We find that ETRs are decreasing in income for the full sample of profitable Compustat firms. However, our analysis of the data shows that ETRs are actually increasing in income for tax-favored firms and decreasing in income for tax-disfavored firms. In other words, firms with ETRs that exceed the statutory rate drive the overall negative association between profitability and ETRs.

Having established this baseline result, we then assess the extent to which it is explained by the income effect. We infer the sign of the tax avoidance effect by regressing the Henry and Sansing (2018) measure of cash-based BTDs, Δ/MVA, on our measure of profitability (*ROA*), where Δ is a measure of book-tax differences and *MVA* is the market value of assets. BTDs that vary with profitability are decreasing in income on average, suggesting that firms that are more profitable generate more favorable BTDs. However, this effect is different for tax-favored and tax-disfavored firms. For firm-year observations with ETR less than the statutory tax rate, higher pretax profitability is associated with more tax-favored book-tax differences. At the same time, the income effect increases ETR toward the statutory tax rate. The net effect is for an increase in PTI to increase the ETR for tax-favored firms, so the income effect exceeds the tax avoidance effect for tax-favored firms. For tax-disfavored firms, higher income is associated with more tax-disfavored BTDs. However, the income effect decreases the ETR for tax-disfavored firms toward the statutory effect. Again, we find that the income effect outweighs the tax avoidance effect.

We also use quantile regression to both further illustrate the income and tax avoidance effects of profitability on cash tax avoidance and to examine the association between profitability and tax avoidance across the various points of the tax avoidance distribution. While the OLS

estimates describe the effect of profitability on the conditional mean of tax avoidance, we estimate quantile regression at the 10th through the 90th percentile, in increments of 10 percentile points. The quantile regression analysis reveals that the income effect outweighs the tax avoidance effect in the first four quantiles, creating a positive relation between *ROA* and the Cash ETR when the ETR is sufficiently low. When using Δ/MVA as our measure of cash tax avoidance, we find a consistent negative relation between *ROA* and tax avoidance that is increasing across Δ/MVA deciles. This pattern suggests that the relation between profitability and tax avoidance is strongest, both economically and statistically, for the firms that exhibit the greatest tax avoidance.

We also re-examine previous conclusions on the association between profitability and tax avoidance through the lens of our analytically derived predictions. Rego (2003) found a strong negative relation between *PTI* and ETR. We replicate the results of Rego (2003) for its original sample period of 1990-1997 and for our extended sample period of 1988-2016. We confirm the negative association between *PTI* and ETR in both samples. However, when we partition each sample on whether the firm is tax-favored or tax-disfavored, we find that the ETR is increasing in *PTI* for tax-favored firms and decreasing in *PTI* for tax-disfavored firms. We therefore find that the overall result in Rego (2003) arises from a more subtle pattern in which an increase in profitability shifts a firm's ETR toward the statutory rate due to the income effect.

Taken together, our results make several important contributions to the understanding of corporate tax avoidance. We find that firms that are more profitable engage in more tax avoidance, conditional on them being in a tax-favored position. In addition, more profitable tax-disfavored firms have more unfavorable BTDs. We find that a negative association between profitability and ETRs does not mean that firms that are more profitable avoid more tax; rather, this result arises due to the income effect, in which higher income taxed at the statutory tax rate

shifts the ETR toward the statutory tax rate. Finally, we provide evidence that the relation between tax avoidance and profitability is strongest for the for those firms engaging in the greatest level of tax avoidance.

We also contribute to research focused on the measurement of corporate tax avoidance. As in Henry and Sansing (2018), we find that the use of *PTI* in the denominator of an ETR leads to incorrect inferences for certain research questions. Our results imply that using an ETR as the measure of tax avoidance to understand whether more profitable firms exhibit more favorable tax preferences is misguided. Researchers interested in tax preferences that vary with income should focus on BTD-related measures instead. Further, our results underscore the importance of examining tax-favored and tax-disfavored firms separately in studies of corporate tax avoidance.

BACKGROUND AND EXPECTATIONS

A large body of research examines the determinants of tax avoidance.[5] The majority of these studies focus on the extent to which firm-level characteristics can explain variation in a firm's effective tax rate (ETR). For example, Phillips (2003) finds that the structure of management compensation contracts explains firms' tax avoidance activities, whereas Rego (2003) finds that greater foreign operations lead to lower ETRs. Studies also examine the impact of managerial characteristics and their networks on tax avoidance (e.g., Dyreng, Hanlon and Maydew, 2010; Chyz, 2013; and Brown and Drake, 2014), the association between firm reputation and tax avoidance (Davis et al., 2016 and Dyreng, Hoopes and Wilde, 2016), and the relation between corporate governance on tax avoidance (Armstrong et al., 2015; Badertscher, Katz and Rego, 2013).

Although the extant literature shows that myriad firm characteristics affect a firm's ETR, it has yet to reach a consensus as to whether and how profitability affects the ETR. Rego (2003)

[5] See Hanlon and Heitzman (2010) for a review.

focuses specifically on the association between firm size and profitability and tax avoidance. She hypothesizes that larger, more profitable firms will avoid more tax because they have greater incentive to reduce tax payments and more opportunity to use tax preferences. She finds a strong negative association between ETRs and profitability and a positive association between ETRs and firm size, suggesting that while larger firms avoid fewer taxes, more profitable firms engage in more tax avoidance.

However, profitability does not appear to exhibit a robust and consistent empirical association with tax avoidance across the various sample firms and periods. We reviewed all tax avoidance studies using an ETR as the dependent variable published in *The Accounting Review, Journal of Accounting and Economics, Journal of Accounting Research, Contemporary Accounting Research, and Review of Accounting Studies* within the past 5 years. Of the 16 studies that report results from including profitability as a control variable, six document a significant negative association, four document a significant positive association and six document an insignificant association. Studies explain the positive association between profitability and ETRs as arising from the progressivity of the corporate tax structure and/or firms with higher profitability having less of their taxable income offset by permanent tax shields, *ceteris paribus* (Mills, Nutter and Schwab, 2013).

Because the Cash ETR is the primary measure of corporate tax avoidance in contemporary research, we choose to derive analytically the association between it and profitability to develop theory-based predictions for empirical research. To begin, we follow the approach in Henry and Sansing (2018) and decompose the effective tax rate into its underlying components. Let y denote a firm's pretax book income and let τ denote the statutory tax rate. Let cash taxes paid be $\tau y + \Delta$, where Δ represents everything that causes the firm's tax payments to

deviate from τy. We consider a firm to be tax-favored if $\Delta < 0$ and to be tax-disfavored if $\Delta > 0$. The firm's Cash ETR is $\frac{\tau y+\Delta(y)}{y}$, where we allow, but do not require, Δ to vary with y.

Differentiating the Cash ETR with respect to y yields the rate of change in ETR in response to a change in profitability:

$$\frac{\partial CashETR}{\partial y} = \frac{y\Delta'(y)-\Delta(y)}{y^2}. \quad (1)$$

We express the sign of the right-hand side of equation (1) as

$$Sign\left[\frac{\partial CashETR}{\partial y}\right] = Sign\left[\Delta'(y) - \frac{\Delta(y)}{y}\right]. \quad (2)$$

Expressing the effect of income on the Cash ETR in this way shows that two factors are at play. The first term, $\Delta'(y)$, represents the possibility that firms with more income generate more book-tax differences, which we call the tax avoidance effect. For example, if a firm has a net operating loss (NOL) carryover, an increase in PTI increases the amount of the NOL that can be used. In addition, a more profitable firm could be more likely to make greater capital investments, which would reduce cash taxes paid if capital expenditures generate favorable book-tax differences. Alternatively, a more profitable firm could hire more workers, thereby generating unfavorable book-tax differences to the extent a larger workforce increases the firm's accrued post-retirement health care benefits. Thus, the sign of the tax avoidance effect is *ex ante* unclear.

