Does Voluntary Private Tax Disclosure Reduce IRS Audit Risk?

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Abstract. This paper examines the trade-off between voluntary private tax disclosure and audit risk associated with firms' use of private letter rulings (PLRs). PLRs allow firms to seek binding guidance from the Internal Revenue Service (IRS) on the tax treatment of specific transactions, reducing uncertainty but requiring voluntary disclosure of sensitive tax information to the IRS. Using a novel dataset of PLRs disclosed in public firms' SEC filings, we find that firms receiving a PLR for the first time experience a decreased likelihood of audit. These results are concentrated in small to mid-size firms, and those with moderate levels of tax avoidance. We find no other change in tax outcomes—GAAP ETRs, Cash ETRs, or UTBs, suggesting that firms' tax behavior does not change following receipt of the PLR. We find firms that disclose PLRs also change tax disclosure, suggesting they perceive and want to convey to stakeholders this decreased audit risk. Our study contributes to the literature on corporate tax strategy, voluntary disclosure, and tax enforcement by providing large-sample empirical evidence on the effects of PLRs. For policymakers, our results suggest that expanding the availability of PLRs or similar programs could improve tax compliance and reduce enforcement costs for both firms and the IRS.

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1. Introduction

The past two decades have seen a proliferation of mandatory tax disclosure rules, largely in response to aggressive tax planning by multinational corporations. These regimes, including Country-by-Country Reporting, the public disclosure of tax return information in Australia and Japan, and public U.K. Tax Strategy disclosures, all operate under the assumption that greater mandatory disclosure can influence corporate tax behavior absent changes to the underlying tax laws. A substantial body of empirical work already explores the mixed, often modest, effects of these mandatory disclosure regimes. However, far less is known about *voluntary* tax disclosures, especially those shared privately with the tax authority rather than broadcast to investors or the public. As Hoopes, Robinson and Slemrod (2024) observe, research has only begun to examine the consequences of voluntary tax disclosures for firm behavior and enforcement outcomes. This paper fills that gap by studying the longest-standing U.S. mechanism for voluntary, private tax disclosure: Private Letter Rulings (PLRs). Using a newly constructed dataset that links firm-year observations of PLR disclosures in SEC filings to subsequent IRS-audit indicators, we examine whether obtaining a PLR changes a firm's audit risk and its general tax behavior.

We examine voluntary tax disclosures in the context of PLRs. A PLR is a formal determination issued by the IRS, at the request of a taxpayer, that provides definitive guidance on the tax treatment of a particular tax position. The IRS offers PLRs in order to provide clarity and certainty to taxpayers in advance of tax filings. The PLR process begins with the taxpayer submitting a detailed written request to the IRS, describing the facts of the situation, the relevant law, and the desired tax treatment. The IRS then scrutinizes the request—often engaging in back-and-forth correspondence for clarifications—and ultimately issues a ruling letter stating whether it agrees with the proposed tax treatment (or specifying how the position will be treated). The PLR, which applies only to the requesting taxpayer and that specific situation, is binding on the IRS. This offers the firm certainty on that issue (barring changes in law), effectively precluding the IRS from later successfully challenging the position if it was carried out in accordance with the facts presented.

However, firm behavior with regards to disclosure considers both the benefits, and costs of disclosure (Verrecchia 1983), and there could be substantial costs with PLRs. Obtaining a PLR can be expensive and time-consuming: the process takes months or even years, the IRS charges user fees, and firms incur substantial legal and professional fees to prepare comprehensive requests. If the issue is material, the firm may be required to publicly disclose that it has requested a PLR, and in some cases, may have to publicly disclose that the IRS has responded unfavorably or declined to issue a ruling. Perhaps the principal concern for firms is that requesting a PLR requires voluntarily disclosing detailed information about a contemplated transaction to the IRS, potentially flagging a significant tax position—or its tax planning strategies more broadly—to the tax authority.

The voluntary disclosure inherent in a PLR request creates a fundamental trade-off for firms. On one hand, securing a favorable PLR provides certainty and may help the firm avoid future disputes or adverse tax outcomes. On the other hand, not all PLR requests result in favorable rulings, and in the process, the firm essentially "shows its cards" to the IRS, potentially inviting greater scrutiny. That is, filing a PLR entails disclosing to the IRS areas of uncertainty in the firm's tax position, which may increase the likelihood of audit. Whether PLRs ultimately increase or decrease audit risk is an empirical question. We examine whether firms that obtain PLRs experience lower subsequent IRS audit risk and, if so, if that comes at the cost of having to change subsequent tax behavior.

We explore this question using a novel sample of PLR usage by U.S. public firms. Although PLRs are *private* in the sense that the IRS does not disclose the taxpayer's identity, public companies often reveal the existence of significant PLRs in their financial statements or other disclosures when the matter is material. Using a large language model (GPT), we collect and identify 6,688 firm-years of PLRs mentioned in SEC filings, ultimately using 1,093 firm-years after eliminating financial and utilities firms and observations with missing data. To measure whether a firm experienced an IRS audit, we use data from Armstrong (2023), who similarly uses GPT to read and classify 10-K text to identify instances where a firm indicates it is under IRS audit.

We first provide a descriptive analysis of the PLR data. We show that disclosed PLR usage increases over time, suggesting a growing demand for tax certainty amid increasing regulatory complexity or firms' increasing desire to mitigate risk. In 1996, the first full year of data, 41 firms mention PLRs in their financial statements, compared to 82 firms in 2022, a 100% increase. We find a similar and more pronounced pattern when we examine the percentage of firm-years disclosing a PLR. Around 1.0% of observations in 1996 disclose a PLR, with the proportion peaking at above 3.7% in 2015, and ending at 2.9% in 2022. In terms of the types of tax issues covered by PLRs, we find that just over half of the PLRs in our sample are related to reorganizations (54%), followed by retirement and benefit plans (9%). The remaining categories cover a wide range of topics, such as net operating losses, stock options, synthetic fuel credits, etc.

