How do most low ETR firms avoid paying taxes?

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Abstract

Evidence suggests a large proportion of profitable U.S. firms have low effective tax rates (i.e., an ETR between 0 and 10%). Despite widespread interest in how firms avoid paying taxes, we do not know how most firms attain low ETRs and whether they are primarily benefiting from benign or aggressive tax positions. Using a research design that explicitly examines low ETR firms, we predict and find that the majority are primarily benefiting from a benign tax position: large net operating loss carryforwards (NOLs). We also find that large NOLs allow firms to persistently retain low ETRs year after year. In contrast, we find that multinationals and tax haven firms, which should have more opportunities for aggressive tax planning, have a lower probability of attaining a low ETR (relative to domestic and non-tax haven firms). Collectively, these findings suggest that the typical low ETR firm does not incur significant tax risk. Consistent with this, we find that low ETR firms accrue unrecognized tax benefits at a similar rate as firms that pay the statutory tax rate and do not experience higher future tax rate volatility. Overall, the results shed light on the profile of the average low ETR firm and provide evidence that the majority are utilizing large NOLs rather than aggressive tax planning.

Keywords Taxes · Net operating loss carryforwards · Tax risk · Political economy

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1 Introduction

Recent studies document that a large proportion of profitable U.S. firms have effective tax rates (ETRs) far below the statutory tax rate.¹ For instance, Dyreng et al. (2008) find that roughly one out of five firms has an annual cash ETR of less than 10%. Similarly, the Institute on Taxation and Economic Policy (ITEP) finds that around 20% of large firms have an ETR of less than 10% (Gardner et al. 2017). And the U.S. Government Accountability Office (2016) documents that about 20% of large firms paid no federal income taxes in 2012. Given the evidence that a large number of firms attain such low ETRs, a natural question arises: How are they doing it?

One plausible explanation is that low ETR firms are engaging in aggressive tax planning. Numerous academic studies provide evidence consistent with this explanation.² Notably, Dyreng et al. (2019) find that, on average, firms with relatively lower ETRs bear greater tax risk than firms with higher ETRs. Similarly, the media, policymakers, and public interest groups frequently portray low ETR firms as “tax dodgers” that use accounting gimmicks to push the envelope of tax law. For instance, the business press is replete with headlines about how multinational firms avoid paying taxes by shifting billions in profits offshore to tax havens.³ Likewise, politicians, such as Senator Bernie Sanders, argue: “There is something profoundly wrong in America when one out of five profitable corporations pay nothing in federal income taxes.... Corporate greed is destroying the fabric of America. It must come to an end.”⁴

While it is intuitive to link firms with low ETRs to aggressive tax planning, there is also evidence that raises questions about how prevalent aggressive strategies really are. Specifically, De Simone et al. (2019) find that, rather than shifting profits out of the United States, the majority of multinational firms report net *inbound* payments from their foreign subsidiaries. Similarly, Blouin and Robinson (2020) provide evidence that studies have significantly overstated the magnitude of tax-motivated profit shifting, because they use data that double counts foreign profits.⁵ And Guenther et al. (2017, p. 133) find that low ETRs tend to be persistent and ETRs are not negatively associated with future tax rate volatility, which is “... most consistent with the idea that low ETRs reflect the extent to which a firm’s operations allow the firm to take advantage of benign tax-favored transactions as opposed to differences in managers’ willingness to reduce the firm’s tax payments through risky tax positions.”

Given the alternative interpretations of how firms attain low ETRs, we argue that we still have a very limited understanding of this group of firms. That is, while there is an

¹ Hereafter we use the term “firm” to refer to profitable firm-years of U.S. corporations, unless stated otherwise.

² See Balakrishnan et al. (2019); Hasan et al. (2014); Donohoe and Knechel (2014); Chyz et al. (2013); Rego and Wilson (2012); Kim et al. (2011); Chen et al. (2010).

³ See *The Economist* (2013, 2018); Drucker (2010); Chew (2016); Torrey (2014); Drucker and Bowers (2017).

⁴ See Sanders (2016). For other examples by policymakers and public interest groups, see Levin and McCain (2013); Joint Committee on Taxation (2010); Gravelle (2015); and Phillips et al. (2017).

⁵ In addition, the ITEP study discussed above suggests that just 30 Fortune 500 companies account for nearly 70% of the estimated \$2.6 trillion of accumulated offshore profits. Further, the largest sample of tax shelters examined in the literature is just a few hundred firms, and, due to enforcement, the incidence of tax shelters has sharply declined since the turn of the century (Lisowsky et al. 2013).

extensive literature on cross-sectional differences in ETRs, studies generally focus on average ETRs and thus cannot directly speak to how a firm ends up in the left-tail of the ETR distribution. Similarly, even though there is plenty of evidence that large multinational firms engage in aggressive tax planning, we do not know whether that is an accurate profile of the majority of low ETR firms. Consequently, in this study, we examine how most firms attain low ETRs (i.e., an ETR between 0 and 10%).

We predict that the majority of profitable firms that attain a low ETR are primarily benefiting from a benign tax position: large net operating loss carryforwards (NOLs). We make this prediction for three reasons. First, the costs of achieving a low ETR are likely to be high for firms using aggressive tax positions but negligible for firms utilizing large NOLs. A fundamental principle of the Scholes and Wolfson framework (Scholes et al. 2015) is that firms will reduce their ETRs as long as the marginal benefits exceed the marginal costs. In the case of aggressive tax planning, firms must weigh the increased tax savings with the potential costs, such as implementation and concealment costs, potential fines and penalties, auditor scrutiny (Donohoe and Knechel 2014; Hoopes et al. 2012), reduced corporate transparency (Desai and Dharmapala 2006; Balakrishnan et al. 2019), agency costs (Chen et al. 2010), increased borrowing costs (Hasan et al. 2014), and reputational concerns (Graham et al. 2014). Since prior research provides evidence that these costs can be significant, they are likely to constrain many firms from realizing a low ETR through aggressive tax planning.

In contrast, firms with large NOLs need not weigh the increased tax savings with the potential costs. Since using large NOLs is not a choice but a result of prior poor performance, large NOLs simply allow firms to reduce their ETRs with no material costs or risk of the position being overturned by tax authorities. As a result, large NOL firms do not face the same potential costs of tax planning as firms without large NOLs and thus should have a greater likelihood of attaining a low ETR.

Second, there is evidence that the tax savings attributable to NOLs can be substantial. For example, a recent study by the Treasury Inspector General for Tax Administration (2015) estimates that firms have accumulated roughly \$2 trillion in Federal NOLs alone as of 2012.

Third, there is a direct link between NOLs and ETRs. In particular, NOLs reduce cash taxes paid and thus result in a lower cash ETR. Further, as we discuss in detail later, the utilization of large NOLs is typically accompanied by a reversal of the valuation allowance, which leads to a lower GAAP ETR.

Collectively, these reasons suggest that the majority of firms that attain a low ETR are likely benefiting from large NOLs. To be clear, while it is well documented that NOLs reduce average ETRs, the nature of our question is very different. It is not obvious from prior research whether the *majority* of firms that attain low ETRs are primarily benefiting from aggressive tax planning or large NOLs.

To perform our tests, we construct a sample of profitable firm-years for the time period 1994–2014. To identify firms with low ETRs, we create an indicator variable that equals one if a firm has an ETR between 0 and 10% and zero otherwise. We use 10% as the cutoff, as this is the threshold used in the influential study by Dyreng et al. (2008) to identify firms with the lowest ETRs. Consistent with prior research that suggests a large proportion of firms have low ETRs, we find that approximately 25% (10%) of our sample have low annual cash (GAAP) ETRs, and roughly 16% (12%) have low long-run three- (five-) year cash ETRs.

To identify firms with large NOLs, we use an intuitive proxy based on whether a firm reports an accumulated deficit on its balance sheet (i.e., negative retained earnings). This measure identifies firms that suffered heavy losses in prior years and classifies roughly 25% of our sample as large NOL firms. We also corroborate our results using another proxy for large NOLs based on the predicted NOL benefit constructed by Heitzman and Lester (2020). These proxies overcome the severe measurement error in Compustat NOL data (Heitzman and Lester 2020; Kinney and Swanson 1993; Mills et al. 2003) and allow us to answer our research question.

We begin our empirical analysis with a set of univariate tests. First, we calculate the probability that a firm with large NOLs will be included in the low ETR group. We find that firms with large NOLs are roughly four (12) times more likely than firms without large NOLs to have a low annual cash (GAAP) ETR. To put these findings into perspective, we calculate the probability that multinational firms and multinationals with a subsidiary in a tax haven (i.e., haven firms) have a low ETR. Multinationals and, in particular, haven firms are often assumed to have more opportunities for aggressive tax planning (e.g., income shifting) and have been shown to have lower average ETRs than purely domestic and non-haven firms (Rego 2003; Dyreng and Lindsey 2009). However, we find that multinational (haven) firms have a significantly lower probability of attaining a low ETR than domestic (non-haven) firms.

In our second univariate test, we examine the subsample of low ETR firms and simply count the number that have large NOLs. We find that the *majority* of low ETR firms have large NOLs. In particular, while large NOL firms only constitute a quarter of our sample, we find they comprise 57% (78%) of firms with a low annual cash (GAAP) ETR. Similarly, large NOL firms comprise 58% (56%) of firms with a low three- (five-) year cash ETR. In contrast, we find that while multinational (haven) firms are more common in our sample than large NOL firms, they comprise only 29% (23%) of firms with a low annual cash ETR and 21% (16%) with a low annual GAAP ETR. Collectively, our univariate tests suggest that most low ETR firms are primarily benefiting from large NOLs.

We then conduct multivariate tests that examine the probability that a firm with large NOLs will attain a low ETR after controlling for other typical firm characteristics examined in the literature. In these tests, we continue to find that large NOL firms are roughly three (six) times more likely than firms without large NOLs to have a low annual cash (GAAP) ETR. Our inferences are also similar using long-run cash ETRs. Further, similar to our univariate tests, we continue to find that multinational (haven) firms have a lower probability of attaining a low ETR than domestic (non-haven) firms.⁶

To provide further evidence that our results are attributable to large NOLs, we also examine how firms with large NOLs are dispersed across the distribution of ETRs. If

⁶ To further corroborate these analyses, we perform numerous additional tests outlined in detail in the [internet appendix](#). For example, we show the results are stronger when firm profits are more likely to be in the same jurisdiction as the large NOLs. The results also hold (1) for both large and small firms (i.e., S&P 1500 and non-1500), (2) using entropy balancing, (3) with firm fixed effects, (4) in every single year of our sample, and (5) using Compustat NOL data. To further address identification, we use the bursting of the Dot.com bubble and the financial crisis as shocks that caused firms to suffer heavy losses and generate large NOLs. Using a difference-in-differences design, we show that in the years following these shocks, the firms most heavily affected by the shocks were more likely to attain low ETRs.

large NOLs are helping firms attain low ETRs, we expect that firms with large NOLs are more likely to be concentrated in lower, rather than higher, portions of the ETR distribution.⁷ Consistent with our expectation, in both univariate and multivariate tests, we find that firms with large NOLs are more likely to be concentrated in lower portions of the ETR distribution. In addition, we find that multinational (haven) firms have a higher probability of reporting an ETR between 10% to 30% and are overrepresented in the 10% to 30% ETR range, relative to domestic (non-haven) firms.