The second term on the right-hand side of equation (2), $-\frac{\Delta(y)}{y}$, reflects the income effect, decreasing Cash ETR when $\Delta > 0$ and increasing it when $\Delta < 0$. Suppose a firm's BTD does not vary with income, so $\Delta'(y) = 0$. This could occur, for example, if reductions in taxes associated with fixed costs do not increase with pretax income because fixed costs do not vary with output volume. The Cash ETR of a firm with favorable BTDs arising from the fixed costs will increase

in its profitability, as the additional income increases cash taxes paid at the statutory rate. The reverse occurs if the firm has unfavorable book-tax differences that do not vary with pretax income, such as a write-down of goodwill following an acquisition in which goodwill was recognized for financial reporting purposes but not for tax purposes. In this case, higher pretax profitability taxed at the statutory rate will lower the ETR. In each case, higher pretax income moves the ETR toward the statutory rate, even though the level of tax avoidance is not changing as income changes.

Our derivation suggests that the relation between pretax profitability and the ETR is theoretically ambiguous. It depends jointly on how higher profitability affects book-tax differences, Δ, and whether aggregate book-tax differences are favorable ($\Delta < 0$) or unfavorable ($\Delta > 0$). Equation (2) suggests that a negative association between profitability and Cash ETR could arise for very different reasons. There could be a negative association between profitability and BTDs ($\Delta'(y) < 0$), reflecting the tax avoidance effect. Alternatively, a firm could have unfavorable BTDs that do not vary with income ($\Delta > 0$ and $\Delta'(y) = 0$), in which case the negative association reflects the income effect. Which effect is stronger is an empirical question, to which we now turn.

EMPIRICAL ANALYSIS

Research Method

In this section, we examine which term in equation (2) explains the association between profitability and ETR in a sample of Compustat firms. We first estimate the overall association between ETR and profitability (*ROA*) by regressing Cash ETR on *ROA* as follows:

$$Cash\ ETR_{i,t} = \alpha_0 + \beta_1 ROA_{i,t} + \varepsilon_{i,t} \quad (3)$$

where Cash ETR is equal to cash taxes paid divided by pre-tax book income. Cash ETR is reset to fall between zero and one.[6] *ROA* is equal to pretax profitability divided by market value of assets.[7]

We then estimate $\Delta'(y)$, the association between Δ and profitability. Henry and Sansing (2018) develop a measure of Δ, which is equal to the difference between cash taxes paid, adjusted for the change in tax receivables, and the product of a firm's pre-tax income and the statutory tax rate. Essentially, Δ reflects cash-basis BTDs and the extent to which they are favorable or unfavorable. To estimate $\Delta'(y)$, we regress scaled Δ on *ROA* as follows:

$$\Delta/MVA_{i,t} = \alpha_0 + \delta_1 ROA_{i,t} + \gamma_{i,t} \ . \quad (4)$$

We estimate both equations (3) and (4) for a full sample of firms and then separately for tax-favored (Δ<0) and tax-disfavored (Δ>0) firm-year observations. We then use the estimated coefficient δ_1 to infer which of the two effects described above explains the estimated coefficient β. We estimate equations (3) and (4) using both one- and ten-year measures of Cash ETR and Δ*/MVA* to understand patterns in both short- and long-run corporate tax avoidance.

Finally, we estimate equations (3) and (4) on a multivariate basis including control variables used in the prior literature (e.g., Dyreng, Hanlon and Maydew, 2008). Control variables include firm size (*SIZE*), leverage (*LEV*), the ratio of intangible assets to total assets (*INTAN*), advertising expense (*ADV*), capital expenditures (*CAPEX*), the existence of foreign operations (*FOR*), the existence of a net operating loss carryforward (*NOL*), property, plant, and equipment (*PPE*), selling, general and administrative expense (*SGA*), and research and development expense (*R&D*). Detailed variable definitions are included in Table 2.

[6] We reset Cash ETR to remain consistent with the approach taken in the prior literature. We also winsorize the ETR at its first and 99th percentiles, and find our results unchanged.
[7] Market value of assets (*MVA*) is equal to a firm's book value of assets (AT) plus the difference between market value of equity (PRCC_F*CSHO) and book value of equity (SEQ).

Sample and Descriptive Statistics

We construct a sample of firm-year observations spanning 1988-2016, the longest period for which information about cash taxes paid is available. We follow the sample selection procedure from the extant literature (e.g., Dyreng, Hanlon and Maydew, 2008; Henry and Sansing, 2018) by dropping firms with non-missing pretax income and cash taxes paid, observations with negative pretax income, and missing Compustat information to construct a standard set of one-year and ten-year firm-level characteristics used in previous tax avoidance studies. Our sample of one-year measures consists of 79,562 firm-year observations and our sample of ten-year measures consists of 24,760 firm-year observations. Our sample selection procedure is outlined in Table 1.

We present in Table 2 descriptive statistics for our full sample of profitable firms and separately for tax-favored and tax-disfavored firm-years. A greater proportion of profitable firms are tax-favored (55,353 tax-favored firm-years versus 24,234 tax-disfavored firm-years). We find that tax-favored firms have statistically larger average *ROA*, suggesting that more profitable firms engage in more tax avoidance. Tax-favored firms are also larger in terms of total assets and tangible assets. As expected, tax-favored firms also have larger tax preferences in the form of net operating loss carryforwards and research and development expenditures. Finally, tax-favored firms also have greater leverage.

Results

The results of estimating equations (3) and (4) on a univariate basis for the full sample of profitable firm-years and separately for tax-favored and tax-disfavored firms are provided in Table 3. We cluster standard errors by firm. We focus our discussion on the one-year analyses in Panels A and B, as the ten-year measures yield similar results in Panels C and D. First, we find a statistically and economically significant negative relation between *ROA1* and Cash ETR in the

full sample of profitable firm-years (coefficient estimate of -0.5170 and *t*-statistic of -28.27). However, we find that this negative association is non-monotone across tax-favored and tax-disfavored firm-years. The association between *ROA1* and Cash ETR is positive and significant when a firm's Cash ETR is less than the statutory tax rate (coefficient estimate of 0.0946 and *t*-statistic of 7.97) but it is negative and significant when a firm's Cash ETR exceeds the statutory rate (coefficient estimate of -1.7530 and *t*-statistic of -40.13). This result suggests that for firms with Cash ETRs less than the statutory tax rate, increases in profitability actually increase the ETR, while profitability decreases the ETR for firms in tax-disfavored positions. Further, the results in Panel A provide an explanation for the mixed evidence in prior literature because the underlying relation between ETR and *ROA* is not monotone.

In Panel B of Table 3, we report the estimated association between scaled Δ and *ROA*. We find that *ROA1* is negatively associated with Δ*/MVA1* in the full sample of profitable firms (coefficient estimate of -0.1603 and *t*-statistic of -53.21), suggesting that the BTDs that do vary with income do so negatively. Again, however, we find that tax-favored and tax-disfavored firm-years behave differently. While profitability decreases BTDs for tax-favored firms (coefficient estimate of -0.2129 and *t*-statistic of -92.78), profitability further increases BTDs for tax-disfavored firms (coefficient estimate of 0.0362 and *t*-statistic of 18.52).