Regarding the types of firms that disclose PLRs, we find in a determinants analysis that these firms are larger and have lower sales growth, profitability, and GAAP ETRs than firms not disclosing PLRs. Overall, this suggests that PLRs tend to be used by large, mature firms, which result holds even after the addition of firm fixed effects, suggesting that these factors matter not only between different types of firms but also within firm (as the same firm grows larger, more complex, etc., it is more likely to seek a PLR).

After providing this descriptive information, we move to our first research question—whether use of PLRs changes the probability of being audited. We examine our main research question by using a stacked difference-in-differences design. Compared to an entropy-balanced control group, we find that firms are significantly less likely to be audited by the IRS following the first disclosure of a PLR. The magnitude of this effect is considerable. We estimate that future audits are reduced by 3.9 percentage points, relative to a baseline of 16.9% (i.e., a reduction of 23.1%).

Having shown that IRS audits decrease following a PLR, we next examine whether the firm alters its tax behavior after disclosing the receipt of a PLR. We have two motivations for this test. First, simply understanding post-PLR behavior from firms is interesting in its own right. Second, if a firm changes its behavior post-PLR, that might provide a mechanism for the reduction in IRS audits we observe. For example, audit risk may decrease not because of the PLR, per se, but rather because the firm is making less risky tax decisions. However, in our tests, we observe no post-PLR change in tax behavior. This result provides insights into post-PLR behavior, as well as suggests that the change in audits we observe stems from the IRS response to the PLR and not from post-PLR reduction in tax avoidance.

A primary limitation of this test is that the decision to seek a PLR, or to grant it, may be non-random. Firms that pursue PLRs and disclose them in financial statements may be fundamentally different than other firms, and these differences may be correlated with the propensity of being audited. Ideally, one would identify an exogenous shock or instrument that is associated with PLR usage and disclosure but not with IRS audit rates. However, we are aware of no such instruments that pass weak instrument tests.[1] Instead, we identify two alternative specifications that can alleviate selection issues.

First, we compare firms that disclose PLRs sought from the IRS versus PLRs sought from a foreign tax authority. Firms that disclose foreign PLRs reveal that they have a similar propensity to pursue and disclose a PLR. If private voluntary disclosure to the IRS drives the effect on IRS audits rather than some unobservable characteristic correlated with the choice to seek PLRs in general, we would expect to only find a reduction in IRS audits among U.S. PLRs. However, if firm type drives our main result (e.g., firms that begin obtaining PLRs are shifting their overall tax strategy to reduce audit risk, or that firms with contemporaneous changes in an unobservable characteristic are those that choose to seek PLRs), we would expect to see similar results among both U.S. and foreign PLRs. We find that IRS audit rates decline only for U.S. PLRs, consistent with our hypothesis.

Second, we examine a setting where firms are taking proactive action to reduce their tax risk associated with a major transaction or tax position (and disclose this action to investors), but do not reveal to the IRS the details of the tax position. Specifically, we repeat our main test for firms that disclose receiving tax-related opinion letters from law and/or accounting firms. We find no effect of opinion letters on future IRS audits, suggesting the mechanism is the disclosure to the IRS, and not simply that the firm was attempting to reduce tax-related uncertainty.

Next, we explore additional evidence that a firm's IRS audit risk declines following a PLR. In a similar entropy-balanced stacked difference-in-differences design, we find significant changes in firms' 10-K disclosures following the first disclosure of a PLR. Specifically, we find that the

[1] For example, many potential instruments, such as the IRS budget, would be associated with both PLR usage and IRS audits. Others, such as changes in PLR user fees, are too weak—likely because the fees are immaterial to large, public firms.

tax footnote exhibits fewer uncertainty related words, using the Loughran and McDonald (2014) dictionary, and that the footnote also contains more numbers, which may be a mechanical effect of capturing disclosure about the PLR. Importantly, we show that the extent of uncertainty-related words in the MD&A does not change, suggesting that our result is not driven by a general change in uncertainty related to the underlying economics of the transactions which may have inspired the PLR.

Finally, we perform several cross-sectional tests to determine where the effects are more concentrated and to validate our research design. First, we examine the heterogeneity of our response across quartile of firm size. Because large firms are audited more consistently and may not be able to reduce audit risk via voluntary disclosure, we expect our results to be concentrated in smaller firms. Indeed, we find our effect is concentrated in the smallest firms, with only the smallest two quartiles of size exhibiting a statistically significant coefficient. Second, we examine whether a firm's existing level of tax avoidance interacts with the ability of a PLR to reduce future IRS audit risk. We find that only PLRs from firms in the upper-middle quartile of tax avoidance are associated with a statistically significant decrease in future IRS audits. This suggests that the private voluntary tax disclosure inherent in PLRs acts as a marginal signal to the IRS when compared with other more salient signals like a firm's historical level of tax avoidance. Third, we examine the results among non-reorganization related PLRs. We do this because many PLRs are associated with reorganizations, which imply other major changes at the firm that could be driving our results. We show that the results hold in a smaller sample of only non-reorganization related PLRs, with a similar magnitude (4.7%) as the full sample.