Overall, the results shed light on the profile of the average low ETR firm and provide evidence that the majority are utilizing large NOLs rather than aggressive tax planning. Since there is a link between tax aggressiveness and tax risk (Blouin 2014), this finding has implications for the relation between low ETRs and tax risk. Recent studies provide conflicting evidence regarding whether low ETR firms incur significant tax risk. For instance, Dyreng et al. (2019) find that firms with lower cash ETRs recognize larger additions in unrecognized tax benefits (UTBs), suggesting that, as firms engage in more tax avoidance, they incur more tax risk. In contrast, Guenther et al. (2017) find that firms with lower ETRs do not have higher future tax rate volatility and interpret the finding as suggesting that low ETRs are likely driven by benign tax positions.

Our finding that the majority of low ETR firms are primarily benefiting from large NOLs (i.e., a benign tax position) suggests that, on average, low ETR firms do not incur significant tax risk. To test this prediction, we first examine whether large NOLs allow firms to persistently retain a low ETR year after year. If large NOLs allow firms to persistently retain a low ETR, then these firms need not engage in aggressive tax planning that results in additions in UTBs, and they are unlikely to experience future tax rate volatility. We find that low ETRs are indeed more persistent for firms with large NOLs, compared to firms without large NOLs, over a five-year period. Further, we find that low ETR firms accrue UTBs at a similar rate as firms that pay roughly the statutory tax rate (i.e., low tax risk firms). Likewise, we find that low ETR firms have future tax rate volatility that is similar to firms that pay roughly the statutory tax rate. Finally, we also provide evidence that the relation between ETRs and tax risk is nonlinear, so the differences in Dyreng et al. (2019) and Guenther et al. (2017) can be largely attributed to how the models are specified. Taken together, the tests provide consistent evidence that low ETR firms generally do not incur significant tax risk.

This study contributes to our understanding of *how* profitable firms attain low ETRs. The business press, public interest groups, policymakers, and academics are interested in firms with the lowest ETRs. Yet we argue that little is known about this group of firms since studies typically examine variation in average ETRs. By using a research design that explicitly examines low ETR firms, we provide evidence that suggests the majority are benefiting from large NOLs rather than aggressive tax planning. This finding is consistent with the notion that the costs of aggressive strategies constrain firms from attaining low ETRs through aggressive tax planning. In addition, our study contributes to an emerging literature that examines the association between low ETRs and tax risk (Guenther et al. 2017; Dyreng et al. 2019; Guenther et al. 2019). We provide evidence that low ETR firms,

⁷ Some firms with large NOLs may still pay some income taxes. Reasons for this include (1) limitations on NOL utilization when calculating the alternative minimum tax, (2) firms may not have NOLs in all jurisdictions where they have taxable income, and (3) limitations on NOL utilization under I.R.C. § 382.

on average, do not incur more tax risk than firms that pay roughly the statutory tax rate. Collectively, these findings revise how we think about low ETR firms.

Our findings also complement recent work by Henry and Sansing (2018) and Drake et al. (2020). Henry and Sansing (2018) find that, by adding loss firms to a sample of profit firms, the average firm in the overall population does not appear to be tax-favored. Drake et al. (2020) provide evidence that valuation allowances related to prior-period losses explain almost the entire downward trend in average ETRs over the last 20 years for profitable domestic firms. However, neither study provides empirical evidence that explains how profitable firms attain low ETRs (i.e., 0 to 10%). In contrast, our paper provides empirical evidence that large NOLs are a primary way that profitable firms attain a low ETR.

Lastly, it is important to note that our study should not be interpreted as suggesting that firms do not engage in aggressive tax planning. It is well documented that firms do lower their ETRs through aggressive tax planning, and our study is not intended to refute this evidence. Rather, our findings suggest that the use of large NOLs appears to be the more common way for firms to attain low ETRs.

2 Background and empirical prediction

2.1 Prior research and background on net operating losses

The literature typically defines tax avoidance as any position that reduces the firm's explicit tax liability.⁸ Hanlon and Heitzman (2010) and Lisowsky et al. (2013) elaborate on this definition by suggesting that tax avoidance should be viewed as a continuum that spans from benign tax positions on the left (e.g., investments in municipal bonds) to more aggressive tax positions on the right (e.g., tax sheltering). Lisowsky et al. (2013) further add that the cash and GAAP ETRs typically examined by the business press, public interest groups, policymakers, and academics capture tax positions across the entire tax avoidance continuum.

This leads to the primary question addressed in this study: How do most profitable firms with low ETRs avoid paying taxes? That is, are most firms that attain low ETRs engaging in aggressive tax planning or are most simply benefiting from the tax rules as explicitly intended by legislation?

There is evidence consistent with both views in the tax literature. On the one hand, numerous studies provide evidence that can be interpreted as suggesting that low ETR firms are likely engaging in aggressive tax planning that would fall somewhere on the right side of the tax avoidance continuum.⁹ For example, Dyreng et al. (2019, 179) state: "Our expectation is that, on average, as firms engage in greater levels of tax

⁸ Lisowsky et al. (2013) describe that, under the U.S. tax reporting system, a firm assesses its tax liability and files a tax return showing how it calculated the liability. Following Lisowsky et al. (2013), we refer to any item reported on these tax returns as tax positions.

⁹ There is no consensus in the tax literature as to where specific tax positions fall on the tax avoidance continuum (Blouin 2014). In this study, we take the stance that positions such as tax shelters, income shifting across jurisdictions, and the use of complex financial instruments are typically riskier and fall somewhere on the more aggressive side of the continuum. In contrast, we believe that the deduction for NOLs falls on the benign end of the tax avoidance continuum.

avoidance [measured using cash ETRs] they will use strategies that involve increasing levels of tax uncertainty.”¹⁰ Indeed, the authors find that firms with cash ETRs in the lowest tercile face significantly greater tax uncertainty. In addition, Balakrishnan et al. (2019, p. 49) express that: “... firms with unusually low tax liabilities [measured using cash and GAAP ETRs relative to industry peers] can be considered more tax aggressive.” Consistent with their prediction, they find that firms with lower ETRs have lower corporate transparency, which is consistent with these firms engaging in aggressive tax planning that increases financial and organizational complexity. And Kim et al. (2011, p. 640) suggest: “... a very low level of *LRETR* [long run cash ETR] likely captures extreme cases of tax sheltering activities such as Enron’s.” The authors then provide evidence that firms with lower cash ETRs have a higher probability of incurring a future stock price crash, which they interpret as suggesting that more aggressive tax planning facilitates managerial rent extraction and the hoarding of bad news.¹¹

On the other hand, recent evidence also suggests that firms with low ETRs may be using more benign tax positions than previously realized. Specifically, Guenther et al. (2017) find that low ETRs are more persistent than high ETRs and that ETRs are not negatively associated with future tax rate volatility. The authors interpret the findings as evidence that lower ETRs, on average, reflect a firm’s ability to take advantage of benign tax-favored investments that are unlikely to be challenged by tax authorities. Moreover, Guenther et al. (2019) provide evidence that higher rates of tax avoidance are not riskier than lower rates of tax avoidance, as reflected by increases in UTBs. The authors interpret the findings as suggesting that differences in the rates of tax avoidance are more likely a function of firm characteristics that facilitate tax avoidance than differences in managers’ willingness to engage in risky tax positions. With that said, Guenther et al. (2017) and Guenther et al. (2019) do not provide evidence of the specific tax positions that firms are using to attain a low ETR without incurring additional tax risk.

Given the alternative interpretations of extant research, understanding specifically how the majority of low ETR firms avoid paying taxes is an empirical question.¹² We believe the answer to this question involves net operating losses, which arise when a firm has negative income for tax purposes. Tax law around the world has long treated negative and positive income asymmetrically. That is, while positive income is subject to immediate taxation, negative income is not necessarily subject to an immediate tax refund. Rather, taxable income is truncated at zero in the year the net operating loss is

¹⁰ There is also no consensus in the tax literature as to the relation between tax uncertainty and tax risk. For instance, Dyreng et al. (2019, p. 182) state: “While precise definitions of these constructs are not yet agreed upon in the literature, it is clear that risk, uncertainty, and aggressiveness are related, at least in the tax realm (Blouin 2014).” In this study, we define tax risk as the likelihood that a firm will have to make future tax payments related to current period tax positions, and we also use uncertain tax benefits as a measure of tax risk. Consistent with Blouin (2014), tax risk increases as a tax position becomes more aggressive.

¹¹ There are numerous other examples of tax studies that can be interpreted as suggesting that firms are engaging in aggressive tax planning (e.g., Hasan et al. 2014; Chyz et al. 2013; Rego and Wilson 2012).

¹² Dyreng et al. (2017) examine the time trend in ETRs and suggest that researchers also know very little about how ETRs evolve over time. In response to this question, recent research provides evidence that the decline in multinational firm’s ETRs arises from a combination of increasing tax benefits from international operations, losses, and declining ETR effects from state taxes, while the decline in domestic firm’s ETRs over time can be attributed to losses and changes in the valuation allowance (Henry and Sansing 2018; Drake et al. 2020). In this study, we are interested in cross-sectional differences in how firms attain low ETRs.

generated, and the firm must carry forward the net operating loss (i.e., NOL) to offset taxes to be paid in the future.¹³ If a firm suffers heavy or continued losses, large NOLs can arise and dramatically reduce ETRs when firms subsequently become profitable.

2.2 Empirical prediction

We predict that the majority of profitable firms that attain a low ETR are primarily benefiting from large NOLs, rather than from aggressive tax planning. We expect this for at least three reasons. First, the costs of achieving a low ETR are likely to be high for firms using aggressive tax planning but negligible for firms utilizing large NOLs. Prior research suggests that, as firms engage in aggressive tax planning, they must trade off the marginal tax savings with the marginal costs (Scholes et al. 2015). These marginal costs can be significant and include such things as implementation and concealment costs, potential fines and penalties, agency costs (Chen et al. 2010), reduced corporate transparency (Desai and Dharmapala 2006; Balakrishnan et al. 2019), increased borrowing costs (Hasan et al. 2014), auditor scrutiny (Donohoe and Knechel 2014), and increased tax uncertainty (Dyrenge et al. 2019). Indeed, surveys of tax executives find that many firms pass on aggressive tax strategies if they perceive that the costs—including reputational concerns and the threat of a tax audit—are too high (Hoopes et al. 2012; Graham et al. 2014). Thus it is likely that many firms will not be able to reduce their ETR as much as they desire before the marginal costs exceed the marginal benefits.

In contrast, firms using large NOLs do not need to trade off the marginal tax savings with the marginal costs. Since using large NOLs is not a choice, but a result of prior poor performance, large NOLs simply allow firms to reduce their ETRs with no material costs or risk of the position being overturned by tax authorities. As a result, firms with large NOLs do not face the same potential costs of tax planning as firms without large NOLs and thus should have a greater likelihood of attaining a low ETR.

Second, the deduction for NOLs can have a material impact on the tax burden of a large number of firms. For example, using corporate tax return data available from the Internal Revenue Service (IRS) Statistics of Income (SOI) program for the years 1994–2013, we estimate that roughly one-third of profit firms used NOLs to completely eliminate their U.S. tax liability (untabulated).