Taken together, the results of Panels A and B have several implications. The overall association between Cash ETR and *ROA* is positive for tax-favored firms, but the association between Δ*/MVA* and *ROA* is negative. This means that the positive association between profitability and Cash ETR for tax-favored firms is a result of the income effect, in which an extra dollar of income taxed at the statutory rate increases the Cash ETR. Similarly, the income effect shifts the Cash ETR down toward the statutory rate for tax-disfavored firms, outweighing the tax avoidance effect that shows that BTDs are increasing in income for tax-disfavored firms.

Without separate examination of tax-favored and tax-disfavored firms, one would conclude from Panel A that more profitable firms avoid more taxes. What is clear from our analytic and empirical analysis is that this result is actually driven by firms whose Cash ETR *exceeds* the statutory tax rate. Moreover, this result is driven by the income effect. When focusing on a measure of tax preference unaffected by the income effect, Δ/MVA, we find that firms that are more profitable engage in more tax avoidance, conditional on them being in a tax-favored position. However, profitability increases the unfavorable BTDs of tax-disfavored firms.

In Table 4, we confirm that our conclusions with respect to *ROA* and Cash ETR and Δ/MVA remain when including variables that control for other determinants of corporate tax avoidance. We also find that the relation between tax avoidance and several other firm characteristics are similarly non-monotone. *LEV1* and *R&D1* are negatively associated with Cash ETR for tax-favored observations but positively associated with Cash ETR for tax-disfavored observations. The result is similar, but in an opposite direction, of the profitability result because increases in each of these variables decrease both taxable income and pretax income. Thus, if each of these variables reduces taxable income at the statutory rate, the Cash ETR will be mechanically shifted away from the statutory rate. We also perform a series of robustness tests to confirm our conclusion holds across various regression specifications. We find our conclusions are robust to including industry fixed effects and to scaling variables by book value of assets, as opposed to market value of assets.

The OLS regression results presented in Table 4 suggest that, on average, firms that are more profitable are more tax favored. This analysis describes the association between profitability and tax avoidance at the conditional mean of the tax avoidance distribution. To provide a fuller understanding of the relation between profitability and tax avoidance, we perform a quantile regression analysis. Quantile regression provides a more comprehensive

analysis of the relations between variables because it allows us to consider the effect of *ROA* on the entire distribution of cash tax avoidance, not just its conditional mean. In other words, by estimating regression coefficients at various quantiles, we can determine whether the association between profitability and tax avoidance for the firms that are most tax favored differs than other quantiles of tax avoidance.

In Table 5, we report estimates from estimating equations (3) and (4) on a multivariate basis across quantiles of Cash ETR and Δ*/MVA*.[8] In Panels A and B, we find that the coefficient estimate on *ROA* is always negative and statistically significant for all deciles of Δ*/MVA1* and Δ*/MVA10* except the highest (i.e., the most tax-disfavored observations). The quantile regression estimates illustrate a clear monotone pattern; the coefficient on *ROA* is most negative for the lowest Δ*/MVA1* and Δ*/MVA10* quantiles and decreases in magnitude as both Δ*/MVA1* and Δ*/MVA10* increase. These patterns suggest that the relation between profitability and tax avoidance is strongest, both economically and statistically, for the firms that avoid the most cash taxes, i.e., for firms with the lowest values of Δ*/MVA.* According to equation (2), if there were no income effect, we would then expect to see a coefficient on *ROA* in Cash ETR regressions that is negative in all quantiles. Instead, we observe that the relation between *ROA* and both the one-year and ten-year Cash ETR is positive for the first four quantiles and negative for the last five. Thus, the income effect outweighs the tax avoidance effect in the first four quantiles, creating a positive relation between *ROA* and the Cash ETR when the ETR is sufficiently low.

APPLICATION TO PRIOR RESESARCH

Our empirical results thus far provide insight into the association between profitability and Cash ETR for our broad sample of Compustat firms. But as our description of prior research indicates, the empirical association between the two tends to vary across studies. As a result, we

[8] We include control variables but do not report their coefficient estimates across quantiles for ease of exposition.

re-examine the results of prior literature through the lens of equation (2) and the subsets of tax-favored and tax-disfavored firms. We choose to focus on Rego (2003), which focuses explicitly on the association between profitability and tax avoidance.[9] She hypothesizes in her study that firms with greater pre-tax income avoid more taxes than other firms, resulting in lower ETRs. She tests this hypothesis by regressing worldwide GAAP-based ETRs on a proxy for firm size (natural log of total net sales) and profitability (natural log of pre-tax income), as well as proxies for the extent of foreign operations, an indicator for whether or not the firm is a multi-national corporation (MNC), and the interaction of the MNC indicator with firm size and profitability. The results in Rego (2003) consistently support the hypothesis that more profitable firms avoid more taxes.

In this section, we replicate the results in Rego (2003), which are based on the worldwide GAAP ETR (*WWETR*) in a sample of firms from 1990-1997, and extend them to our setting of a cash-based ETR and a sample period of 1988-2016. Table 6 presents the results from our explicit replication of Rego (2003). Our sample size of 17,749 firm-year observations are similar to her sample of 19,737 firm-year observations. Our descriptive statistics are also similar in magnitude to those in Table 3 of Rego (2003). Finally, we report results nearly identical to those in Rego (2003)'s Table 4 which shows that her measure of pre-tax profitability is significantly negatively related to *WWETR*.[10]

In Table 7, we extend Rego (2003) by expanding the sample period to match that of our empirical analyses and also drop firms with data insufficient to compute a Cash ETR and ΔMVA measure. This process, presented in Panel A of Table 7, results in a sample of 34,579 firm-year

[9] In contrast, other studies of tax avoidance use profitability as a control variable for research questions unrelated to profitability.

[10] As in Rego (2003), we also include year and industry fixed effects. However, we do not include geographic indicators because our results show that coefficient estimates and the adjusted R^2 are similar in economic and statistical magnitude without their inclusion.

observations. Panel B presents descriptive statistics for the variables used in Rego (2003) with the expanded sample of firms.

We confirm that *WWETR* is negatively associated with pre-tax profitability in the expanded sample period in Panel A of Table 8. In Panel B, we extend the results of Rego (2003) to the use of the Cash ETR and find that it too is negatively associated with profitability for the full sample of profitable firms. We also partition the results on whether or not a firm is tax-favored or tax-disfavored. Again, both ETR measures are increasing in *PTI* for tax-favored firms and decreasing in *PTI* for tax dis-favored firms. In Panel C, we confirm that this result is consistent with the income effect.

We note that in the results presented in Table 4, ETR is increasing in size for tax-favored firms but decreasing in size for tax-disfavored firms, where we measure *SIZE* as the natural log of total assets. The opposite pattern holds in Panels A and B of Table 8, where *SIZE* is measured as the natural log of total net sales. This occurs because Rego (2003) includes both a measure of size and unscaled natural log of *PTI* in the regressions. Because the log of *PTI* is equal to the log of total sales plus the log of return on sales (*ROS*), size is essentially present in the Rego (2003) regressions twice. If we replace the log of *PTI* with the log of *ROS*, we find results consistent with those in Table 4; i.e., that ETR is increasing in size for tax-favored firms and decreasing in size for tax-disfavored firms.