Because our analysis relies on disclosed PLRs, it is important to note that our observations reflect two distinct disclosures: one private and one public. First, there is a private, voluntary disclosure to the IRS when a firm requests a PLR—this is a voluntary revelation to the IRS that potentially affects audit risk. Second, when a firm publicly discloses the existence of the PLR in its 10-K, it may be engaging in either voluntary or mandatory disclosure under financial reporting rules. Our baseline assumption is that firms do not voluntarily disclose immaterial potential tax risks to investors; therefore, when PLRs are mentioned in SEC filings, they likely pertain to tax issues that are material under applicable accounting standards and thus require disclosure, making them mandatory. However, because materiality is ultimately a managerial judgment and the accounting rules governing such disclosures are principles-based, we cannot definitively determine whether any particular disclosure is mandatory or voluntary. This ambiguity notwithstanding, the presence of a public PLR disclosure allows us to observe when the private disclosure to the IRS occurred. Furthermore, our comparison with foreign PLRs and opinion letters, which would involve a similar disclosure choice by firms, holds constant both disclosure decisions.

Our study makes several contributions. First, we contribute to the disclosure literature in accounting. Prior work on voluntary disclosure has predominantly examined information flow from firms to investors or the public. In contrast, we examine a form of voluntary disclosure to the tax authority, an angle that has been largely overlooked. As Hoopes, Robinson, and Slemrod (2024) observe, firms regularly issue mandatory disclosures to investors, regulators, and tax authorities, but *voluntary* and *private* disclosures such as PLRs to the IRS are rare. Moreover, few studies examine the consequences of this class of firm disclosure.

Second, we contribute to the academic literature on corporate tax strategy and tax risk by providing novel evidence on an important yet understudied mechanism: PLRs. While PLRs have existed for decades and are commonly used in practice, there is little published empirical research documenting their effects. By constructing a large-sample database of PLRs in U.S. public firms and analyzing their consequences, we fill this gap.[2] Finally, our results have practical relevance for managers and tax professionals. The PLR process is costly, and its benefits have remained somewhat opaque—our results highlight one clear advantage: a reduction in future IRS audits.

2. Background and Hypothesis Development

2.1. Tax Disclosure and Firm Outcomes

A large and growing literature examines the effect of various private and public tax disclosure regimes on firms' (mostly tax) outcomes. The central premise of these regimes—e.g., public and private Country-by-Country Reporting (CbCR), U.K. Tax Strategy disclosures, public tax return disclosures for large companies in Australia—is that greater disclosure of firms' tax activities, without changing the underlying tax laws, may curb aggressive tax planning. The results in this literature are mixed, with many studies finding little to no effects, but there are important nuances depending on the disclosure type.

Hoopes, Robinson, and Slemrod (2024) break out prior literature into four areas, based on two dimensions: (1) mandatory or voluntary disclosure, and (2) public or private tax disclosure. Mandatory and public disclosures have received the bulk of the attention in prior research, primarily because of accountants' interest in financial reporting (which is public) and because these public disclosures produce data available for researchers to use. In terms of *public* disclosure, studies have examined whether CbCR leads to a reduction in tax avoidance, with moderate evidence of decrease in income shifting, but no evidence of reductions in effective tax rates (Joshi, Outslay, and Persson 2020). Several papers study U.K. tax strategy disclosure, a mandatory

[2] Our findings contrast with a concurrent study by Gardner, Polk, and Yazzie (2025),which finds that firms requesting PLRs are associated with heightened tax authority monitoring. We discuss this paper in Section 4.2, including differences in design choice that lead to our different result.

qualitative disclosure, with findings suggesting increased voluntary disclosure but no widespread effect on effective tax rates (Belnap 2023; Bilicka, Casi, Seregni, and Stage 2025; Xia 2020). The Australian public tax return disclosure regime has provided few examples of explicit firm changes to tax planning, but does provide examples of firms trying to get out of disclosure (Hoopes, Robinson, and Slemrod, 2018; Chen, 2016; Kays, 2021). This literature highlights the complex trade-offs and potential unintended consequences of public tax transparency initiatives. However, in general, studies examining disclosure regimes to the public, which involve public shaming as a mechanism, find little evidence such disclosures are effective (Hanlon, Hoopes, and Shackelford 2025).

In addition to these public disclosure regimes, firms can also make voluntary, one-off, tax-related public disclosures to convey good news to investors. For example, Hepfer, Judd, and Rice (2025) find that IPO firms signal the quality of their R&D by claiming R&D tax credits (and disclosing this fact) even when the firms don't expect to utilize the credits. A concurrent paper by Chen, Lusch, Murphy, and Xia (2025) also examines PLRs, using a targeted sample of firms that announce tax-free spin-offs. They find that market returns are more positive to spin-off announcements that disclose the receipt of a favorable PLR from the IRS.

A number of studies also examine *private mandatory* tax disclosures, which involve the sharing of tax-sensitive information directly with tax authorities. Studies on specific U.S. private disclosures like Schedule M-3 show initial investor beliefs that it would increase future tax burdens or compliance costs (Donohoe and McGill 2011), but other research suggests these short-term changes did not persist and tax avoidance was greatest in later years despite new disclosure requirements (Henry, Massel, and Towery 2016). Similarly, for Schedule UTP, which requires reporting uncertain tax positions, research found no discernible market reaction in one study

(Edwards, Koester, and Shevlin 2010), while another found market reactions suggesting details of the regime's design matter (Abernathy, Davenport, and Rapley 2012); other studies indicate firms modified financial statement disclosures to avoid UTP reporting (Abernathy et al. 2012; Honaker and Sharma 2017; Towery 2017). Research on private CbCR reporting suggests a small increase in effective tax rates (Joshi 2020; Hugger 2019), but no robust evidence of reduced profit shifting (Joshi 2020), alongside unintended consequences like changes in real investment to substantiate profits (De Simone and Olbert 2022) or reduced investment in high-tax countries (Joshi, Markle, and Robinson 2022).