Third, as we discuss in detail in the [internet appendix](#), there is a direct link between the deduction for NOLs and the ETRs typically examined in the literature. For instance, the utilization of NOLs reduces cash taxes paid and thus results in a lower cash ETR. Additionally, since the carryforward period for NOLs extends well beyond one year in most jurisdictions, large NOLs can also reduce long-run cash ETRs. Further, the

¹³ During our sample period, firms could also carry back net operating losses to offset taxes paid in the past. However, the carryback period was limited to between two and five years in the United States, while losses could be carried forward up to 20 years. After our sample period, the Tax Cuts and Jobs Act was passed, making it so that most U.S. corporations could only carry net operating losses forward (indefinitely), although the recent Coronavirus Aid, Relief, and Economic Security (CARES) Act allows five-year carrybacks for losses incurred in 2018, 2019, or 2020. NOL carrybacks do not directly affect our inferences, because they only affect ETRs in the first year a loss is recognized, and loss years are not included in our sample. Further, we do not believe carrybacks will have a major effect on our proxies for large NOLs, because studies, such as Cooper and Knittel (2006), suggest the vast majority of losses are carried forward.

utilization of large NOLs typically results in a decrease in the valuation allowance and thus a lower GAAP ETR.¹⁴ In Section 3.1.1, we summarize our empirical validation of the link between NOLs and the valuation allowance conducted in the [internet appendix](#).

Collectively, the above reasons suggest that the majority of firms that attain a low ETR are likely benefiting from large NOLs.

3 Empirical analysis

3.1 Measurement of large NOLs

The challenge in examining the impact of large NOLs on ETRs is finding a reliable measure of NOLs that is available for a large sample of firms. In particular, tax return data is not publicly available (nor available on a worldwide basis), and it is well known that Compustat NOL data is plagued with measurement error (Kinney and Swanson 1993; Mills et al. 2003; Heitzman and Lester 2020). Consequently, we use two alternative proxies to capture whether a firm has economically large NOLs. First, we use an intuitive proxy based on whether a firm reports an accumulated deficit on its balance sheet. Second, we identify firms that have large NOLs based on the predicted NOL benefit developed by Heitzman and Lester (2020). We describe each measure in turn.

3.1.1 Accumulated deficit

Retained earnings reported in the balance sheet provides a measure of the cumulative profitability of a firm over time (Altman 1968). A firm will report an accumulated deficit in retained earnings (i.e., negative retained earnings) when cumulative book losses exceed cumulative book profits.¹⁵ We argue that, when a firm reports an accumulated deficit, it is also likely to report economically large NOLs for tax purposes. Since book income and taxable income are not perfect substitutes and the carryback and carryforward procedures of net operating losses do not perfectly map into the calculation of retained earnings, we create an indicator variable (*Deficit*) that equals one if a firm's prior year retained earnings is negative and zero otherwise.

¹⁴ As we discuss in detail in the [internet appendix](#), when no valuation allowance is initially recognized, the GAAP tax benefit of NOLs is recognized in the year the loss occurs and thus NOLs do not affect the GAAP ETR in the future when they are utilized. However, when a valuation allowance initially offsets the NOL, the GAAP tax benefit of the NOL is deferred until the NOLs are utilized in future years. While we show there is a clear link between the use of NOLs and reversals of the valuation allowance, we acknowledge not all firms with large NOLs will record a valuation allowance.

¹⁵ To demonstrate that losses are the primary driver of accumulated deficits, we regress the change in retained earnings on net income (with both variables scaled by beginning total assets) for a sample that includes both profit and loss firm-years. Theoretically, if net income were the only driver of changes in retained earnings, we would expect to see a coefficient of 1 for net income and an adjusted R² of 1. We find that the coefficient on net income is 0.964 (*t*-statistic 191.46) with an adjusted R² of 92.3% (untabulated). We find very similar results using a sample of only loss firm-years. While these findings provide evidence that losses are the primary driver of deficits, we acknowledge that a small number of deficits are likely attributed to other transactions (e.g., stock repurchases).

The benefits of this proxy are that it is readily available and easy to compute for a large sample of firms with minimal sample attrition, it captures worldwide losses, and, most importantly, it should capture economically large NOLs that are likely to have the biggest impact on ETRs. Furthermore, since it is based on whether a firm has a cumulative book loss, it should capture NOLs that arise from *real economic losses*, rather than other forms of tax planning. That is, publicly traded firms generally prefer to engage in nonconforming tax avoidance, which reduces taxable income without reducing book income (Badertscher et al. 2009). Thus it seems unlikely that a large number of U.S. publicly traded firms would engage in such a high level of conforming tax avoidance that they reduce both book and taxable income to the extent it creates an accumulated deficit on their balance sheet.

The main limitation of this measure is that it is likely to miss relatively smaller NOLs or NOLs created by differences in the calculation of book and taxable income. However, by design, we are interested in identifying firms that suffered economically large losses and are now simply benefiting from the deduction for NOLs. Thus we are less concerned in our setting about the measure not capturing relatively smaller NOLs or NOLs created by book-tax differences.

To confirm that having an accumulated deficit is fairly common, we construct a typical tax avoidance sample with profitable firm-years from Compustat.¹⁶ Our sample begins in 1994 and ends in 2014. Consistent with prior literature, we exclude (1) firms incorporated outside of the United States, (2) firm-years with negative pretax income, (3) cash ETRs below zero or above one, and (4) regulated firms (SIC 6000–6999 and 4900–4949). We also exclude firms-years missing necessary data to calculate the following control variables: pretax return on assets (ROA); foreign income (*Multinational*); a subsidiary in a tax haven (*Haven*); leverage (*Leverage*); gross property, plant, and equipment (*PPE*); research and development (*R&D*); stock option expense (*Stock Option Expense*); firm size (*LnAssets*); and market-to-book (*MTB*). (See [Appendix A](#) for variable definitions.)¹⁷ This results in a sample of 46,816 firm-years. Table 1 reports descriptive statistics for this sample and illustrates that 25% of the observations have an accumulated deficit. This finding is consistent with the notion that a nontrivial number of the profit firms typically examined in the tax literature have economically large NOLs. Thus this benign tax position could play a major role in achieving a low ETR.

To validate this proxy (as well as confirm the level of measurement error inherent in Compustat NOL data), we use a random number generator to select 1,050 firm-years from our main sample (50 firms per year equally split between deficit and non-deficit firms) and hand-collect the deferred tax asset related to NOLs from the tax footnote in the 10-K filing. This data is collected for year $t-1$, as that reflects the NOL from prior years that would be available for use during year t .

¹⁶ Focusing on profitable firm-years is important in our setting because our research question is about how profitable firms attain low ETRs. Hence loss firm-years are not included in our primary sample.

¹⁷ It is common in the literature to truncate or winsorize ETRs at 0 and 1. We choose to truncate because ETRs less than 0 and greater than 1 are typically caused by atypical transactions that are not associated with actual tax positions, such as non-tax deductible goodwill recognized for financial accounting purposes or extreme reversals of the valuation allowance that are not tied to the use of NOLs (Schwab, Stomberg, and Xia 2020). However, all inferences are unchanged if we winsorize ETRs rather than truncating.

As we explain in detail in the [internet appendix](#), we conduct the following analyses. First, we compare the Compustat NOL data to our hand-collected NOL data. We find that Compustat fails to identify an NOL for roughly 42% of our sample that discloses a NOL in the tax footnote. Troublingly, we also find that Compustat misses a substantial number of firms that disclose large NOLs that are likely to have the biggest impact on ETRs.

Second, we compare the *Deficit* measure to our hand-collected NOL data. Consistent with our expectation that *Deficit* can identify firms that report large NOLs, we find that approximately 87% of deficit firms disclose NOLs. Further, we find that, among firms that report NOLs in their financial statements, the average deferred tax assets associated with NOLs for deficit firms are 25.1% of beginning total assets compared to only 3.4% for non-deficit firms. However, as expected, we also find that *Deficit* fails to identify relatively smaller NOLs.

Finally, we also use our hand-collected sample to confirm that NOLs can affect GAAP ETRs through changes in the valuation allowance. Specifically, the analysis reported in the [internet appendix](#) shows that 98% of deficit firms that attain a low GAAP ETR disclose a valuation allowance. More importantly, we find that for these firms the correlation between changes in the NOL deferred tax asset and changes in the valuation allowance is 0.75 ($p < 0.01$). This suggests there is a clear link between the use of NOLs and reversals of the valuation allowance. Furthermore, we find that the change in the valuation allowance is larger for deficit firms than for non-deficit firms.

Collectively, the validation tests described in the [internet appendix](#) suggest that *Deficit* is a valid proxy for economically large NOLs that are most likely to impact corporate taxpayer behavior and both cash and GAAP ETRs, with the caveat that *Deficit* will not capture relatively smaller NOLs.

3.1.2 Predicted NOL benefit

Our second proxy for large NOLs is based on the predicted NOL benefit calculated by Heitzman and Lester (2020). Heitzman and Lester (2020) use hand-collected NOL data from the tax footnote for a large sample of U.S. firms to construct a model that predicts the NOL benefit. Specifically, the authors regress their hand-collected NOL data from 2010 to 2015 on a number of readily available variables that reflect financial performance and other firm characteristics (including the presence of negative retained earnings) and then use the parameter estimates to construct predicted values for the NOL benefit.

Following their methodology, we use the parameter estimates from their determinants model (as described in detail in [Appendix B](#)) to construct *Predicted NOL*. Since we are interested in firms that report economically large NOLs that can significantly reduce ETRs, we then create an indicator variable (*High Pred. NOL*), which equals one if a firm's prior year *Predicted NOL* is in the top quartile and zero otherwise. Descriptive statistics for *High Pred. NOL* are presented in Table 1. Further, in untabulated analyses, we find that our proxies for large NOLs (*Deficit* and *High Pred. NOL*) have a Pearson correlation of 0.74, suggesting these proxies capture a similar economic construct.

Table 1 Descriptive Statistics

Variables	N	Mean	Std. Dev.	25%	Median	75%
<i>Deficit</i>	46,816	0.250	0.433	0.000	0.000	1.000
<i>High Pred. NOL</i>	46,816	0.250	0.433	0.000	0.000	1.000
<i>Cash ETR 1yr</i>	46,816	0.253	0.181	0.101	0.250	0.361
<i>ROA</i>	46,816	0.135	0.115	0.059	0.106	0.176
<i>Multinational</i>	46,816	0.403	0.490	0.000	0.000	1.000
<i>Haven</i>	46,816	0.328	0.469	0.000	0.000	1.000
<i>Leverage</i>	46,816	0.246	0.264	0.024	0.189	0.364
<i>PPE</i>	46,816	0.309	0.270	0.107	0.229	0.429
<i>R&D</i>	46,816	0.030	0.057	0.000	0.000	0.031
<i>Stock Options</i>	46,816	0.008	0.016	0.000	0.003	0.009
<i>LnAssets</i>	46,816	5.827	2.067	4.389	5.796	7.228
<i>MTB</i>	46,816	2.919	3.475	1.304	2.136	3.550

Cash ETR 1yr is the firm's continuous cash ETR, calculated as cash taxes paid (TXPD) divided by pretax income (PI). For this variable, we require firm-years to have positive pretax income and an ETR between [0,1]. See [Appendix A](#) for all other variable definitions

3.2 Univariate analysis

We begin our empirical analysis with a set of univariate tests that examine the extent to which firms with large NOLs attain low ETRs. To do so, we create an indicator variable that equals one if a firm has an ETR between 0 and 10% and zero otherwise.¹⁸ We create separate indicators for annual cash and GAAP ETRs (*Low Cash ETR 1yr* and *Low GAAP ETR 1yr*) and for common long-run cash ETRs examined in the academic literature (*Low Cash ETR 3yr* and *Low Cash ETR 5yr*). We calculate the low annual ETRs for year t and the low three- (five-) year ETRs using data for t to $t + 2$ ($t + 4$). (See [Appendix A](#) for variable definitions.) As the results of our tests are similar for both large NOL proxies, for the sake of brevity, we only discuss the findings for the *Deficit* measure. However, note that finding similar results with both measures provides additional comfort that we are capturing large NOLs.