CONCLUSION

We provide an explanation for why the expected and empirical relation between tax avoidance and profitability is theoretically ambiguous and therefore inconsistent across studies of tax avoidance. We find that two effects are in play. First, a firm with higher income tends to have larger absolute BTDs. As a result, the ETR of tax-favored firms is decreasing in income and the ETR of tax-disfavored firms is increasing in income, which we call the tax avoidance effect.

Second, the income effect shifts the ETR toward the statutory tax rate for all firms. We show that the income effect dominates the tax avoidance effect in explaining the association between ETR and pre-tax income. The overall negative association between profitability and ETRs documented in previous research is driven by the income effect of tax-disfavored firms, where additional income shifts the ETR downward toward the statutory rate. Our results imply that using an ETR as the measure of tax avoidance to understand whether more profitable firms exhibit more favorable tax preferences yields misleading inferences. Researchers interested in tax preferences that vary with income should focus on BTD-related measures instead. Further, our results underscore the importance of separate examination of tax-favored and tax-disfavored firms in studies of corporate tax avoidance.

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Table 1: Sample Selection

Sample Period	One Year Measures 1988 - 2016	Ten Year Measures 1997 - 2016
Domestic Corporation Firm-Years	204,701	51,852
Less:		
Missing pretax income	(31,002)	(16,339)
Missing cash taxes paid	(36,972)	(3,977)
PTI <0	(46,724)	(3,074)
Missing control variables	(10,416)	(3,688)
Sample Firm-Years	**79,587**	**24,774**

This table presents the sample selection process for observations examined in this study. The sample period begins in 1988 and ends in 2016. Sample selection begins with the population of domestic corporate entities where Compustat variable STKO is not equal to 1 (subsidiary of a publicly traded company), STKO is not equal to 2 (subsidiary of a non-publicly traded company), and where STKO is equal to 0 (publicly traded company) and share price is non-missing as our reading of firms' 10-Ks indicates that, although the firm is currently a publicly traded firm, the firm-years included in our study represent subsidiary years. After dropping subsidiary observations, we drop observations with missing pretax income and cash taxes paid, loss observations and observations with missing information necessary to compute Δ/MVA or Cash ETR.

Table 2: Descriptive Statistics for the Full Sample of Firms and its Various Subsamples

Panel A: One-year measures

	Full Sample			ETR < Statutory Rate (1)		
	N	**Mean**	**Std.**	**N**	**Mean**	**Std.**
Cash ETR1	79,587	0.2740	0.2350	55,353	0.1560	0.1173
Δ/MVA1	79,587	-0.0069	0.0184	55,353	-0.0133	0.0177
ROA1	79,587	0.0700	0.0597	55,353	0.0721	0.0621
SIZE1	79,587	5.7204	2.2206	55,353	5.7488	2.2997
LEV1	79,587	0.1548	0.1795	55,353	0.1590	0.1823
INTAN1	79,587	0.0885	0.1442	55,353	0.0888	0.1451
ADV1	79,587	0.0083	0.0224	55,353	0.0076	0.0213
CAPEX1	79,587	0.0455	0.0555	55,353	0.0467	0.0590
FOR1	79,587	0.3449	0.4753	55,353	0.3460	0.4757
NOL1	79,587	0.3118	0.4632	55,353	0.3513	0.4774
PPE1	79,587	0.4244	0.3974	55,353	0.4347	0.4103
SGA1	79,587	0.1877	0.2061	55,353	0.1790	0.2057
R&D1	79,587	0.0142	0.0297	55,353	0.0151	0.0310

	ETR ≥ Statutory Rate (2)			Differences in Means	
	N	**Mean**	**Std.**	**(1) – (2)**	
Cash ETR1	24,234	0.5435	0.2136	-0.3874	***
Δ/MVA1	24,234	0.0078	0.0096	-0.0211	***
ROA1	24,234	0.0651	0.0534	0.0070	***
SIZE1	24,234	5.6554	2.0269	0.0934	***
LEV1	24,234	0.1453	0.1724	0.0136	***
INTAN1	24,234	0.0876	0.1421	0.0012	
ADV1	24,234	0.0099	0.0248	-0.0023	***
CAPEX1	24,234	0.0427	0.0467	0.0040	***
FOR1	24,234	0.3424	0.4745	0.0035	
NOL1	24,234	0.2214	0.4152	0.1300	***
PPE1	24,234	0.4007	0.3650	0.0340	***
SGA1	24,234	0.2076	0.2057	-0.0286	***
R&D1	24,234	0.0119	0.0266	0.0032	***

Panel B: Ten-year measures

	Full Sample			ETR < Statutory Rate (1)		
	N	**Mean**	**Std.**	**N**	**Mean**	**Std.**
Cash ETR10	24,774	0.3221	0.1766	16,365	0.2364	0.0895
Δ/MVA10	24,774	-0.0023	0.0064	16,365	-0.0056	0.0048
ROA10	24,774	0.0554	0.0284	16,365	0.0561	0.0255
SIZE10	24,774	6.5715	2.0848	16,365	6.8290	2.0855
LEV10	24,774	0.1386	0.1265	16,365	0.1397	0.1272
INTAN10	24,774	0.0872	0.1108	16,365	0.0860	0.1109
ADV10	24,774	0.0068	0.0164	16,365	0.0058	0.0142
CAPEX10	24,774	0.0388	0.0345	16,365	0.0403	0.0372
FOR10	24,774	0.5291	0.4992	16,365	0.5412	0.4983
NOL10	24,774	0.5170	0.4997	16,365	0.5385	0.4985
PPE10	24,774	0.4155	0.3359	16,365	0.4202	0.3448
SGA10	24,774	0.1503	0.1467	16,365	0.1254	0.1281
R&D10	24,774	0.0106	0.0196	16,365	0.0107	0.0191

	ETR ≥ Statutory Rate (2)			Differences in Means	
	N	**Mean**	**Std.**	**(1) – (2)**	
Cash ETR10	8,409	0.4888	0.1851	-0.2524	***
Δ/MVA10	8,409	0.0042	0.0039	-0.0098	***
ROA10	8,409	0.0540	0.0333	0.0021	***
SIZE10	8,409	6.0706	1.9903	0.7584	***
LEV10	8,409	0.1364	0.1250	0.0032	*
INTAN10	8,409	0.0893	0.1106	-0.0033	**
ADV10	8,409	0.0089	0.0198	-0.0031	***
CAPEX10	8,409	0.0359	0.0283	0.0044	***
FOR10	8,409	0.5055	0.5000	0.0356	***
NOL10	8,409	0.4753	0.4994	0.0631	***
PPE10	8,409	0.4062	0.3175	0.0140	***
SGA10	8,409	0.1988	0.1671	-0.0734	***
R&D10	8,409	0.0105	0.0207	0.0002	