Voluntary audit programs, such as those in cooperative compliance programs like the U.S. CAP, indicate that moderately uncertain firms, rather than the most aggressive or conservative, are more likely to participate (Beck and Lisowsky 2014), seeking certainty and quicker dispute resolution. They could be considered a private mandatory tax disclosure. Overall, while some private disclosure regimes aim to increase tax revenue and compliance, empirical evidence on their consistent success in achieving these goals is limited, with firms sometimes taking action to avoid these disclosures. Despite the widespread availability of voluntary private disclosure programs, Hoopes et al. (2024) highlights that there are few published studies that examine their effects on firm outcomes. Two recent exceptions are Chen, Lusch, Murphy, and Xia (2025) and Gardner, Polk, and Yazzie (2025). Chen et al. (2025) examine the public disclosure of PLRs as a signal to investors, as discussed above. Gardner, Polk and Yazzie (2025) find firms that seek PLRs are more likely to draw IRS scrutiny, the exact opposite of our result. We discuss the differences between our paper and Gardner, Polk and Yazzie (2025) later, including empirical choices we make differently to generate a different empirical relationship.

2.2. *Mitigating Tax Uncertainty*

Tax uncertainty arises from multiple sources, including the complexity of tax law (e.g., ambiguous statutes and intricate regulations), conflicting interpretations among tax authorities and courts, and changes in law over time. For public companies, this uncertainty presents even greater challenges, as it affects not only tax compliance but also financial reporting. Since the adoption of ASC 740-10 in 2007, firms have been required to disclose unrecognized tax benefits and identify tax years that remain subject to potential IRS examination. These requirements increase the visibility of uncertain tax positions, thereby creating strong incentives for firms to avoid positions that could negatively impact reported earnings or invite regulatory scrutiny.

Several mechanisms have evolved to help firms manage tax uncertainty proactively. We briefly review three prominent tools—advanced pricing agreements (APAs), "enhanced relationship" programs (including the IRS Compliance Assurance Process), and opinion letters—before turning to PLRs.

APAs establish transfer pricing methods in advance between a firm and the IRS (and sometimes a foreign tax authority). APAs require extensive information sharing, lengthy negotiations, and substantial costs, but their use has expanded with the growth of cross-border transactions. The IRS's Compliance Assurance Process (CAP) involves corporations agreeing to continuous, real-time audits of their tax affairs in exchange for quicker resolution and fewer surprises (Beck and Lisowsky 2014). This essentially turns the audit into a collaborative, pre-filing process. Prior literature finds that such programs can benefit both the tax authority and the taxpayer. For instance, De Simone, Sansing, and Seidman (2013) analytically examine "enhanced relationship" tax compliance programs (like CAP) and identify conditions under which they are mutually beneficial (i.e. both parties gain).[3] However, these programs require considerable ongoing voluntary disclosure and a cooperative posture from the firm. Finally, firms may seek opinion letters from tax professionals to assess how the IRS or courts might view a transaction. While not binding, these opinions can protect management by demonstrating due diligence and may deter aggressive positions. Unlike PLRs, however, opinion letters are private, limiting their visibility to researchers.

PLRs are a long-standing feature of the U.S. tax system that allow taxpayers to reduce uncertainty by obtaining advance confirmation from the IRS regarding the tax treatment of planned transactions. Since 1954, taxpayers have been permitted to rely on PLRs so long as they provide complete and accurate information, act in good faith, and there are no changes in law or material facts (Rev. Ruling 54-172).

To obtain a ruling, taxpayers must submit a comprehensive request that includes the facts of the transaction, supporting documentation such as contracts or other instruments, a legal analysis, and citations to authorities both supporting and contradicting the taxpayer's position. Depending on the nature of the transaction, additional statements may also be required, such as disclosures about prior rulings by foreign tax authorities in cases involving treaty issues. Each year, the IRS publishes updated procedures and fee structures governing PLR requests (e.g., Rev. Proc. 2024-1). The standard fee for most PLR requests is currently $38,000, and rulings are typically issued within 120 to 180 days of submission (Devos et al. 2023). Although PLRs are

[3] In practice, the CAP program has been seen as a success in improving transparency: an IRS advisory panel noted that full disclosure and transparency under CAP have proven beneficial to both the IRS and participating companies (McCormally and Washington 2014). CAP and similar programs (adopted in countries like Australia, the U.K., and the Netherlands) significantly reduce uncertainty for firms because tax issues are resolved before the tax return is filed, virtually eliminating the risk of a future contentious audit on those issues.

publicly disclosed, they are heavily redacted to remove identifying information, making it difficult for outside observers to link rulings to particular firms.

We focus on PLRs as a setting to explore voluntary private tax disclosures for several reasons. PLRs are a common tool for obtaining tax certainty on a wide range of issues—arguably the most common way for corporations to get advance tax guidance, given that APAs are limited to transfer pricing and CAP enrollment is limited, much more costly, and more permanent. Unlike an APA or CAP (which tend to be continuous or cover a broad set of issues), each PLR is a one-off ruling on a specific transaction or question of law. Hundreds of PLRs are issued by the IRS each year (for all taxpayer types, not just corporations) (Bishop-Henchman, 2023). Public companies frequently disclose material PLRs in their filings, suggesting this phenomenon is widespread enough to study systematically. Yet, as of now, there is very little published empirical research on the effects of PLRs.

2.3 Hypothesis Development

PLRs can lead to opposing effects on IRS audit risk. First, obtaining a PLR could reduce audit risk. By proactively addressing an uncertain tax matter with the IRS and effectively obtaining pre-approval from the tax authority, the firm removes that issue from contention. The firm may also signal a type that is transparent, cooperative, and seeks to be fully compliant, which might lead the IRS to view the firm as lower-risk and allocate scarce audit resources elsewhere. Moreover, if the IRS has already examined the specific issue covered by the ruling process, it may have less need to audit the firm on related matters in the future.