In our first univariate test, we compare the probability that firms with large NOLs (*Deficit* = 1) attain a low ETR, relative to firms without large NOLs (*Deficit* = 0). These results are reported in Table 2 Panel A. Consistent with our expectation, we find that firms with large NOLs have a significantly higher probability of attaining a low ETR. For example, the probability that a large NOL firm attains an annual cash (GAAP) ETR between 0 and 10% is approximately 56% (34%), compared to only 14% (3%) for firms without large NOLs. Thus firms with large NOLs are roughly four (12) times more likely to attain a low ETR. Similarly, we find that the probability that a firm with large NOLs attains a low three- (five-) year cash ETR is approximately 40% (31%), relative to only 9% (7%) for firms without large NOLs. The differences between each of these probabilities for firms with and without large NOLs are statistically significant ($p < 0.01$).

¹⁸ To put this in perspective, during our entire sample period, the statutory rate was 35%.

Table 2 Univariate Tests: Large NOL Partitions

Panel A: Probability of attaining an ETR between 0 and 10%									
Variable	N	Deficit Partition			High Predicted NOL Partition			Diff. in	
		All	Deficit = 1	Deficit = 0	High Pred.	NOL = 1	NOL = 0	Means	Means
		Mean	Mean	Mean	Mean	Mean	Mean		
<i>Low Cash ETR 1yr</i>	46,816	0.248	0.562	0.144	0.590	0.404	0.135	0.418 ***	0.455 ***
<i>Low Cash ETR 3yr</i>	34,303	0.161	0.396	0.087	0.404	0.307	0.079	0.309 ***	0.325 ***
<i>Low Cash ETR 5yr</i>	27,331	0.123	0.312	0.069	0.307	0.331	0.062	0.243 ***	0.245 ***
<i>Low GAAP ETR 1yr</i>	54,235	0.098	0.342	0.027	0.331		0.021	0.314 ***	0.310 ***
Panel B: Percentage of firms with large NOLs in each Low ETR subsample									
Subsample	N	Deficit Partition			High Predicted NOL Partition			Diff. in	
		All	Deficit = 1	Deficit = 0	High Pred.	NOL = 1	NOL = 0	Total	Total
<i>Low Cash ETR 1yr = 1</i>	11,625		57%	43%	59%	63%	40%	100%	100%
<i>Low Cash ETR 3yr = 1</i>	5,506		58%	42%	63%	62%	37%	100%	100%
<i>Low Cash ETR 5yr = 1</i>	3,357		56%	44%	62%	84%	38%	100%	100%
<i>Low GAAP ETR 1yr = 1</i>	5,335		78%	22%	84%		16%	100%	100%

*, **, *** indicate that the difference in means is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. See [Appendix A](#) for variable definitions

In our second univariate test, we examine the subset of firms that have low ETRs (e.g., *Low Cash ETR* = 1) and simply count the number of low ETR firms with and without large NOLs. The results are reported in Table 2 Panel B. While large NOL firms only make up 25% of our overall sample, we find that 57% (78%) of the subset of firms that have a low annual cash (GAAP) ETR are in fact large NOL firms. We also find that, among firms that have a low three- (five-) year cash ETR, 58% (56%) are large NOL firms. Thus, across all of these different ETR measures, large NOL firms constitute the *majority* of firms with low ETRs.

To put these results into perspective, we also perform the same univariate tests using proxies for firms with more opportunities to engage in aggressive tax planning. Specifically, we compare the probability of attaining a low ETR for firms with and without foreign income (i.e., multinational versus domestic firms) and for firms with and without a subsidiary in a tax haven. Both of these proxies capture income shifting opportunities that have been a prominent subject of concern by policymakers.

In Table 3 Panel A, we find that firms with foreign income (*Multinational* = 1) have a significantly *lower* probability of having a low ETR than firms without foreign income (i.e., domestic firms). For example, the probability that a multinational firm will have a low annual cash (GAAP) ETR is approximately 18% (6%), compared to 29% (12%) for domestic firms. Similarly, we find that the probability that a multinational firm will have a low three- (five-) year cash ETR is approximately 11% (9%), relative to 20% (15%) for domestic firms. Again, the differences between each of these probabilities for multinational and domestic firms are statistically significant ($p < 0.01$).

Next, in Table 3 Panel B, we examine the subset of firms that have low ETRs (e.g., *Low Cash ETR* = 1) and simply count how many of them are multinational and domestic firms. While multinational firms make up 40% of our overall sample, we find that only 29% (21%) of the subset of firms that have a low annual cash (GAAP) ETR are in fact multinational firms. Thus firms with foreign income (i.e., international transfer pricing opportunities), which are often assumed to have more opportunities for aggressive tax planning, are the minority of firms with low annual ETRs.

Table 3 also reports similar results for firms with a subsidiary in a tax haven. For example, in Table 3 Panel A, we find that firms with a subsidiary in a tax haven (*Haven* = 1) have a significantly *lower* probability of attaining a low ETR. Similarly, we see that, while haven firms make up 33% of our overall sample, when we examine the subset of firms that have low cash (GAAP) ETRs, only 23% (16%) are haven firms (Table 3 Panel B). Thus haven firms are also the minority of firms with low annual ETRs.¹⁹

Overall, these univariate tests suggest that large NOLs are a primary way that firms attain low ETRs, which is consistent with our prediction.

¹⁹ Large NOLs appear to play some role in why domestic firms are more likely than multinational firms to attain low ETRs. For example, in untabulated analyses, we find 47% (63%) of multinational firms with low cash (GAAP) ETRs have large NOLs, whereas 61% (83%) of domestic firms with low cash (GAAP) ETRs have large NOLs. Similarly, 42% (56%) of haven firms with low cash (GAAP) ETRs have large NOLs, whereas 61% (83%) of non-haven firms with low cash (GAAP) ETRs have large NOLs.

Table 3 Univariate Tests: Multinational and Haven Partitions

Panel A: Probability of attaining an ETR between 0 and 10%									
Variable	N	All		Multinational Partition		Diff. in Means		Haven Partition	
		Mean		Multi. = 1	Multi. = 0			Haven = 1	Haven = 0
				Mean	Mean			Mean	Mean
<i>Low Cash ETR 1yr</i>	46,816	0.248		0.180	0.294	-0.114***		0.176	0.284
<i>Low Cash ETR 3yr</i>	34,303	0.161		0.111	0.196	-0.085***		0.115	0.184
<i>Low Cash ETR 5yr</i>	27,331	0.123		0.090	0.146	-0.056***		0.094	0.138
<i>Low GAAP ETR 1yr</i>	54,235	0.098		0.059	0.120	-0.061***		0.056	0.116
Panel B: Percentage of multinational and haven firms in each Low ETR subsample									
Subsample	N	Multinational Partition		Diff. in Means		Haven Partition		Total	
		Multi. = 1	Multi. = 0			Haven = 1	Haven = 0		
<i>Low Cash ETR 1yr = 1</i>	11,625	29%	71%			23%	77%	100%	100%
<i>Low Cash ETR 3yr = 1</i>	5,506	29%	71%			24%	76%	100%	100%
<i>Low Cash ETR 5yr = 1</i>	3,357	31%	69%			26%	74%	100%	100%
<i>Low GAAP ETR 1yr = 1</i>	5,335	21%	79%			16%	84%	100%	100%

*, **, *** indicate that the difference in means is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. See [Appendix A](#) for variable definitions

Table 4 Multivariate Analysis: Low ETRs (from 0 to 10%)

Dependent Variable:	Pr. Sign	<i>Low Cash ETR 1yr</i>		<i>Low GAAP ETR 1yr</i>	
		(1)	(2)	(3)	(4)
<i>Deficit</i>	(+)	0.336*** (43.72)		0.240*** (39.01)	
<i>High Pred. NOL</i>	(+)		0.378*** (51.84)		0.237*** (42.73)
<i>ROA</i>		-0.219*** (-9.60)	-0.179*** (-8.31)	-0.038** (-2.14)	-0.018 (-1.01)
<i>Multinational</i>		-0.053*** (-7.90)	-0.058*** (-8.97)	-0.020*** (-4.69)	-0.021*** (-5.05)
<i>Haven</i>		-0.009 (-1.47)	-0.017*** (-2.80)	0.019*** (4.94)	0.016*** (4.13)
<i>Leverage</i>		0.069*** (6.28)	0.093*** (9.05)	0.067*** (8.24)	0.087*** (11.20)
<i>PPE</i>		0.125*** (7.82)	0.100*** (6.51)	-0.008 (0.87)	-0.025*** (-2.70)
<i>R&D</i>		0.531*** (8.27)	0.437*** (6.99)	0.408*** (7.94)	0.351*** (6.71)
<i>Stock Options</i>		1.815*** (9.62)	1.757*** (9.60)	1.039*** (6.48)	1.082*** (6.62)
<i>LnAssets</i>		-0.030*** (-16.00)	-0.023*** (-12.81)	-0.033*** (-24.11)	-0.031*** (-23.23)
<i>MTB</i>		-0.001 (-0.72)	-0.002*** (-2.76)	-0.002*** (-2.92)	-0.003*** (-4.46)
<i>Intercept</i>		0.342*** (15.29)	0.290*** (13.85)	0.241*** (20.26)	0.219*** (19.11)
Industry & Year F.E.		Yes	Yes	Yes	Yes
Adj. R ²		0.239	0.263	0.250	0.254
N		46,816	46,816	54,235	54,235

*, **, *** indicate that the estimated coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. Coefficient estimates are reported with corresponding *t*-statistics in parentheses, where standard errors are clustered by firm. See [Appendix A](#) for variable definitions

3.3 Multivariate analysis

We next examine whether firms with large NOLs are more likely to have low ETRs using multivariate regressions. This allows us to control for other tax positions that may lead firms to have low ETRs. To perform these analyses, we employ the following regression model.

$$Low\ ETR_{it} = \beta_0 + \beta_1 Large\ NOL_{it} + \sum_k \beta_k Controls_{it} + \varepsilon_{it}, \quad (1)$$

where, as previously discussed, *Low ETR* is an indicator variable that equals one if a

firm has an ETR between 0 and 10% and zero otherwise. We calculate *Low ETR* separately for the annual cash ETR (*Low Cash ETR 1yr*) and annual GAAP ETR (*Low GAAP ETR 1yr*). *Large NOL* represents our independent variable of interest, *Deficit* or *High Pred. NOL*, and *Controls* include the variables previously noted in our sample requirements. The model also includes year and industry fixed effects (Fama French 48), with standard errors clustered by firm, and all continuous variables are winsorized at the top and bottom 1% to mitigate the influence of outliers. We perform this analysis using a linear probability model (i.e., OLS) for ease of interpreting economic magnitudes and including fixed effects (Hanlon and Hoopes 2014; Christensen 2016).²⁰ We predict that firms with large NOLs will be more likely to have low ETRs ($\beta_1 > 0$).

Table 4 reports the results of these analyses. Again, as the results from our two large NOL proxies are similar, for the sake of brevity, we focus our discussion on the *Deficit* measure. Consistent with our expectation, Table 4 shows that large NOL firms have a significantly higher probability of attaining a low annual cash and GAAP ETR, relative to firms without large NOLs (*t*-statistics of 43.72 and 39.01, respectively). The magnitudes of these effects are also economically significant. Holding all else constant, the probability that large NOL firms will have a low annual cash (GAAP) ETR is 50.0% (28.4%), relative to only 16.4% (4.4%) for firms without large NOLs. Thus the probability that a large NOL firm will have a low cash (GAAP) ETR is 33.6% (24.0%) percentage points higher or roughly three (six) times more likely than firms without large NOLs.²¹ We also find similar results for low long-run ETRs. (See the [internet appendix](#) for details.)