This table presents descriptive statistics of *Cash ETR, Δ/MVA* and other firm characteristics for one-year and ten-year samples. The columns labeled "Full Sample" represent characteristics of the entire sample of profitable domestic firm-year observations. The columns labeled "ETR<Statutory Rate" represent observations where *Cash ETR* is less than the statutory tax rate (34 percent for years 1988-1992 and 35 percent thereafter) and the columns labeled "ETR≥Statutory Rate" represent observations where *Cash ETR* is greater than the statutory rate. Columns labeled "Test of Differences in Means" present *t*-tests of differences in means across each sample partition. ***, **, and * indicate statistical differences at the 1, 5, and 10 percent levels, respectively, using a two-tailed test. *Cash ETR1* is equal to cash taxes paid (TXPD) divided by pretax income (PTI) and *CashETR10* is equal to the sum of TXPD over a 10-year period divided by the sum of PTI over the same 10 year period. Both Cash ETR measures are reset to fall between 0 and 1. *ROA1* and *ROA10* represent pretax return on assets and are equal to pretax income divided by market value of assets. *SIZE1* and *SIZE10* are equal to the natural log of average total assets (AT) over 1- and 10-year periods. *LEV1* and *LEV10* are equal to the average long-term debt (DLTT) divided by market value of assets. *INTAN1* and *INTAN10* are equal to the average ratio of intangibles (INTAN) to market value of assets over the 1- and 10-year sample periods. *ADV1* and *ADV10* are computed as the advertising expense (XAD) scaled by market value of assets. *ADV* is set equal 0 if missing. *CAPEX1* and *CAPEX10* are equal to capital expenditures (CAPX) divided by market value of assets. *FOR1* and *FOR10* is an indicator variable equal to 1 if the firm reports a non-missing, nonzero amount of pretax foreign income (PIFO) in any of the 1- or 10-year computation periods, respectively. *NOL1* and *NOL10* represent an indicator variable set equal to one if a firm reports a non-missing,

nonzero amount of net operating loss carryforward (TLCF) in any of the 1- or 10-year computation periods, respectively. *PPE1* and *PPE10* is equal to ratio of the sum of gross property plant and equipment (PPEGT) to market value of assets over 1 and 10 years. *SGA1* and *SGA10* are equal to the sum of selling, general and administrative expense (XSGA) divided by the sum of market value of assets over the 1- and 10-year periods. *R&D1* and *R&D10* is computed as the sum of research and development expense (XRD) divided by the sum of market value of assets over 1- and 10-year periods. Compustat data items are in parentheses. All other variables are winsorized at 1 and 99 percent.

Table 3 – The Association between Profitability and Tax Avoidance
Univariate Regressions of Cash ETR1 and Cash Book-Tax Differences (Δ*/MVA*) on Scaled Profitability (*ROA*)

$$CashETR_{i,t} = \alpha_0 + \beta_1 ROA_{i,t} + \varepsilon_{i,t}$$
$$\Delta/MVA_{i,t} = \alpha_0 + \delta_1 ROA_{i,t} + \gamma_{i,t}$$

Panel A: One Year Cash ETR

Measure:	Full Sample *Cash ETR1*			ETR < Statutory Rate *Cash ETR1*			ETR ≥ Statutory Rate *Cash ETR1*		
	Coeff.	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**
α	0.3102	0.0022	142.02	0.1492	0.0013	115.07	0.6576	0.0033	202.09
ROA1	-0.5170	0.0183	-28.27	0.0946	0.0119	7.97	-1.7530	0.0437	-40.13
N		79,587			55,353			24,234	
R^2		0.017			0.003			0.192	

Panel B: One Year Δ/MVA

Measure:	Full Sample Δ*/MVA1*			ETR < Statutory Rate Δ*/MVA1*			ETR ≥ Statutory Rate Δ*/MVA1*		
	Coeff.	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**
α	0.0043	0.0002	25.83	0.0021	0.0001	15.15	0.0054	0.0001	40.58
ROA1	-0.1603	0.0030	-53.21	-0.2129	0.0023	-92.78	0.0362	0.0020	18.52
N		79,587			55,353			24,234	
R^2		0.270			0.561			0.041	

Panel C: Ten Year Cash ETR

Measure:	Full Sample *Cash ETR10*			ETR < Statutory Rate *Cash ETR10*			ETR ≥ Statutory Rate *Cash ETR10*		
	Coeff.	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**
α	0.3794	0.0075	50.69	0.1742	0.0041	42.58	0.6596	0.0078	84.35
ROA1	-1.0344	0.1045	-9.90	1.1087	0.0664	16.71	-3.1626	0.1196	-26.44
N		24,774			16,365			8,409	
R^2		0.028			0.100			0.325	

Panel D: Ten Year Δ/MVA

Measure:	Full Sample Δ*/MVA10*			ETR < Statutory Rate Δ*/MVA10*			ETR ≥ Statutory Rate Δ*/MVA10*		
	Coeff.	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**	**Coeff.**	**StErr**	***t*-Stat**
α	-0.0004	0.0002	-1.55	-0.0029	0.0002	-13.98	0.0045	0.0002	26.5
ROA1	-0.0350	0.0045	-7.85	-0.0491	0.0044	-11.27	-0.0068	0.0028	-2.40
N		24,774			24,774			8,409	
R^2		0.0240			0.069			0.003	

This table presents univariate regressions of Cash ETR and Δ*/MVA* on *ROA* for one- and ten-year samples. The columns labeled "Full Sample" represent characteristics of the entire sample of profitable domestic firm-year observations. The columns labeled "ETR<Statutory Rate" represent observations where *Cash ETR* is less than the statutory tax rate (34 percent for years 1988-1992 and 35 percent thereafter) and the columns labeled "ETR≥Statutory Rate" represent observations where *Cash ETR* is greater than the statutory rate. *Cash ETR* is reset to 0 and 1, while Δ*/MVA* and *ROA* are winsorized at the 1st and 99th percentiles. Detailed variable definitions are in Table 2.

Table 4 – Multivariate Regressions of Cash ETR1 and Δ/MVA on ROA and Various Firm Characteristics

$$DepVar_{i,t} = a_i + \beta_1 SIZEX_{i,t} + \beta_2 ROAX_{i,t} + \beta_3 LEVX_{i,t} + \beta_4 INTANX_{i,t} + \beta_5 ADVX_{i,t} + \beta_6 CAPEXX_{i,t} + \beta_7 FORX_{i,t} + \beta_8 NOLX_{i,t} + \beta_9 PPEX_{i,t} + \beta_{10} SGAX_{i,t} + \beta_{11} R\&D_{Xi,t} + \varepsilon_{i,t}$$

Panel A: One Year Cash ETR

	Full Sample			**ETR < Statutory Rate**			**ETR ≥ Statutory Rate**		
DepVar=	*Cash ETR1*			*Cash ETR1*			*Cash ETR1*		
	Coeff.	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
α	0.3110	0.0052	60.27	0.1027	0.0031	33.59	0.7186	0.0070	102.58
SIZE1	0.0031	0.0007	4.18	0.0123	0.0005	26.06	-0.0193	0.0009	-20.70
ROA1	-0.6206	0.0196	-31.60	0.1796	0.0118	15.22	-1.9348	0.0456	-42.40
LEV1	-0.0708	0.0088	-8.01	-0.0898	0.0048	-18.67	0.0708	0.0113	6.28
INTAN1	0.0524	0.0097	5.40	0.0163	0.0058	2.82	0.0689	0.0120	5.74
ADV1	0.1319	0.0567	2.32	0.0425	0.0344	1.24	0.0540	0.0709	0.76
CAPEX1	0.0498	0.0271	1.84	0.0276	0.0147	1.88	0.1532	0.0455	3.37
FOR1	0.0416	0.0029	14.18	0.0276	0.0019	14.46	0.0115	0.0036	3.24
NOL1	-0.0869	0.0026	-33.44	-0.0480	0.0015	-31.73	0.0158	0.0036	4.32
PPE1	-0.0229	0.0046	-4.92	-0.0214	0.0024	-8.80	0.0224	0.0066	3.41
SGA1	0.1203	0.0077	15.57	0.0198	0.0046	4.31	0.0694	0.0093	7.49
R&D1	-0.5867	0.0440	-13.32	-0.3975	0.0237	-16.79	0.4849	0.0603	8.04
N		79,587			55,353			24,234	
R^2		0.063			0.145			0.249	