Alternatively, obtaining a PLR might increase IRS scrutiny. By voluntarily disclosing detailed information about a transaction, a firm may heighten its visibility to the IRS, thereby increasing the probability of broader examination. Although the PLR resolves the specific tax issue addressed, it may prompt the IRS to more closely evaluate the firm's other tax position or elevate its overall audit risk. This possibility aligns with the findings in a concurrent study by Gardner, Polk, and Yazzie (2025), which documents a positive association between PLR requests and tax authority monitoring. Specifically, firms that obtained PLRs exhibited higher values on the Finley and Stekelberg (2022) measure of tax authority monitoring in subsequent years relative to firms that did not seek rulings. This evidence supports the salience theory—the notion that while a ruling may offer transactional certainty, it may also increase the firm's exposure to enforcement. Accordingly, the net effect of PLRs on audit risk is ultimately an empirical question. We state our hypothesis in the null:

H1: Private voluntary tax disclosure, via private letter rulings, has no effect on future IRS audit incidence.

3. Sample Construction and Descriptive Statistics

3.1. Sample Construction

To investigate the effects of PLRs on IRS audit risk, we construct a novel firm-level dataset of PLR usage by U.S. publicly traded corporations. We begin by identifying any indication of a PLR in the 10-K, 10-Q, and 8-K filings of publicly traded firms between 1996 and 2022, using a two-step approach. First, we develop a keyword dictionary related to PLRs and opinion letters—terms such as "private letter ruling", "PLR", "private ruling", "letter ruling", "ruling received", "ruling issued", "unfavorable ruling", "favorable ruling", "IRS ruling", "Internal Revenue Service ruling", "IRS letter", "ruling sought", "IRS determination", "IRS decision", "IRS guidance", "IRS approval", "tax ruling", "tax guidance", "tax determination", "tax decision", "tax authority ruling", "IRS private letter determination", "tax position ruling", "IRS interpretative ruling", "tax compliance determination", "IRS private guidance", "IRS administrative ruling", and "opinion letter". Using these keywords, we parsed a comprehensive corpus of 10-K, 10-Q, and 8-K filings from Edgar to retrieve any text that potentially references a PLR.

Second, because a pure keyword search can produce many false positives (e.g., mentions of rulings in general, private letters in other contexts, or mentioning applying for a PLR that was denied, etc.), we employed an AI classifier to verify and extract structured information from these passages. In particular, following the framework outlined in de Kok (2024), we fine-tuned a GPT-based language model to recognize whether a given text block indeed refers to the firm receiving a PLR (as opposed to, say, mentioning a PLR in an abstract context, or PLR in another context, such as Private Label Rights, Public Lending Right, Prime Lending Rate, etc.) and to capture key details (such as the year of the PLR and the tax issue involved). In Appendix B we provide full details on this approach and the specific queries used, as well as the validation we did to ensure the data we are capturing are of high quality. This AI-assisted classification adds a layer of human-like judgement to confirm PLR instances beyond simple keywords.[4] The result of this process is a dataset of 6,688 firm-year observations in which a public company discloses having received a PLR. Our primary dependent variable *PLR* is equal to one for these observations, and zero for all other observations. For each PLR event, we record (when discernible) the month, the fiscal year, the issuing country, whether the PLR was favorable, whether the disclosure is referring to a future PLR, whether the disclosure is referring to an external PLR, and the tax nature of the issue.

We merge the PLR data with firm financial data from Compustat. After merging and applying necessary filters (e.g., requiring non-missing financial variables, and excluding firms in

[4] While this process does allow for classification of disclosures at very low cost, it does come with the downside of not being perfectly reproducible, as the AI model itself may classify the same text differently if it read through it again. Further, it is difficult to restrict the AI model to only use the text, rather than other information it knows, in order to carry out its assigned task. While these drawbacks of AI use may be deeply concerning in the context of using AI to make predictions (Levy 2024), we believe these costs are worth the benefit for simply classifying text.

regulated industries where tax behavior is atypical), our final sample consists of 1,093 firm-year observations containing PLRs. Our full sample, which includes control observations we use to construct an entropy-balanced stacked difference-in-differences design contains 31,965 observations. Table 1 provides a summary of our sample selection process.

Because the IRS does not publicly link PLRs to specific taxpayers, our identification strategy relies on firms' own disclosures. Companies are required to disclose material tax items and contingencies in their financial statements and footnotes. If a transaction is sufficiently material that the firm sought a PLR, it often warrants disclosure to investors (for example, as part of a discussion of tax contingencies, or in the tax footnote if it impacts the effective tax rate, or even in legal proceedings notes if relevant).

The key outcome in our analysis is whether a firm is under IRS audit in a given year. We use data from Armstrong (2023), who fine-tunes a transformer model (OpenAI's GPT-3.5) to read snippets of 10-K text and determine whether the firm is disclosing an ongoing IRS audit for any tax year. Armstrong (2023) follows the framework outlined by de Kok (2024) for implementing generative AI in research tasks. Armstrong (2023) validates the model on a test set of disclosures that were independently hand-classified.