To put these findings into perspective, when we examine the coefficients on measures that capture income shifting opportunities (*Multinational* and *Haven*), we see that, in the majority of cases, the estimated coefficients are negative and statistically significant. Thus firms with foreign income or a subsidiary in a tax haven tend to be less likely to have a low ETR. These findings again suggest that aggressive income shifting is not the primary way the average low ETR firm avoids paying taxes.

Collectively, these multivariate findings provide further evidence that large NOLs appear to be the more common way of attaining low ETRs. These findings are consistent with the idea that the potential costs of aggressive tax planning constrain firms from achieving low ETRs and expand our understanding of specifically *how* so many firms attain low ETRs.

3.4 Distribution of large NOL firms across ETRs

Our previous analyses suggest that large NOLs are a primary way that firms attain low ETRs. To provide further evidence that the findings are indeed attributable to large NOLs, we next examine how firms with large NOLs are dispersed across the ETR distribution (0 to 100%). If large NOLs help firms attain low ETRs, we expect that large NOL firms are more likely to be concentrated in lower portions of the ETR distribution than higher portions. To assess this, we divide the firms in our sample into

²⁰ Using logistic regression produces similar results (untabulated).

²¹ Since *Deficit* is a binary explanatory variable, its coefficient of 0.336 (0.240) in Table 4 is just the difference in the probability that *Low Cash ETR 1yr* (*Low GAAP ETR 1yr*) = 1 when *Deficit* = 1 of 50.0 (28.4), compared to 16.4 (4.4) when *Deficit* = 0, holding all other explanatory variables fixed.

Table 5 Univariate Tests: Distribution of ETRs

Panel A: Probability of attaining a <i>Cash ETR 1yr</i> across the distribution												
Full Sample			Deficit Partition			High Predicted NOL Partition						
			Deficit = 1			Deficit = 0			High Pred. NOL = 1		High Pred. NOL = 0	
ETR Range	Prob.	Cum.	Prob.	Cum.	Prob.	Cum.	Prob.	Cum.	Prob.	Cum.	Prob.	Cum.
[0%, 10%]	25%	25%	56%	56%	14%	14%	59%	59%	13%	13%	13%	13%
(10%, 20%]	16%	41%	15%	71%	16%	30%	15%	74%	16%	74%	16%	29%
(20%, 30%]	20%	61%	11%	82%	24%	54%	10%	84%	24%	84%	24%	53%
(30%, 40%]	21%	82%	8%	89%	26%	80%	7%	90%	26%	90%	26%	79%
(40%, 100%]	18%	100%	11%	100%	20%	100%	10%	100%	21%	100%	21%	100%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
N	46,816		11,723		35,093		11,704				35,112	

Panel B: Percentage of firms with large NOL in each portion of the Cash ETR 1yr distribution

Deficit Partition					High Predicted NOL Partition				
Deficit = 1					High Pred. NOL = 1				
					High Pred. NOL = 0				
ETR Range	N	Deficit = 1	Deficit = 0	Total	High Pred. NOL = 1	High Pred. NOL = 0	Total		
[0%, 10%]	11,625	57%	43%	100%	59%	41%	100%		
(10%, 20%]	7,326	24%	76%	100%	24%	76%	100%		
(20%, 30%]	9,519	13%	87%	100%	12%	88%	100%		
(30%, 40%]	9,996	9%	91%	100%	8%	92%	100%		
(40%, 100%]	8,350	15%	85%	100%	14%	86%	100%		
Total	46,816	25%	75%	100%	25%	75%	100%		

Table 5 (continued)

Panel C: Probability of attaining GAAP ETR <i>I</i> _{yr} across the distribution									
ETR Range		Full Sample		Deficit Partition		Deficit = 0		High Predicted NOL Partition	
		Prob.	Cum.	Prob.	Cum.	Prob.	Cum.	Prob.	Cum.
[0%, 10%]		10%	10%	34%	34%	3%	3%	33%	33%
(10%, 20%]		6%	16%	10%	44%	5%	7%	10%	43%
(20%, 30%]		14%	29%	10%	53%	15%	22%	11%	54%
(30%, 40%]		53%	82%	28%	81%	60%	83%	28%	82%
(40%, 100%]		18%	100%	19%	100%	17%	100%	18%	100%
Total		100%		100%		100%		100%	
N		54,235		12,256		41,979		13,559	
Panel D: Percentage of firms with large NOL in each portion of the GAAP ETR <i>I</i> _{yr} distribution									
ETR Range		Deficit Partition		Deficit = 0		High Predicted NOL Partition		Total	
		N	Prob.	Prob.	Cum.	Prob.	Cum.	Prob.	Cum.
[0%, 10%]		5,335	78%	22%	100%	84%	16%	100%	100%
(10%, 20%]		3,095	38%	62%	100%	42%	58%	100%	100%
(20%, 30%]		7,540	16%	84%	100%	20%	80%	100%	100%
(30%, 40%]		28,644	12%	88%	100%	13%	87%	100%	100%
(40%, 100%]		9,621	24%	76%	100%	25%	75%	100%	100%
Total		54,235	23%	77%	100%	25%	75%	100%	100%

“Prob.” refers to probability, and “Cum.” refers to the cumulative probability. See [Appendix A](#) for variable definitions

Table 6 Multivariate Analysis: Various ETR Indicators

Panel A: Ability of Deficit to explain various ETR indicators						
Dependent Variable	Deficit Coef.	t-stat.	Controls	Industry & Year F.E.	Adj. R ²	N
Cash ETR 1yr [0–10%]	0.336 ***	(43.72)	Yes	Yes	0.239	46,816
Cash ETR 1yr (10–20%]	−0.001	(−0.11)	Yes	Yes	0.018	46,816
Cash ETR 1yr (20–30%]	−0.089 ***	(−18.93)	Yes	Yes	0.040	46,816
Cash ETR 1yr (30–40%]	−0.126 ***	(−26.99)	Yes	Yes	0.077	46,816
Cash ETR 1yr (40–100%]	−0.120 ***	(−23.01)	Yes	Yes	0.048	46,816
GAAP ETR 1yr [0–10%]	0.240 ***	(39.01)	Yes	Yes	0.250	54,235
GAAP ETR 1yr (10–20%]	0.043 ***	(11.00)	Yes	Yes	0.032	54,235
GAAP ETR 1yr (20–30%]	−0.030 ***	(−6.37)	Yes	Yes	0.066	54,235
GAAP ETR 1yr (30–40%]	−0.231 ***	(−29.65)	Yes	Yes	0.131	54,235
GAAP ETR 1yr (40–100%]	−0.022 ***	(−3.30)	Yes	Yes	0.066	54,235
Panel B: Ability of High Predicted NOL to explain various ETR indicators						
Dependent Variable	High Pred. NOL Coef.	t-stat.	Controls	Industry & Year F.E.	Adj. R ²	N
Cash ETR 1yr [0–10%]	0.378 ***	(51.84)	Yes	Yes	0.263	46,816
Cash ETR 1yr (10–20%]	−0.001	(−0.18)	Yes	Yes	0.018	46,816
Cash ETR 1yr (20–30%]	−0.102 ***	(−21.59)	Yes	Yes	0.042	46,816
Cash ETR 1yr (30–40%]	−0.143 ***	(−31.26)	Yes	Yes	0.081	46,816
Cash ETR 1yr (40–100%]	−0.133 ***	(−26.38)	Yes	Yes	0.052	46,816

Table 6 (continued)

GAAP ETR 1yr [0–10%]	0.237 ***	(42.73)	Yes	Yes	0.254	54,235
GAAP ETR 1yr (10–20%]	0.043 ***	(12.17)	Yes	Yes	0.033	54,235
GAAP ETR 1yr (20–30%]	−0.017 ***	(−3.50)	Yes	Yes	0.066	54,235
GAAP ETR 1yr (30–40%]	−0.236 ***	(−32.12)	Yes	Yes	0.135	54,235
GAAP ETR 1yr (40–100%]	−0.027 ***	(−4.61)	Yes	Yes	0.066	54,235

*, **, *** indicate that the estimated coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. Coefficient estimates are reported with corresponding *t*-statistics, where standard errors are clustered by firm. The dependent variable in each regression is an indicator variable that equals 1 if the ETR falls within a particular ETR range (e.g., 20% to 30%) and 0 otherwise. See [Appendix A](#) for variable definitions

Table 7 Univariate Tests: Low ETR Persistence

ETR Range	Full Sample			Deficit Partition			High Predicted NOL Partition		
				Deficit = 1			Deficit = 0		
	N	%		N	%		N	%	
Panel A: Probability of retaining a Low Cash ETR I_{jyr} in year $t + k$									
$[0\%, 10\%] t$	11,625	100%		6,586	100%		5,039	100%	
$[0\%, 10\%] t + 1$	7,607	57%		4,034	68%		3,573	46%	
$[0\%, 10\%] t + 2$	6,042	50%		3,114	60%		2,928	39%	
$[0\%, 10\%] t + 3$	5,122	45%		2,583	54%		2,539	37%	
$[0\%, 10\%] t + 4$	4,406	43%		2,171	50%		2,235	35%	
Panel B: Probability of retaining a Low GAAP ETR I_{jyr} in year $t + k$									
$[0\%, 10\%] t$	5,335	100%		4,186	100%		1,149	100%	
$[0\%, 10\%] t + 1$	2,396	60%		1,692	68%		704	39%	
$[0\%, 10\%] t + 2$	1,986	40%		1,366	47%		620	27%	
$[0\%, 10\%] t + 3$	1,774	33%		1,226	37%		548	24%	
$[0\%, 10\%] t + 4$	1,640	31%		1,166	34%		474	22%	

This begins with the subsample of firms that have low ETRs in year t and examines their ability to retain a low ETR into the future. Each year into the future the number of observations (i.e., N) declines as firms drop out of the sample (e.g., due to loss years). % reports the percentage of remaining observations that continue to have an ETR between 0 and 10% in year $t + k$

five groups based on their ETR: (1) 0 to 10%, (2) 10% to 20%, (3) 20% to 30%, (4) 30% to 40%, and (5) greater than 40%. Table 5 reports univariate results for the probability of attaining an ETR in each group, and the percentage of firms with large NOLs in each group, for both *Cash ETR 1yr* (Panels A and B) and *GAAP ETR 1yr* (Panels C and D).

Consistent with our expectation, Panels A and C illustrate that firms with large NOLs are concentrated in lower ETR groups and have a low probability of being in higher ETR groups.²² Moreover, Panels B and D suggest that firms with large NOLs make up the majority of the sample in the low ETR group (0 to 10%), and the reverse is true in all other ETR groups. In untabulated analysis, we also examine the ETR distributions of firms with opportunities to engage in aggressive tax planning (*Multinational* and *Haven*). While we showed in Table 3 that multinational and haven firms have a lower probability of having an ETR between 0 and 10% and are underrepresented in the 0 to 10% group, we find these firms have a higher probability of having an ETR in the 10% to 20% and 20% to 30% groups and are overrepresented in the 10% to 20% and 20% to 30% groups.

We also estimate multivariate regressions to examine the likelihood that firms with large NOLs attain ETRs within each of the five groups. These regressions follow Eq. (1), except the dependent variable becomes an indicator for whether the firm had an ETR within a particular ETR group (e.g., 20% to 30%). Table 6 reports the results of these regressions. As expected, the findings generally mirror the univariate results. Firms with large NOLs are more likely to be in the 0 to 10% group and less likely to be in the 20% to 30%, 30% to 40%, and 40% to 100% groups. We also find that multinational and haven firms are generally less likely to be in the 0 to 10% and 30% to 40% groups and more likely to be in the 10% to 20% and 20% to 30% groups (not tabulated). Overall, the results in Tables 5 and 6 help validate that large NOLs are a primary way that firms attain low ETRs by showing that firms with large NOLs are more likely to be concentrated in lower ETR groups.