Panel : One Year Δ/MVA

	Full Sample			**ETR < Statutory Rate**			**ETR ≥ Statutory Rate**		
DepVar=	*Δ/MVA*			*Δ/MVA*			*Δ/MVA*		
	Coeff.	**StErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
α	0.0056	0.0004	14.25	0.0008	0.0003	2.49	0.0077	0.0004	21.60
SIZE1	0.0003	0.0001	6.03	0.0006	0.0000	15.65	-0.0007	0.0000	-14.34
ROA1	-0.1673	0.0030	-55.73	-0.2104	0.0023	-89.74	0.0269	0.0020	13.73
LEV1	-0.0076	0.0006	-12.61	-0.0073	0.0005	-15.64	0.0015	0.0006	2.60
INTAN1	0.0009	0.0007	1.30	0.0003	0.0006	0.59	0.0015	0.0006	2.61
ADV1	0.0142	0.0051	2.76	0.0123	0.0041	3.00	-0.0005	0.0041	-0.12
CAPEX1	0.0006	0.0024	0.25	0.0034	0.0017	2.06	-0.0012	0.0028	-0.45
FOR1	0.0015	0.0002	7.52	0.0015	0.0002	9.26	0.0005	0.0002	3.10
NOL1	-0.0065	0.0002	-35.94	-0.0041	0.0001	-28.68	-0.0005	0.0002	-2.93
PPE1	-0.0017	0.0004	-4.76	-0.0015	0.0002	-6.03	0.0017	0.0004	4.74
SGA1	0.0071	0.0007	9.59	0.0014	0.0006	2.35	0.0047	0.0005	8.97
R&D1	-0.0501	0.0037	-13.4	-0.0297	0.0029	-10.25	0.0142	0.0033	4.31
N		79,587			55,353			24,234	
R^2		0.312			0.589			0.085	

Panel C: Ten Year Cash ETR

	Full Sample			ETR < Statutory Rate			ETR ≥ Statutory Rate		
DepVar=	*Cash ETR10*			*Cash ETR10*			*Cash ETR10*		
	Coeff.	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
α	0.4763	0.0146	32.72	0.1926	0.0093	20.74	0.7381	0.0180	40.90
SIZE10	-0.0127	0.0014	-8.78	0.0024	0.0010	2.38	-0.0175	0.0020	-8.80
ROA10	-1.5011	0.1087	-13.8	0.9307	0.0655	14.21	-3.2252	0.1290	-25.01
LEV10	-0.0588	0.0293	-2.01	-0.0784	0.0164	-4.77	0.0468	0.0370	1.26
INTAN10	0.1077	0.0276	3.90	0.0005	0.0173	0.03	0.0882	0.0347	2.54
ADV10	-0.0368	0.1505	-0.24	0.0229	0.1040	0.22	-0.0301	0.1480	-0.20
CAPEX10	-0.5908	0.1078	-5.48	-0.4336	0.0712	-6.09	0.0434	0.1604	0.27
FOR10	0.0220	0.0053	4.17	0.0154	0.0033	4.70	0.0063	0.0063	0.99
NOL10	-0.0344	0.0047	-7.38	-0.0245	0.0030	-8.23	0.0075	0.0061	1.23
PPE10	0.0271	0.0126	2.15	0.0042	0.0080	0.52	0.0048	0.0162	0.29
SGA10	0.2482	0.0209	11.86	0.1053	0.0158	6.66	0.0308	0.0204	1.51
R&D10	-0.7371	0.1371	-5.38	-0.6002	0.0903	-6.65	0.0519	0.1518	0.34
N		24,774			16,365			8,409	
R^2		0.123			0.195			0.361	

Panel D: Ten Year Δ/MVA

	Full Sample			ETR < Statutory Rate			ETR ≥ Statutory Rate		
DepVar=	*Δ/MVA10*			*Δ/MVA10*			*Δ/MVA10*		
	Coeff.	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
α	0.0033	0.0006	5.73	-0.0010	0.0005	-2.08	0.0057	0.0005	11.43
SIZE10	-0.0003	0.0001	-5.17	0.0001	0.0001	1.04	-0.0004	0.0001	-7.02
ROA10	-0.0538	0.0044	-12.09	-0.0586	0.0041	-14.18	-0.0100	0.0032	-3.09
LEV10	-0.0017	0.0010	-1.72	-0.0026	0.0008	-3.10	0.0001	0.0009	0.09
INTAN10	0.0009	0.0011	0.81	-0.0015	0.0010	-1.53	0.0034	0.0009	3.68
ADV10	-0.0045	0.0062	-0.73	0.0003	0.0061	0.05	-0.0016	0.0047	-0.35
CAPEX10	-0.0374	0.0051	-7.28	-0.0305	0.0045	-6.75	0.0040	0.0047	0.86
FOR10	0.0005	0.0002	2.54	0.0006	0.0002	3.07	0.0001	0.0002	0.84
NOL10	-0.0019	0.0002	-9.98	-0.0015	0.0002	-8.72	-0.0001	0.0002	-0.73
PPE10	0.0012	0.0005	2.46	0.0003	0.0004	0.65	0.0006	0.0004	1.37
SGA10	0.0113	0.0009	12.27	0.0063	0.0009	6.96	0.0024	0.0006	3.96
R&D10	-0.0352	0.0056	-6.25	-0.0336	0.0050	-6.70	0.0028	0.0046	0.61
N		24,774			16,365			8,409	
R^2		0.152			0.177			0.063	

This table presents the results of OLS regressions of Cash ETR1(10) and Δ/MVA1 (10) on profitability (ROA) and various firm characteristics known to explain tax avoidance. The columns labeled "Full Sample" represent characteristics of the entire sample of profitable domestic firm-year observations. The columns labeled "ETR<Statutory Rate" represent observations where *Cash ETR* is less than the statutory tax rate (34 percent for years 1988-1992 and 35 percent thereafter) and the columns labeled "ETR≥Statutory Rate" represent observations where *Cash ETR* is greater than the statutory rate. *Cash ETR* is winsorized at 0 and 1, while all other continuous variables are winsorized at the 1st and 99th percentiles. Detailed variable definitions are in Table 2.

Table 5 - Quantile Regressions of Cash ETR1 and Δ/MVA on ROA and Various Firm Characteristics

$$DepVar_{i,t} = a_i + \beta_1 SIZEX_{i,t} + \beta_2 ROAX_{i,t} + \beta_3 LEVX_{i,t} + \beta_4 INTANX_{i,t} + \beta_5 ADVX_{i,t} + \beta_6 CAPEXX_{i,t} + \beta_7 FORX_{i,t} + \beta_8 NOLX_{i,t} + \beta_9 PPEX_{i,t} + \beta_{10} SGAX_{i,t} + \beta_{11} R\&D_{Xi,t} + \varepsilon_{i,t}$$

Panel A: One-year Measures

	DepVar = CashETR1		***DepVar = Δ/MVA1***	
Quantile of *DepVar*	**Coef. Est. for *ROA1***	***t*-Stat**	**Coef. Est. for *ROA1***	***t*-Stat**
0.10	0.0278	9.38	-0.316	-403.44
0.20	0.0722	7.9	-0.2732	-257.67
0.30	0.0897	6.69	-0.2335	-155.71
0.40	0.0608	3.74	-0.1712	-85.1
0.50	-0.0524	-2.82	-0.1186	-63.23
0.60	-0.2231	-11.21	-0.079	-50.97
0.70	-0.4867	-23.17	-0.0479	-29.14
0.80	-0.9023	-50.27	-0.0237	-14.42
0.90	-1.6034	-79.43	-0.002	-0.89
Controls	**YES**	**YES**	**YES**	**YES**
N	79,587	79,587	79,587	79,587
Avg. Adj. R1	0.053		0.160	