3.2. Descriptive Statistics

In this section, we provide descriptive statistics for our sample. We also present a number of descriptive results, given the paucity of prior research on PLRs, in order to shed light on their usage. Table 2 presents descriptive statistics for our primary sample. Panel A contains all firm-years (firm-years with and without PLRs), and Panel B contains PLR firm-years. Across the full sample, 3.4% of observations have PLRs, 3.5% have Opinion Letters, and 16.9% have IRS audits. 51.8% are multinational, 39.9% have tax haven subsidiaries, and 28.4% have M&A activity. The average firm size is $512 million in total assets (unlogged). The mean Cash (GAAP) ETR is 19.1% (24.6%). Among PLR observations in Panel B, we find that they are more likely to be audited (24.8%), be multinational (65.5%), have tax haven subsidiaries (56.9%), and have M&A activity (36.8%). They are also larger ($1.7 billion in totals assets) and have higher ETRs (20.4% for cash, 24.5% for GAAP). We define all variables in detail in Appendix A.

In Figure 1, we first illustrate the prevalence of PLRs over time. In Panel A, we show that in 1996, which is the first full year of Edgar data, our approach identifies 41 distinct PLR observations. The trend in PLRs disclosed in financial statements increases modestly over time, with 82 observations by 2022. In Panel B, we scale by the number of observations to examine the trend in the proportion of firms using PLRs. We show a similar but more pronounced trend. In 1996, 1.0% of firm-year observations disclosed a PLR, relative to 2.9% in 2022. Disclosed PLR usage appears particularly high between 2012 and 2019, with the highest proportion at 3.7% in 2015.

In Figure 2, we illustrate the types of topics covered by PLRs and PLR usage by industry. For the categories in Panel A, we ask ChatGPT to classify PLRs into topics based on the tax code sections and other discussion contained in nearby text. Panel A displays the 20 most common topics. We find that about half (54%) of all PLR observations are related to corporate reorganizations. The next most common topic is retirement and benefit plans (9%), followed by a wide range of other topics, such as net operating losses, stock options, tax-exempt organizations, etc. The long tail of niche issues—such as R&D, interest deductions, and gross income from mining—highlights the breadth of topics addressed via PLRs, but also suggests that a relatively small number of categories account for the majority of requests. In Panel B we break down the prevalence of PLRs by industry. We display the 20 industries, based on two-digit SIC codes, with the highest percentage of observations disclosing PLRs. We show that PLRs are most common in business services (73), chemicals and allied products (28), and electronic and other electrical equipment (36).

In our last descriptive test, we build on Table 2 and conduct a determinants analysis to examine the differences between PLR and non-PLR observations in a multivariate regression. In Table 3, we regress *PLR* on a number of firm-level characteristics. In all columns we include year fixed effects to control for temporal trends. In columns 1-2 we do not include firm fixed effects so that we can examine differences across the types of firms that use and don't use PLRs. In columns 3-4, we include firm fixed effects to examine whether changes in within-firm characteristics are associated with PLR usage. In the first two columns, we show firms that disclose PLRs are, on average, significantly larger, tend to exhibit lower sales growth, and reduced profitability compared to non-PLR firms. We do not find an association with tax avoidance, based on cash ETRs but do observe that firms that disclose PLRs do report slightly lower GAAP ETRs.

With the firm fixed effects in columns 3-4, we examine whether these observed differences are driven by inherent characteristics of certain types of firms or reflect changes within firms over time. We show that each of these factors—firm size, sales growth, and GAAP ETRs—remain statistically significant and directionally consistent with the cross-sectional patterns in columns 1-2. Overall, the results indicate that the use of PLRs responds to dynamic changes in firm characteristics. That is, even within a given firm, shifts in size, growth opportunities, or tax avoidance levels are associated with changes in PLR behavior. Taken together, these characteristics point toward a pattern in which PLRs are more commonly utilized by large, mature firms with complex tax functions. These firms may have greater incentives and resources to obtain

PLRs as a means of managing tax uncertainty or planning for transactions with significant tax implications.

4. Research Design and Results

4.1. Research Design

Our primary analyses employ an entropy-balanced stacked difference-in-differences design to examine the relationship between PLR usage and subsequent IRS audits. The main empirical challenge is isolating the effect of obtaining a PLR from other factors—firms that seek PLRs might differ systematically from those that do not (as we showed in the previous section), and IRS audit selection is not random. We address this with a combination of firm fixed effects (to control for time-invariant differences between firms), entropy-balancing, and a stacked difference-in-differences (DiD) event study design around the first PLR event for each firm. Our baseline specification is a panel regression of the form:

$$IRS\ Audit_{jtc} = \beta_1 First\ PLR_{jc} + \beta_2 Post_{tc} + \beta_3 First\ PLR_{jc} \times Post_{tc} + \beta_n Control\ Variables_{jtc} + Firm\text{-}by\text{-}Cohort\ Fixed\ Effects_{jc} + Year\text{-}by\text{-}Cohort\ Fixed\ Effects_{tc} + \varepsilon$$

IRS Audit is an indicator for whether firm *j* is under IRS audit in year *t* (as measured by our disclosure-based metric). *First PLR* is an indicator for whether firm *j* discloses a PLR for the first time in cohort year *c*, and *Post* is an indicator variable equal to one for years after the cohort year *c*, and zero otherwise. The coefficient of interest, β_3, captures the interaction of *First PLR* and *Post*. We include control variables for R&D activity (*R&D* and *R&D Missing*), intangibles (*Intangible Intensity*), acquisition activity (*M&A*), tax havens (*Tax Havens*), multinational status (*MNC*), book-to-market (*BTM*), size (*Size*), pretax return on assets (*ROA*), leverage (*Leverage*), and tax avoidance (*Cash ETR*). We define all variables in detail in Appendix A.