4 Do low ETR firms incur tax risk?

The results in Section 3 provide evidence that the majority of firms with low ETRs are primarily benefiting from large NOLs rather than aggressive tax planning. Since there is a conceptual link between tax aggressiveness and tax risk (Blouin 2014), this finding has implications for the relation between low ETRs and tax risk. There is currently conflicting evidence regarding whether low ETR firms incur tax risk. On one hand, Dyreng et al. (2019) find that firms with lower cash ETRs recognize larger additions in UTBs, suggesting that as firms avoid more taxes, they incur more tax risk. On the other hand, Guenther et al. (2017) find that ETRs are not negatively associated with future tax rate volatility, suggesting that lower ETRs are likely driven by benign tax positions.

²² Interestingly, the probability of firms without large NOLs obtaining *GAAP ETR 1yr* between 30% and 40% is 60%, suggesting that most firms without large NOLs have one-year GAAP ETRs around the statutory rate. We also find that the probability of having *GAAP ETR 1yr* above 40% is similar for firms with and without large NOLs. This is consistent with the findings of Schwab et al. (2020) that items, such as non-deductible goodwill impairments, can distort high ETRs.

Table 8 Multivariate Analysis: Low ETR Persistence

Panel A: Ability of Deficit to explain Low ETR persistence					
Dependent Variable	Deficit Coef.	t-stat.	Controls	Industry & Year F.E.	Adj. R²
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 1	0.188***	(13.32)	Yes	Yes	0.095
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 2	0.185***	(11.04)	Yes	Yes	0.111
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 3	0.142***	(7.76)	Yes	Yes	0.103
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 4	0.127***	(6.53)	Yes	Yes	0.106
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 1	0.177***	(6.46)	Yes	Yes	0.158
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 2	0.086***	(3.00)	Yes	Yes	0.165
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 3	0.044	(1.56)	Yes	Yes	0.131
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 4	0.033	(1.13)	Yes	Yes	0.097
Panel B: Ability of High Predicted NOL to explain Low ETR persistence					
Dependent Variable	High Pr. NOL Coef.	t-stat.	Controls	Industry & Year F.E.	Adj. R²
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 1	0.226 ***	(16.69)	Yes	Yes	0.107
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 2	0.204 ***	(12.71)	Yes	Yes	0.117
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 3	0.164 ***	(9.57)	Yes	Yes	0.108
<i>Cash ETR</i> 1yr [0–10%] <i>t</i> + 4	0.134 ***	(7.18)	Yes	Yes	0.107
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 1	0.233 ***	(7.97)	Yes	Yes	0.166
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 2	0.083 ***	(2.73)	Yes	Yes	0.164
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 3	0.024	(0.77)	Yes	Yes	0.130
<i>GAAP ETR</i> 1yr [0–10%] <i>t</i> + 4	0.023	(0.70)	Yes	Yes	0.096

*, **, *** indicate that the estimated coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. Coefficient estimates are reported with corresponding *t*-statistics, where standard errors are clustered by firm. The dependent variable in each regression is an indicator variable that equals 1 if the ETR falls within 0–10% in year *t* + *k*, and 0 otherwise. See [Appendix A](#) for variable definitions

Our finding that the majority of low ETR firms are primarily benefiting from large NOLs (i.e., a benign tax position) suggests that, on average, low ETR firms do not incur significant tax risk. To investigate this prediction, we conduct three sets of tests. We first examine whether large NOLs allow firms to persistently retain a low ETR. We then examine the relation between low ETRs and both additions to UTBs (Dyreng et al. 2019) and future tax rate volatility (Guenther et al. 2017).

4.1 Persistence of low ETRs for firms with large NOLs

To understand the relation between low ETRs and tax risk, we first examine whether large NOLs allow firms to persistently retain a low ETR. Although simply having an NOL is unlikely to result in persistently low ETRs, if firms have amassed large NOLs, they should be able to retain a low ETR for several years into the future. In contrast, firms without large NOLs would likely need to engage in aggressive tax planning to obtain a low ETR, which

Table 9 Low ETRs and Ex Ante Tax Risk

Dependent Variable:	<i>UTB Additions</i>					
ETR Distribution:	Cash ETR			GAAP ETR		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>ETR [0–10%]</i>	0.004 (0.34)	0.046*** (2.72)	0.060*** (3.17)	0.021 (1.12)	0.126*** (3.41)	0.140*** (3.04)
<i>ETR (10–20%]</i>	0.036*** (3.12)	0.038*** (3.21)	0.040*** (3.31)	0.124*** (7.09)	0.127*** (7.20)	0.130*** (7.28)
<i>ETR (20–30%]</i>	0.012 (1.41)	0.012 (1.42)	0.013 (1.47)	0.072*** (6.49)	0.071*** (6.49)	0.073*** (6.57)
<i>ETR (40–100%]</i>	−0.017* (−1.95)	−0.016* (−1.83)	−0.015* (−1.66)	0.014 (1.25)	0.017 (1.61)	0.021** (1.99)
<i>Deficit</i>		−0.016 (−1.15)			−0.024* (−1.76)	
<i>Deficit × ETR [0–10%]</i>		−0.071*** (−3.16)			−0.152*** (−3.67)	
<i>High Pr. NOL</i>			−0.028** (−2.11)			−0.040*** (−3.45)
<i>High Pr. NOL × ETR [0–10%]</i>			−0.078*** (−3.34)			−0.137*** (−2.77)
<i>Intercept</i>	0.090*** (3.84)	0.091*** (4.02)	0.098*** (4.29)	0.049** (2.34)	0.055*** (2.76)	0.060*** (2.92)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.090	0.094	0.096	0.106	0.112	0.113
N	10,319	10,319	10,319	10,357	10,357	10,357

*, **, *** indicate that the estimated coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. Coefficient estimates are reported with corresponding *t*-statistics, where standard errors are clustered by firm. See Appendix A for variable definitions

Table 10 Low ETRs and Ex Post Tax Risk

Dependent Variable:	<i>Future Cash ETR Volatility</i>					
	Cash ETR			GAAP ETR		
ETR Distribution:	(1)	(2)	(3)	(4)	(5)	(6)
<i>ETR [0–10%]</i>	–0.001 (–0.22)	0.006* (1.93)	0.006** (1.98)	–0.020*** (–6.90)	–0.005 (–1.03)	–0.005 (–0.73)
<i>ETR (10–20%]</i>	0.009*** (4.06)	0.007*** (3.47)	0.007*** (3.11)	0.005 (1.46)	0.003 (0.94)	0.002 (0.66)
<i>ETR (20–30%]</i>	0.004** (2.12)	0.003* (1.94)	0.003* (1.83)	–0.003 (–1.58)	–0.004* (–1.66)	–0.004* (–1.84)
<i>ETR (40–100%]</i>	0.021*** (11.09)	0.020*** (10.85)	0.020*** (10.78)	0.017*** (8.55)	0.017*** (8.20)	0.017*** (8.14)
<i>Deficit</i>		0.011*** (4.08)			0.007*** (3.05)	
<i>Deficit × ETR [0–10%]</i>		–0.021*** (–5.22)			–0.026*** (–4.26)	
<i>High Pr. NOL</i>			0.013*** (5.66)			0.010*** (4.72)
<i>High Pr. NOL × ETR [0–10%]</i>			–0.021*** (–5.59)			–0.026*** (–3.72)
<i>Intercept</i>	0.094*** (11.57)	0.094*** (11.47)	0.093*** (11.41)	0.079*** (12.45)	0.078*** (12.31)	0.077*** (12.21)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R ²	0.018	0.020	0.021	0.024	0.026	0.026
N	25,686	25,686	25,686	27,573	27,573	27,573

*, **, *** indicate that the estimated coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. Coefficient estimates are reported with corresponding *t*-statistics, where standard errors are clustered by firm. See [Appendix A](#) for variable definitions

may not be sustainable over multiple years. Therefore we expect that low ETRs will be more persistent for firms with large NOLs than firms without large NOLs.

To test whether large NOLs allow firms to persistently retain a low ETR, we track firms with a low ETR in year t over a five-year period (t to $t + 4$) and compare the persistence of low ETRs for firms with and without large NOLs. Consistent with our previous tests, we identify firms as having large NOLs at the end of year $t-1$. Table 7 reports univariate results, with Panel A showing the findings for low annual cash ETRs. N is equal to the low ETR observations in year t that remain in the sample in the future year $t + k$.²³ For example, of the 11,625 *Low Cash ETR 1yr* observations in year t , 7,607 remain in the sample in year $t + 1$,

²³ There are many reasons why firms do not remain in the sample in year $t + k$, such as having negative pretax income, an ETR outside the range of 0 to 1, being acquired, bankruptcy, etc. If a firm does not meet the requirements to stay in the sample for a given year but meets the requirements in a subsequent year, they are included in the sample in the subsequent year. For example, if a firm has negative pretax income in year $t + 1$, they are not included in the sample for that year. However, if they have positive pretax income in the following year (and meet all other requirements), they are included in the sample for $t + 2$.

Table 11 Tax-Advantaged versus Tax-Disadvantaged Analyses

Dependent Variable:	<i>Delta MVA</i>					
	Pr. Sign	<i>Profit firm-years</i>		Pr. Sign	<i>All firm-years</i>	
		(1)	(2)		(3)	(4)
<i>Deficit</i>	(-)	-0.181*** (29.06)		(+)	0.047*** (8.31)	
<i>High Pred. NOL</i>	(-)		-0.221*** (-33.58)	(+)		0.059*** (9.23)
<i>ROA</i>		-0.347*** (-11.46)	-0.305*** (-10.74)		-0.062*** (-11.10)	-0.059*** (-10.56)
<i>Multinational</i>		0.002 (0.23)	0.000 (0.04)		0.006 (0.97)	0.006 (0.92)
<i>Haven</i>		-0.013* (-1.93)	-0.008 (-1.24)		-0.014** (-2.27)	-0.016** (-2.56)
<i>Leverage</i>		-0.000 (-0.03)	-0.023*** (-2.84)		0.037*** (6.61)	0.039*** (7.09)
<i>PPE</i>		-0.160*** (-11.56)	-0.133*** (-9.66)		-0.078*** (6.60)	-0.083*** (-7.06)
<i>R&D</i>		-0.108*** (-4.16)	-0.095*** (-3.65)		0.032*** (5.39)	0.031*** (5.18)
<i>Stock Options</i>		-0.137* (1.69)	-0.101 (-1.27)		-0.314*** (-6.06)	-0.331*** (-6.38)
<i>LnAssets</i>		-0.011*** (-6.24)	-0.011*** (-5.91)		-0.014*** (-9.21)	-0.013*** (-8.28)
<i>MTB</i>		-0.000 (-0.24)	-0.000 (-0.19)		-0.000 (-0.49)	-0.000 (-0.74)
<i>Intercept</i>		0.472*** (19.98)	0.443*** (18.79)		0.557*** (28.05)	0.557*** (28.18)
Industry & Year F.E.		Yes	Yes		Yes	Yes
Adj. R ²		0.071	0.066		0.038	0.038
N		50,660	50,660		78,353	78,353

*, **, *** indicate that the estimated coefficient is statistically significant at the 10%, 5%, and 1% levels, respectively, using a two-tailed test. Coefficient estimates are reported with corresponding *t*-statistics in parentheses, where standard errors are clustered by firm. See [Appendix A](#) for variable definitions

and about 57% of them continue to retain a low ETR. Consistent with our prediction, Panel A illustrates that low ETRs are more persistent for firms with large NOLs, compared to firms without large NOLs. Specifically, about 68% (50%) of firms with large NOLs that had a *Low Cash ETR 1yr* in year *t* continue to have a *Low Cash ETR 1yr* in year *t* + 1 (*t* + 4), relative to only about 46% (35%) for firms without large NOLs. Table 7 Panel B shows similar results using low annual GAAP ETRs. Namely, about 68% (34%) of firms with

large NOLs that had a *Low GAAP ETR 1yr* in year t continue to have a *Low GAAP ETR 1yr* in year $t + 1$ ($t + 4$), relative to just 39% (22%) for firms without large NOLs.