Panel B: Ten-year Measures

	DepVar = CashETR10		***DepVar = Δ/MVA10***	
Quantile of *DepVar*	**Coef. Est. for *ROA10***	***t*-Stat**	**Coef. Est. for *ROA10***	***t*-Stat**
0.10	1.1631	27.88	-0.1166	-33.14
0.20	0.9131	27.56	-0.0738	-29.07
0.30	0.5987	17.8	-0.0572	-25.1
0.40	0.2666	7.98	-0.0472	-27.5
0.50	-0.0574	-1.92	-0.0409	-21.63
0.60	-0.4186	-14.06	-0.0349	-19.97
0.70	-0.891	-24.97	-0.0318	-17.18
0.80	-1.6167	-40.79	-0.0316	-15.8
0.90	-2.8343	-50.46	-0.0303	-15.98
Controls	**YES**	**YES**	**YES**	**YES**
N	24,774	24,774	24,774	24,774
Avg. Adj. R1	0.093		0.093	

This table presents the results of quantile regressions of Cash ETR1(10) and Δ/MVA1 (10) on profitability (ROA) and various firm characteristics known to explain tax avoidance. *Cash ETR* is winsorized at 0 and 1, while all other continuous variables are winsorized at the 1st and 99th percentiles. Detailed variable definitions are in Table 2.

Table 6 – Replication of Rego (2003)
This table reports the results of replicating Rego (2003) for a sample of firms from 1990-1997

Panel A: Sample Selection Procedures	**As Reported in Rego (2003) 1990 - 1997**	**Replication 1990 - 1997**
Number of firm-years with minimum data requirements from Compustat	52,125	66,677
Less:		
Foreign incorporated firms	(2,249)	(8,118)
Firm-years with zero assets or income	(3,885)	(160)
Firm-years with assets or stockholders' equity < 0	(3,820)	(4,569)
Firm-years with missing ETR data	(122)	(13,716)
Banking, insurance, and utility firms	(4,631)	(5,396)
Firm-years with PTI or total income tax expense < 0	(17,271)	(16,607)
Top and bottom 1%	(410)	(362)
Number of firm-years available for ETR analysis	19,737	17,749

Panel B: Descriptive Statistics

Multinational Subsample

Variable	N	Mean	Std.	Q1	Median	Q3
WWETR	3,783	0.3151	0.1356	0.2429	0.3102	0.3657
USETR	3,783	0.3197	0.1935	0.2146	0.3016	0.3713
FORETR	3,783	0.3849	0.2259	0.2403	0.3513	0.4637
Total *PTI*	3,783	310.69	857.28	17.07	54.03	213.40
U.S. *PTI*	3,783	195.92	561.58	10.33	34.88	137.20
Foreign *PTI*	3,783	113.61	380.37	3.00	12.59	58.64
Total Assets	3,783	3,229.76	11,851.74	161.01	526.75	2,106.30
U.S. assets	3,783	2,120.36	8,826.80	107.96	325.37	1,318.90
Foreign assets	3,783	944.13	3,541.08	31.39	129.38	593.24
Total net sales	3,783	3,083.79	8,663.59	191.16	583.30	2,317.49
U.S. net sales	3,783	2,107.78	6,151.85	136.19	403.40	1,581.67
Foreign net sales	3,783	1,069.14	3,307.85	42.18	155.67	678.26
ROA	3,783	0.1212	0.0688	0.0712	0.1081	0.1579
U.S. *ROA*	3,783	0.1343	0.1145	0.0617	0.1097	0.1736
Foreign *ROA*	3,783	0.1363	0.1127	0.0619	0.1081	0.1755
FOROPER	3,783	0.2847	0.1673	0.1525	0.2616	0.3821

Domestic Subsample

Variable	N	Mean	Std.	Q1	Median	Q3
WWETR	13,966	0.2915	0.1720	0.2011	0.3000	0.3539
Total *PTI*	13,966	55.96	243.01	2.17	7.21	24.37
Total Assets	13,966	663.83	2758.95	26.26	77.11	273.05
Total Net Sales	13,966	677.97	2483.78	32.10	1.87	359.38
ROA	13,966	0.1108	0.0772	0.0533	0.0941	0.1499

Panel C: Rego (2003) Table 4 – Results of worldwide ETR regression analysis

$WWETR_{i,t} = \alpha_0 + \beta_1 SIZE_{i,t} + \beta_2 PTI_{i,t} + \beta_3 FOROPER_{i,t} + \beta_4 FOROPER_{i,t}^2 + \beta_5 MNC_{i,t} + \beta_6 MNCxSIZE_{i,t} + \beta_7 MNCxPTI_{i,t} + \varepsilon_{i,t}$

	(1) *WWETR*		(2) *WWETR*	
	Coefficient Estimate	*t*-statistic	Coefficient Estimate	*t*-statistic
Intercept	0.1503	20.14***	0.1503	20.14**
SIZE	0.0439	26.38***	0.0439	26.38***
PTI	-0.0405	-21.73***	-0.0405	-21.73***
FOROPER			-0.0167	-0.32
$FOROPER^2$			0.0213	0.31
MNC	-0.0157	-1.13	-0.0138	-0.91
MNCxSIZE	0.0169	3.78***	0.0169	3.79***
MNCxPTI	-0.0181	-4.00***	-0.0180	-3.99***
N	17,749		17,749	
Adjusted R^2	6.06%		6.05%	

This table presents the results of replicating Rego (2003). In Panel A, we report the sample selection process as originally reported in Rego (2003) and our replication of it. In Panel B, we report descriptive statistics for the variables used in Rego (2003) using the replicated sample. In Panel C, we report the results of replicating Table 4 in Rego (2003), which regresses the worldwide ETR (*WWETR*) on proxies for firm size (*SIZE*, natural log of total sales plus one), pre-tax income (*PTI*, natural log of pre-tax income plus one), foreign operations (*FOROPER* and $FOROPER^2$, equal to foreign assets divided by total assets), an indicator for whether or not the firm is a multi-national corporation (*MNC*, equal to one if either pre-tax foreign income and *FOROPER* are greater than zero), and interactions between *MNC* and *SIZE* and *MNC* and *PTI*. *WWETR* is set equal to one if it exceeds one. Detailed variable definitions are found in Rego (2003).