To isolate the impact of PLRs, in these tests we include only a firm's first instance of having a PLR, as we expect this first instance to be the occasion that has the largest change in information offered to the IRS. This approach reduces the number of PLR firm observations in our sample but ensures that our difference-in-differences narrows in on the IRS audit probability before and after a PLR. We group treated firms into cohorts based on the year of their first PLR, such that all firms with their first PLR in 2010 are in one cohort, firms with their first PLR in 2011 are in another cohort, etc. Each cohort contains the firm-year observations in the three years before and after the PLR year. For each cohort, we limit the control sample of firm-year observations to firms which do not disclose a PLR in any of the 7 years. We then entropy balance these control firms with treated firms within each cohort for the year preceding the cohort year. We balance using the control variables, *Intangible Intensity*, *M&A*, *Tax Havens*, *MNC*, *Size*, *ROA*, *Leverage*, *BTM, and R&D* on the first, second, and third moments. We then stack each cohort and include cohort-by-firm and cohort-by-year fixed effects (Cengiz et al., 2019; Barrios, 2021; Baker et al., 2022; Kroeger 2024; Welsch 2023).

4.2. Results

4.2.1 Main Tests

Table 4 presents our main results on the relation between PLRs and IRS audits. We find a significant negative effect of PLRs on subsequent audit probability. In the DiD model, the coefficient on *First PLR×Post* is –0.039 and statistically significant ($p < 0.05$). Given that we use a linear probability model, this result indicates that after a firm receives a PLR, its likelihood of being under IRS audit drops by nearly 4 percentage points relative to the pre-PLR period and relative to firms that have not obtained a PLR. To put this in context, the mean audit probability (per our measure) in the sample is 16.9% in a given year, making a 4 percentage point reduction a material relative decrease in audit risk. The inclusion of firm-by-cohort fixed effects in the DiD means this result is driven by within-firm changes, alleviating concerns that the coefficient merely picks up that inherently low-risk firms choose to pursue PLRs. Alternatively, in the sample of PLR firms, their mean value of IRS audit is 24.8%, suggesting a more modest, but still sizable, percentage decrease in the likelihood of audit.

In the next three columns, we examine whether firms change their underlying tax behavior following disclosure of their first PLR. This analysis serves two purposes. First, understanding how firms adjust their tax strategies post-PLR is essential to interpreting any observed changes in IRS audit activity. For example, if firms adopt less aggressive tax planning strategies after obtaining a PLR, a subsequent decline in audit rates could reflect the IRS's response to improved compliance rather than to the PLR itself. That is, the reduction in IRS audits could more properly be characterized as a response to the shift in firm tax behavior, and not to the PLR. Second, these firm responses are economically meaningful in their own right. Documenting whether, and how, firms modify their tax practices after receiving a PLR enhances our broader understanding of the role PLRs play in shaping corporate tax strategy.

Columns 2-4 examine how firms' GAAP ETR, Cash ETR, and UTBs change following the first disclosed PLR. We fail to find any significant effect for any three of these outcomes, suggesting, to the extent these measures capture underlying firm behavior, that firms do not materially change their tax strategies following the issuance of a first PLR. This result implies that the observed reduction in audit rates is unlikely to be driven by behavioral shifts and instead reflects the audit consequences of the PLR itself.

4.2.2 Comparison with Foreign PLRs and Opinion Letters

To the extent that our research design does not fully account for differences between PLR and control firms, and those differences are correlated with IRS audit risk, then our coefficient estimates may be biased. For example, firms seeking PLRs may be inherently risk averse or the first disclosure of a PLR may simply convey that the firm is pursuing a number of ways to reduce its tax risk. To help address this possibility, we next replicate our findings from Table 4 using disclosed foreign PLRs and tax opinion letters.

Firms that disclose PLRs with foreign tax authorities but not with the IRS reveal themselves to be of a similar type as those that disclose PLRs with the IRS. Both sets of firms are of the type that seeks tax certainty on some issue that is material enough to disclose in the financial statements. However, we would expect a very different effect on IRS audits: PLRs from foreign tax authorities should not reduce the probability of being audited by the IRS. Hence, by comparing the two groups of firms we can alleviate potential selection issues. In Panel A, we partition our sample by firms that disclose PLRs to foreign tax authorities to the IRS. We show that the effect we document in Table 4 is driven by PLRs to the IRS, and we find no effect among foreign PLRs.[5]

As previously described, tax opinion letters also reflect the presence of tax uncertainty at the firm and an effort to reduce the uncertainty. However, unlike PLRs, these letters are not submitted to the IRS but are instead prepared by external counsel and protected under attorney-client privilege. Thus, they do not involve voluntary disclosure to the IRS. If we were to observe similar effects for opinion letters as for PLRs, such as a reduction in audit rates, it would suggest that our findings may be driven by underlying tax uncertainty and/or the ability to reduce such

[5] However, we note that due to the relatively small number of firm-time foreign PLRs (60 in our sample), that this test may lack power. As a result, coefficient on *First Foreign PLR x Post* is measured imprecisely. Its standard error is large enough such that the difference between the coefficient of -0.045 on *First PLR x Post* and 0.028 on *First Foreign PLR x Post* is not statistically significant. Still, the results are suggestive that voluntary, private tax disclosure via PLRs is driving the result, not selection. To examine this further, we compare PLRs with opinion letters.

uncertainty via a third-party. However, in Table 5, Panel B, we find no evidence that disclosed tax opinion letters are associated with changes in IRS audit rates, GAAP ETRs, Cash ETRs, or UTBs. This null result strengthens the interpretation that audit-related effects observed for PLRs stem specifically from the private, voluntary disclosure to the IRS. That is, the lack of response to opinion letters underscores the unique signaling and risk-management role played by PLRs as a channel of private, voluntary communication with the tax authority.