In an untabulated analysis, we also examine the persistence of low ETRs for multinational and haven firms. We find that multinational (haven) firms have less persistent low ETRs compared to domestic (non-haven) firms. In particular, about 49% (35%) of multinationals and 50% (37%) of haven firms that had a *Low Cash ETR 1yr* in year t continue to have a *Low Cash ETR 1yr* in year $t + 1$ ($t + 4$), compared to about 61% (46%) for domestic firms and 60% (45%) for non-haven firms. Similarly, about 44% (27%) of multinationals and 42% (24%) of haven firms that had a *Low GAAP ETR 1yr* in year t continue to have a *Low GAAP ETR 1yr* in year $t + 1$ ($t + 4$), compared to about 65% (32%) for domestic firms and 64% (33%) for non-haven firms.

Next, we examine low ETR persistence using multivariate regressions that control for other tax positions. To perform these analyses, we employ the regression model outlined in Eq. (1) and estimate regressions for years $t + 1$ to $t + 4$. Table 8 Panel A reports the results for low annual cash ETRs. Consistent with our prediction, we find that firms with large NOLs have a significantly higher probability of retaining a *Low Cash ETR 1yr* in future years, relative to firms without large NOLs. Panel B of Table 8 reports similar results for low annual GAAP ETRs. However, we do not find that firms with large NOLs have a higher probability of retaining a *Low GAAP ETR 1yr* in year $t + 3$ and $t + 4$, suggesting that large NOL firms release the valuation allowance gradually over the first couple of years (i.e., t to $t + 1$) and then release the full amount in year $t + 2$.²⁴ Further, in untabulated results, we find that multinational (haven) firms are less likely to achieve persistently low ETRs than domestic (non-haven) firms. Taken together, the results in Section 3 and Tables 7 and 8 provide evidence that not only do large NOLs allow firms to attain a low ETR, they also allow them to persistently retain a low ETR into the near future.

4.2 Low ETRs and tax risk

In this subsection, we directly examine whether low ETR firms incur tax risk. Given our finding that the majority of low ETR firms are primarily benefiting from large NOLs and that these large NOLs allow firms to persistently retain a low ETR, we predict that low ETR firms do not incur significant tax risk. To test this prediction, we estimate the following OLS regression.

$$\begin{aligned} \text{Tax Risk}_{it} = & \beta_0 + \beta_1 \text{ETR } 0\text{--}10\%_{it} + \beta_2 \text{ETR } 10\text{--}20\%_{it} + \beta_3 \text{ETR } 20\text{--}30\%_{it} \\ & + \beta_4 \text{ETR } 40\text{--}100\%_{it} + \varepsilon_{it}. \end{aligned} \quad (2)$$

²⁴ This explanation is consistent with guidance provided by accounting firms, which advises that firms need to show multiple years of profits before fully releasing the valuation allowance. For example, EY's firm guidance states: "when an entity has experienced an uncertain operating environment characterized by a period of recurring losses, it will not be unusual that a demonstrated ability to operate profitably for a *recurring annual period* as well as evidence of a more stable operating environment will generally be needed" before releasing the full valuation allowance (emphasis added, EY, 2020, p. 166). Manuals for the other large public accounting firms contain similar guidance (see PWC 2019, pp. 5–7; KPMG 2019, pp. 151 and 186; Deloitte 2018, p. 177).

The dependent variable, *Tax Risk*, represents either (1) the firm's current year additions in UTBs (*UTB Additions*) or (2) the firm's future five-year cash ETR volatility (*Future Cash ETR Volatility*), where higher levels of both measures suggest greater tax risk. Similar to Dyreng et al. (2019), we use UTB additions, rather than the level of UTBs, because we are interested in current year positions as opposed to historical positions, which may have been taken before the firm was in its current ETR group. Note that additions to UTBs and future cash ETR volatility capture different aspects of tax risk. For instance, while UTBs reflect managers' and external auditors' assessment about the sustainability of tax positions (i.e., ex ante tax risk), future tax rate volatility captures the dispersion of actual tax outcomes (i.e., ex post tax risk).

Similar to our distribution analysis, the independent variables divide the firms into five groups based on their annual cash or GAAP ETRs. *ETR 0–10%* is an indicator variable equal to one if the firm has an ETR between 0 and 10% in the current year and zero otherwise, and we create analogous indicator variables for the 10% to 20%, 20% to 30%, and 40% to 100% groups. We use the 30% to 40% group as the baseline group for our regressions. We view this group as the appropriate baseline, because these firms pay roughly the statutory tax rate and thus represent a relatively risk-free group that are not likely to be engaging in high levels of aggressive tax planning.²⁵ The benefit of dividing the firms into ETR groups is that it allows us to provide new insights about how tax risk is manifest across the ETR distribution, and allows for an easy comparison between the groups. *ETR 0–10%* is the variable of interest and captures whether low ETR firms incur more or less tax risk relative to firms that pay roughly the statutory tax rate. In addition to the base regression presented in Eq. (2), we estimate a modified version that examines how the relation between low ETRs and tax risk varies across firms with and without large NOLs. To do so, we interact *ETR 0–10%* with our proxies for large NOLs.

The results using our first measure of tax risk, *UTB Additions*, are presented in Table 9.²⁶ Columns (1)–(3) and (4)–(6) report results where the ETR groups are formed using annual cash and GAAP ETRs, respectively. We find that low ETR firms do not incur significant tax risk. Specifically, columns (1) and (4) demonstrate that firms with ETRs between 0 to 10% accrue UTBs at a similar rate as firms that pay roughly the statutory tax rate (i.e., the baseline group with ETRs of 30% to 40%). This finding contrasts with the inference of Dyreng et al. (2019) that firms with relatively lower ETRs bear significantly greater tax risk than firms with higher ETRs.

To reconcile the seemingly opposing results, note that columns (1) and (4) also demonstrate there is a nonlinear relation between ETRs and UTB additions. For instance, while firms with the lowest ETRs incur similar additions in UTBs as firms that pay roughly the statutory tax rate, firms with ETRs between 10% to 20% recognize the highest UTB additions. Since Dyreng et al. (2019) classify firms as “tax avoiders” if their ETR is in the bottom tercile, their classification includes almost all of the firms in both the 0 to 10% and the 10% to 20% groups. To examine how this different classification affects our results, in an untabulated analysis, we combine the 0 to 10% and 10% to 20% groups and create an *ETR 0–20%* variable. Consistent with Dyreng et al. (2019), we find a positive and significant

²⁵ During our sample period, the U.S. federal tax rate was 35%, and prior research estimates the average state tax rate for a large sample of U.S. firms is about 4% (Shevlin et al. 2017).

²⁶ As we are interested in the tax risk of profitable companies, we eliminate observations where pretax income is negative, consistent with our other tests.

association between *ETR 0–20%* and *UTB Additions*. This illustrates that since the relation between ETRs and UTB additions varies across the ETR distribution, inferences will change depending on how the model is specified.²⁷

Columns (2)–(3) and (5)–(6) of Table 9 show the results once we interact *ETR 0–10%* with our proxies for large NOLs. In all columns, we find that the interaction term is negative and significant suggesting that, relative to firms without large NOLs in the 0 to 10% group, firms with large NOLs in this low ETR group have lower UTB additions. We also find that *ETR 0–10%* (i.e., the main effect) becomes positive and significant, suggesting that firms without large NOLs that achieve a low ETR do incur significant tax risk (e.g., multinational and haven firms).²⁸

The results using our second measure of tax risk, *Future Cash ETR Volatility*, are presented in Table 10. Columns (1)–(3) and (4)–(6) report results where the ETR groups are formed using annual cash and GAAP ETRs, respectively. We again find that low ETR firms do not incur significant tax risk. Specifically, columns (1) and (4) demonstrate that firms with ETRs between 0 to 10% do not have higher future tax rate volatility than firms that pay roughly the statutory tax rate (i.e., the baseline group with ETRs of 30% to 40%). The results in columns (1) and (4) also expand on the findings in Guenther et al. (2017) by illustrating there is a nonlinear relation between ETRs and future tax rate volatility. In particular, while firms with the lowest ETRs have similar volatility as firms that pay roughly the statutory tax rate, firms with ETRs between 40% to 100% incur the highest volatility, which likely reflects the effects of transitory items, rather than aggressive tax planning (Schwab et al. 2020).

Columns (2)–(3) and (5)–(6) show the results once we interact *ETR 0–10%* with our proxies for large NOLs. In all columns, we find that the interaction term is negative and significant suggesting that, relative to firms without large NOLs in the 0 to 10% group, firms with large NOLs have lower future tax rate volatility. In columns (2)–(3) but not (5)–(6), we also find that *ETR 0–10%* becomes positive, suggesting that firms without large NOLs that achieve a low cash ETR do have higher future tax rate volatility.

Taken together, the findings in Tables 9 and 10 tell a consistent story: on average, firms with ETRs between 0 to 10% (i.e., low ETR firms) do not incur significant tax risk. Further, by dividing the firms into ETR groups, we shed light on the seemingly opposing results of Dyreng et al. (2019) and Guenther et al. (2017). Specifically, we show that, since the relation between ETRs and tax risk is nonlinear, inferences will change depending on how the model is specified. We also note that, since UTBs capture ex ante tax risk while future tax rate volatility captures ex post risk, there can be differences between the measures in how tax risk is manifest across the ETR distribution.

²⁷ We also replicate Model 1 from Table 4 of Dyreng et al. (2019) and continue to find the effect of nonlinearities. That is, the coefficient on *ETR 0–20%* is positive and significant, but when we separate it into two groups, *ETR 0–10%* is insignificant, and *ETR 10–20%* is positive and significant.

²⁸ For example, in untabulated analyses, if we take the model in column (2) and add an interaction term of *ETR 0–10% × Multinational* (or *× Haven*), the main effect on *ETR [0–10%]* becomes statistically insignificant again, and the interaction term of *ETR 0–10% × Multinational* is positive and statistically significant. Furthermore, the interaction term of *ETR 0–10% × Deficit* continues to be negative and statistically significant.

5 Are firms with large NOLs tax-advantaged or tax-disadvantaged?

The results presented in Sections 3 and 4 suggest that large NOLs allow firms to attain low ETRs in profit years without incurring tax risk. Thus firms with large NOLs appear to have a tax advantage over other profitable firms. At face value, some might see this as evidence that NOLs represent a loophole that policymakers should close. However, we predict that firms with large NOLs are actually tax-disadvantaged when both profit and loss years are considered. We base this prediction on the notion that, if a firm can fully utilize all of its NOLs, the NOLs will at best allow the firm to be tax neutral. This is because, in the best-case scenario, the tax refunds the firm was unable to claim during loss years should eventually equal the tax savings the firm will get in profit years (ignoring the time value of money) when it is able to exactly offset future profits with past losses. However, if the NOLs are not fully utilized, which we expect to sometimes be the case, firms with large NOLs will, on average, be tax-disadvantaged.