Table 7 – Extension of Rego (2003)
Descriptive Statistics
This table reports the descriptive statistics for extending Rego (2003) to the 1988-2016 sample period, the use of *Cash ETR* and Δ*/MVA* as proxies for tax avoidance

Panel A: Sample Selection

	Sample 1988 - 2016
Number of firm-years with minimum data requirements from Compustat	227,221
Less:	
Foreign incorporated firms	(47,400)
Firm-years with zero assets or income	(1,022)
Firm-years with assets or stockholders' equity < 0	(19,949)
Missing GAAP ETR, Cash ETR, and Δ*/MVA* data	(81,764)
Banking, insurance, and utility firms	(11,814)
Firm-years with PTI or total income tax expense < 0	(29,987)
Top and bottom 1%	(704)
Number of firm-years available for ETR analysis	34,579

Panel B: Descriptive Statistics
Multinational Subsample

Variable	N	Mean	Std.	Q1	Median	Q3
WWETR	7,166	0.3037	0.1333	0.2336	0.2997	0.3546
USETR	7,166	0.3055	0.1901	0.2011	0.2923	0.3612
FORETR	7,166	0.3677	0.2156	0.2302	0.3346	0.4405
CashETR	7,166	0.3019	0.1662	0.1965	0.2925	0.3745
Δ*/MVA*	7,166	-0.0040	0.0135	-0.0096	-0.0036	0.0018
Total *PTI*	7,166	727.91	3,520.45	24.85	86.12	329.20
U.S. *PTI*	7,166	372.59	1,329.27	15.06	50.11	201.14
Foreign *PTI*	7,166	351.92	2,519.60	4.81	20.07	96.66
Total Assets	7,166	6,771.56	31,875.79	240.32	828.81	3,322.78
U.S. assets	7,166	3,960.65	18,554.16	159.39	509.21	1,992.12
Foreign assets	7,166	2,655.27	16,998.99	49.81	221.07	941.00
Total net sales	7,166	6,554.69	27,513.13	283.43	933.93	3,487.86
U.S. net sales	7,166	5,753.60	28,867.28	197.60	649.80	2,722.30
Foreign net sales	7,166	3,878.93	25,779.40	69.92	282.00	1,290.00
ROA	7,166	0.1193	0.0664	0.0713	0.1066	0.1535
U.S. *ROA*	7,166	0.1532	1.4629	0.0599	0.1061	0.1693
Foreign *ROA*	7,166	0.1505	0.4585	0.0615	0.1081	0.1791
FOROPER	7,166	0.3062	0.2074	0.1547	0.2717	0.4081

Domestic Subsample

Variable	N	Mean	Std.	Q1	Median	Q3
WWETR	27,413	0.2832	0.1690	0.1911	0.2938	0.3491
CashETR	27,413	0.3112	0.2148	0.1610	0.3017	0.4024
Δ*/MVA*	27,413	-0.0043	0.0883	-0.0103	-0.0027	0.0037
Total *PTI*	27,413	127.05	710.35	4.0150	14.8820	59.0150
Total Assets	27,413	1,532.71	11,174.72	48.63	169.42	633.63
Total Net Sales	27,413	1,529.85	6,740.73	59.25	207.43	768.14
ROA	27,413	0.1108	0.0752	0.0548	0.0944	0.1499

This table presents the results of extending the sample period from 1990-1997 as in Rego (2003) to our longer period of 1988-2016. In Panel A, we report the sample selection process. In Panel B, we report descriptive statistics for the variables used in Rego (2003) using the extended sample period. Detailed variable definitions are found in Rego (2003).

Table 8 – Extension of Rego (2003)
Regressions of Tax Avoidance on Profitability and Size
This table reports the results of regressing GAAP ETR, Cash ETR, and cash BTDs on firm profitability and size for the full 1988-2016 sample period and across tax favored and disfavored firm-year observations.

$DepVar_{i,t} = \alpha_0 + \beta_1 SIZE_{i,t} + \beta_2 PTI_{i,t} + \beta_3 FOROPER_{i,t} + \beta_4 FOROPER_{i,t}^2 + \beta_5 MNC_{i,t} + \beta_6 MNCxSIZE_{i,t} + \beta_7 MNCxPTI_{i,t} + \varepsilon_{i,t}$

Panel A: Worldwide GAAP ETR

DepVar=	**Full Sample** *WWETR*			**ETR < Statutory Rate** *WWETR*			**ETR ≥ Statutory Rate** *WWETR*		
	Coeff.	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
Intercept	0.169	0.007	25.59	0.176	0.005	36.88	0.334	0.012	27.5
SIZE	0.037	0.001	31.54	-0.015	0.001	-17.9	0.079	0.002	38.32
PTI	-0.034	0.001	-27.34	0.028	0.001	31.12	-0.099	0.002	-45.81
MNC	-0.016	0.010	-1.65	0.026	0.007	3.64	-0.086	0.018	-4.85
*MNC*SIZE*	0.016	0.003	5.22	0.008	0.002	3.42	0.012	0.005	2.37
*MNC*PTI*	-0.017	0.003	-5.78	-0.016	0.002	-6.94	0.003	0.005	0.68
N		34,579			25,597			8,982	
R^2		0.0627			0.1114			0.2325	

Panel B: Worldwide Cash ETR

DepVar=	**Full Sample** *CashETR*			**ETR < Statutory Rate** *CashETR*			**ETR ≥ Statutory Rate** *CashETR*		
	Coeff.	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
Intercept	0.213	0.008	25.67	0.108	0.006	19.63	0.466	0.011	42.73
SIZE	0.053	0.001	36.13	-0.003	0.001	-3.18	0.073	0.002	38.92
PTI	-0.057	0.002	-37.05	0.020	0.001	19.13	-0.108	0.002	-54.27
MNC	-0.061	0.013	-4.84	0.027	0.008	3.49	-0.130	0.018	-7.26
*MNC*SIZE*	0.011	0.004	2.99	0.005	0.002	2.08	0.017	0.005	3.33
*MNC*PTI*	-0.004	0.004	-1.19	-0.013	0.002	-5.26	0.007	0.005	1.26
N		34,579			21,838			12,741	
R^2		0.0735			0.1016			0.2333	

Panel C: Cash-Based Book-Tax Differences (Δ/MVA)

DepVar=	Full Sample Δ/*MVA*			ETR < Statutory Rate Δ/*MVA*			ETR ≥ Statutory Rate Δ/*MVA*		
	Coeff.	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**	**Coeff.**	**SrErr**	***t*-Stat**
Intercept	-0.015	0.003	-4.62	-0.039	0.004	-10.54	0.030	0.006	4.69
SIZE	0.004	0.001	7.27	0.007	0.001	10.15	-0.004	0.001	-3.49
PTI	-0.004	0.001	-6.80	-0.005	0.001	-6.79	0.001	0.001	0.87
MNC	-0.002	0.005	-0.42	0.012	0.005	2.27	-0.019	0.011	-1.79
*MNC*SIZE*	0.000	0.002	0.03	-0.003	0.002	-1.84	0.004	0.003	1.32
*MNC*PTI*	0.000	0.002	0.27	0.002	0.002	1.31	-0.002	0.003	-0.63
N		34,579			21,838			12,741	
R^2		0.0024			0.0067			0.0031	

This table reports the results of regressing tax avoidance proxies on firm size and profitability for the full sample and then separate for tax favored (ETR < statutory tax rate) and tax disfavored (ETR > statutory tax rate) observations. Specifically, we replicate the Rego (2003) analysis on the extended sample period by regressing the worldwide ETR (*WWETR*) on proxies for firm size (*SIZE*, natural log of total sales plus one), pre-tax income (*PTI*, natural log of pre-tax income plus one), foreign operations (*FOROPER* and $FOROPER^2$, equal to foreign assets divided by total assets), an indicator for whether or not the firm is a multi-national corporation (*MNC*, equal to one if either pre-tax foreign income and *FOROPER* are greater than zero), and interactions between *MNC* and *SIZE* and *MNC* and *PTI*. We then use *CashETR* as the dependent variable in Panel B and Δ/*MVA* as the dependent variable in Panel C. Following Rego (2003), *WWETR* and *CashETR* are set equal to one if they exceed one for this set of analyses. Detailed variable definitions are found in Rego (2003).