To test this expectation, we use the measure developed by Henry and Sansing (2018), *Delta MVA*, as our dependent variable in a sample of profit and loss years. (See Appendix A for more details on how *Delta MVA* is calculated.) As reported in Table 11, we find that our proxies for large NOLs are negatively associated with *Delta MVA* during profit years, suggesting that, relative to other profitable firms, firms with large NOLs are tax-advantaged in profitable years. However, when we include both profit and loss years in the sample, our proxies for large NOLs are positively associated with *Delta MVA*, consistent with our expectation that firms with large NOLs are tax-disadvantaged overall.

6 Conclusion

We examine how most profitable firms attain low ETRs (i.e., an ETR between 0 and 10%). The business press, public interest groups, policymakers, and academics are interested in firms with the lowest ETRs. Yet we argue that little is known about this group of firms. That is, while there is an extensive literature on cross-sectional differences in ETRs, studies generally focus on average ETRs and thus cannot directly speak to how a firm ends up in the left-tail of the distribution.

While it is often assumed that low ETR firms are engaging in aggressive tax planning, we predict that the majority are primarily benefiting from a benign tax position: large NOLs. Testing this prediction requires reliable measures that identify whether firms have large NOLs. To overcome the severe measurement error in Compustat NOL data, we use an intuitive proxy for large NOLs based on whether a firm reports an accumulated deficit on its balance sheet (i.e., negative retained earnings). We also corroborate our results using another proxy for large NOLs based on the predicted NOL benefit constructed by Heitzman and Lester (2020).

Using these measures, we demonstrate the majority of firms with low ETRs suffered heavy losses in the past and are now utilizing large NOLs. We also find that large NOLs allow firms to persistently retain low ETRs year after year. In contrast, we find that multinationals and tax haven firms, which are often assumed to have more opportunities for aggressive tax planning, have a lower probability of attaining a low

ETR relative to domestic and non-haven firms. Collectively, these findings suggest that the typical low ETR firm does not incur significant tax risk. Consistent with this, we find that low ETR firms accrue unrecognized tax benefits at a similar rate as firms that pay the statutory tax rate and do not experience higher future tax rate volatility. Overall, the results shed light on the profile of the average low ETR firm and provide evidence that the majority are utilizing large NOLs rather than aggressive tax planning.

Our study also has implications for future researchers who want to study or control for large NOLs. In particular, our deficit measure, along with the predicted NOL benefit calculated by Heitzman and Lester (2020), provide two solutions for future researchers, depending on their research question. That is, our deficit measure, which is a component of the predicted NOL benefit, appears to be a parsimonious version of the predicted NOL benefit in terms of identifying firms with large NOLs, while the predicted NOL benefit will better capture the full distribution of NOLs.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11142-021-09614-8>.

Appendix A Variable Definitions

Variable Name	Description
<i>Dependent Variables</i>	
<i>Low Cash ETR 1yr</i>	Indicator variable equal to one if <i>Cash ETR 1yr</i> falls between 0 and 10%, zero otherwise. The underlying <i>Cash ETR 1yr</i> is calculated as cash taxes paid (TXPD) divided by pretax income (PI). Firm-years with negative denominators and/or <i>Cash ETR 1yr</i> outside the range [0,1] are set to missing.
<i>Low Cash ETR 3yr</i>	Indicator variable equal to one if <i>Cash ETR 3yr</i> falls between 0 and 10%, zero otherwise. The underlying <i>Cash ETR 3yr</i> is calculated as the three-year sum (from year t to $t+2$) of cash taxes paid (TXPD) divided by the three-year sum of pretax income (PI). Observations where the three-year sum of pretax income is negative and/or <i>Cash ETR 3yr</i> is outside the range [0,1] are set to missing.
<i>Low Cash ETR 5yr</i>	Indicator variable equal to one if <i>Cash ETR 5yr</i> falls between 0 and 10%, zero otherwise. The underlying <i>Cash ETR 5yr</i> is calculated as the five-year sum (from year t to $t+4$) of cash taxes paid (TXPD) divided by the five-year sum of pretax income (PI). Observations where the five-year sum of pretax income is negative and/or <i>Cash ETR 5yr</i> is outside the range [0,1] are set to missing.
<i>Low GAAP ETR 1yr</i>	Indicator variable equal to one if <i>GAAP ETR 1yr</i> falls between 0 and 10%, zero otherwise. The underlying <i>GAAP ETR 1yr</i> is calculated as total tax expense (TXT) divided by pretax income (PI). Firm-years with negative denominators and/or an ETR outside the range [0,1] are set to missing.
<i>Cash ETR 1yr</i>	Cash taxes paid (TXPD) divided by pretax income (PI). Firms are required to have a positive denominator and <i>Cash ETR 1yr</i> is truncated to the range [0,1].
<i>GAAP ETR 1yr</i>	Total tax expense (TXT) divided by pretax income (PI). Firms are required to have a positive denominator, and <i>GAAP ETR 1yr</i> is truncated to the range [0,1].
<i>ETR (X0%,X0%)</i>	Indicator variable equal to one if the firm's ETR falls within a particular ETR range (e.g., 20% to 30%), zero otherwise.

Variable Name	Description
<i>UTB Additions</i>	Increase in uncertain tax benefit, measured as the increase in current year uncertain tax positions (TXTUBPOSINC) scaled by sales (SALE). Multiplied by 100 for readability.
<i>Future Cash ETR Volatility</i>	The standard deviation of <i>Cash ETR 1yr</i> over a five-year period ($t+1$ to $t+5$). Individual years where <i>Cash ETR 1yr</i> does not have a positive denominator and/or it is outside the range of $[0,1]$ are not included in this calculation.
<i>Delta MVA</i>	Cash taxes paid (TXPD) minus the change in tax refund receivable (TXR) minus the product of pretax income times the statutory tax rate ($PI \times 0.35$), all scaled by the market value of assets ($AT + (PRCC_F \times CSHO) - SEQ$). If the market value of assets is missing, the book value of assets (AT) is instead used as the deflator.
Variables of Interest	
<i>Deficit</i>	Indicator variable equal to one in year t if the firm reported an accumulated deficit (i.e., negative value for its retained earnings: REUNA) at the end of the prior year, zero otherwise.
<i>High Pred. NOL</i>	Indicator variable equal to one in year t if the firm's predicted NOL is in the top quartile at the end of the prior year, zero otherwise. Predicted NOLs are calculated following Heitzman and Lester (2020). For additional details on this calculation, see Appendix B .
Control Variables	
<i>ROA</i>	Return on assets, measured as pretax income (PI) less extraordinary items (XI), all scaled by lagged total assets (AT).
<i>Multinational</i>	Indicator variable equal to one if the firm has nonzero pretax foreign income (PIFO), zero otherwise.
<i>Haven</i>	Indicator variable equal to one if the firm has a subsidiary in a tax haven country per Exhibit 21, zero otherwise.
<i>Leverage</i>	Leverage, measured as long-term debt (DLC + DLTT) scaled by lagged total assets (AT). Set DLC and DLTT to zero if missing.
<i>PPE</i>	Property, plant, and equipment, measured as net PP&E (PPENT) scaled by lagged total assets (AT).
<i>R&D</i>	Research and development expense (XRD) scaled by Sales (SALE). Set XRD to zero if missing.
<i>Stock Options</i>	Stock options, measured as stock option expense (STKCO) divided by lagged total assets (AT). For fiscal years that ended prior to when SFAS 123R went into effect (June 15, 2005), we instead use the implied stock option expense (XINTOPT) in place of STKCO. Set to zero if missing.
<i>LnAssets</i>	The natural log of total assets (AT).
<i>MTB</i>	Market to book ratio, at the beginning of the year, measured as market value of equity ($PRCC_F \times CSHO$) scaled by book value of equity (CEQ).
<i>Industry Fixed Effects</i>	Indicator variables for each of the Fama French 48 industries.

Appendix B Calculation of Predicted NOL

This appendix outlines how *Predicted NOL* is calculated, following Heitzman and Lester (2020). In their paper, Heitzman and Lester hand collect NOL data from the 10-K filings of ExecuComp companies over the years 2010 to 2015. Using this data, they construct a NOL benefit variable, which is measured as tax-rate weighted NOL divided

by total assets. They then use Compustat data to predict this hand collected variable, as reported in their Table 4 columns (4) and (5). We calculate *Predicted NOL* based on the coefficient estimates from those regressions. When Compustat NOL data is available (i.e., $TLCF > 0$), *Predicted NOL* is calculated as follows.

$$\begin{aligned} \text{Predicted_NOL} = & 0.009 + (0.185 \times \text{Compustat_TLCF}) + (-0.013 \times \text{Sum_PTI_3yr}) + \\ & (0.008 \times \text{Neg_Sum_PTI_3yr}) + (0.012 \times \text{Retained_Earn}) + (0.003 \times \text{Tax_Paid}) + \\ & (0.002 \times \text{Foreign_Activity}) + (-0.006 \times \text{RD}) + (0.002 \times \text{Market_To_Book}) \\ & + (-0.001 \times \text{LnBookAssets}) + (-0.013 \times \text{Sum_Acquisitions_3yr}) + (0.007 \times \text{Leverage}). \end{aligned}$$

When Compustat NOL data are not available, Predicted NOL is calculated as follows.

$$\begin{aligned} \text{Predicted_NOL} = & 0.024 + (-0.044 \times \text{Sum_PTI_3yr}) + (0.027 \times \text{Neg_Sum_PTI_3yr}) \\ & + (0.035 \times \text{Retained_Earn}) + (0.012 \times \text{Tax_Paid}) + (0.008 \times \text{Foreign_Activity}) \\ & + (0.074 \times \text{RD}) + (0.004 \times \text{Market_To_Book}) + (-0.002 \times \text{LnBookAssets}) + \\ & (-0.026 \times \text{Sum_Acquisitions_3yr}) + (-0.002 \times \text{Leverage}), \end{aligned}$$

where each of the variable inputs to these equations are calculated as follows. *Compustat_TLCF* equals net operating loss carryforwards (TLCF) divided by total assets (AT). *Sum_PTI_3yr* equals the sum of pretax income (PI) over the years t to $t-2$ minus the sum of special items (SPI) over the years t to $t-2$, all divided by total assets (AT). If special items is missing, it is set to zero. *Neg_Sum_PTI_3yr* is an indicator set to one if *Sum_PTI_3yr* is less than zero and set to zero otherwise. *Retained_Earn* is an indicator set to one if retained earnings (RE) is less than zero and set to zero otherwise. *Tax_Paid* is an indicator set to one if cash taxes paid (TXPD) is less than or equal to zero and set to zero otherwise. *Foreign_Activity* is an indicator set to one if the firm reports nonzero pretax foreign income (PIFO) or foreign taxes (TXDFO or TXFO) and set to zero otherwise. *RD* equals research and development expense (XRD) scaled by sales (SALE). It is set to zero if XRD is missing. *Market_To_Book* equals total assets (AT) minus common equity (CEQ) plus the market value of equity ($\text{PRCC_F} \times \text{CSHO}$), all scaled by total assets (AT). *LnBookAssets* equals the natural log of total assets (AT). *Sum_Acquisitions_3yr* equals the sum of cash (AQC) and stock acquisitions ($\text{ACQCSHI} \times 0.5 \times (\text{ending price} + \text{beginning price})/2$) over the years t to $t-2$, all scaled by beginning total assets (AT). *Leverage* equals total long-term debt (DLTT+DLC) divided by total assets (AT).

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