4.3.3 Pre-Trend Testing

Next, we formally test for pre-trends using our event study framework. In Figure 3, we plot the estimated coefficients for yearly indicators from three years before to three years after the PLR (with the year before the PLR as the reference point) on *IRS Audit*. The pattern reveals that in the years leading up to the PLR, there is no significant trend in audits—the coefficients for year t-3 to t-2 are near zero and not statistically distinguishable from zero, indicating that firms are not more or less likely to have been audited by the IRS before obtaining a PLR. Immediately after the *First PLR* (years t+1 to t+3), the audit probability is visibly lower; the year t+1 and t+2 the coefficient is about –5 percentage points (both significant at the $p < 0.10$). For year t+3 the effect increases to about –8 percentage points (significant at the $p<0.05$) level. That the effect strengthens over time is consistent with the timeline of IRS audits. If a firm discloses a position through a PLR in year t, IRS audits surrounding that return would not ordinarily happen for a few years, suggesting our delayed response is consistent with the institutional realities of IRS audits.

This visual corroborates our DiD regression result: the likelihood a firm is audited drops after the first instance of a PLR. The fact that the pre-event coefficients are flat gives us confidence in the parallel trends assumption underlying the DiD—strengthening the interpretation that the drop in audit risk occurs after the PLR and is attributable to it.

Our results contrast the findings in Gardner et al. (2025), who use OLS estimation and find an increase in *IRS Monitoring* proxied for using a measure from Finley and Stekelberg (2022). We are able to replicate the findings of Gardner et al. (2025). In untabulated analyses, we estimate an OLS regression using the same outcome and control variables, fixed effects structure (industry and year), and firm-level clustering. Consistent with Gardner et al. (2025), we find a positive and statistically significant effect between PLRs and *IRS Monitoring*. However, the significance dissipates when we include firm fixed effects. We further use the Finley and Stekelberg (2022) measure as the outcome variable in our entropy-balanced, stacked cohort difference-in-differences design. Once again, we find statistical significance only with an industry fixed effects design; the effect becomes insignificant when we account for within-firm variation using firm fixed effects.

4.2.4 Changes in Textual Disclosures

Next, we examine whether firms' own financial disclosures reflect the change in audit risk we observe following a PLR. If a PLR meaningfully reduces a firm's perceived exposure to IRS enforcement, we would expect that change to be conveyed in the firm's tax footnote language. Importantly, because these disclosures are not aimed at the IRS but at investors and auditors, they offer a distinct window into the firm's own perceived risk environment (although they are also read by the IRS, Bozanic et al. 2017). By analyzing changes in uncertainty language, numerical detail, and disclosure length in the tax footnote and MD&A, we test whether the informational and enforcement implications of PLRs leave a textual trace in the firm's 10-K. If firms believe the PLR meaningfully lowers their tax uncertainty, we would expect to see that belief reflected in how they describe their tax position.

In Table 6, we show that firms' 10-K disclosures can corroborate the change in audit risk from obtaining a PLR. In this test, we utilize the same design as in Table 4, but our dependent variables relate to features of firms' tax footnote and MD&A disclosures. For this table, our sample is limited to years 2010 to 2022 because we obtain tax footnote disclosures from XBRL tags (prior to mandatory XBRL disclosure, it is difficult to cleanly isolate the start and end of tax footnotes). We examine whether *Disclosure Uncertainty*, *Disclosure Length*, and the number of numbers in the Disclosure (*Disclosure Numbers*) change following the disclosure of the first PLR. Our main focus is on the uncertainty-related language. To the extent that 10-K text related to various risks meaningfully reflects the risks faced by firms, then we would expect uncertainty-related language in the tax footnote to decrease after a PLR. In column 1, we observe a significant decrease in disclosure uncertainty following disclosure of the first PLR—albeit, with a small magnitude. This result suggests that firms, having obtained assurance from the IRS regarding a tax position, use less uncertain language in their tax footnote. The coefficient of 0.089 indicates that the number of uncertainty-related words in the tax footnote declined by 0.089 percentage points. In our sample, tax footnotes contain an average of 1.3 percent uncertainty related words. This implies roughly a 7 percent reduction in uncertainty-related words following a PLR (0.089/1.3).

In column 2, we find no change in disclosure length. In column 3, we find a 2.4% increase in the number of numbers disclosed in the tax footnote, which is statistically significant at the 10% level. However, this may be a mechanical effect of disclosing a PLR, as many PLR discussions include the applicable tax code sections.

To examine whether the decrease in uncertainty language in the tax footnote is driven by overall trends in firms' uncertainty, we repeat this analysis using the MD&A in Panel B. If, for example, PLRs were received when there was substantial general uncertainty at the firm, which might alleviate following the PLR, we might observe changes in the language in the MD&A, where general firm matters are disclosed. However, we observe no change in any of the three textual measures following the disclosure of a PLR, suggesting the results we document in Panel A are likely related to the tax matters of the firm, and not to general firm uncertainty.

5. Additional Analyses

To further examine the robustness and nuances of our main findings, we conduct several cross-sectional tests. These analyses, presented in Tables 7 and 8, explore whether the observed reduction in audit risk following a PLR is concentrated among certain types of firms or specific circumstances.

First, we investigate the role of firm size in the relation between PLRs and audit likelihood. Larger firms are generally subject to more consistent IRS scrutiny, which might diminish the marginal benefit of a PLR in reducing audit probability. We segment our sample into quartiles based on firm size in the year prior to treatment and replicate our main analysis for each. As anticipated, the results presented in Panel A of Table 7 reveal a somewhat monotonic relationship. We find that the reduction in audit risk is statistically significant only for firms in the smallest two quartiles. The IRS audits firms based on an audit selection model that includes firm size as a function, and as a result, large firms are audited at much higher rates than smaller firms (Hoopes, Mescall, and Pittman 2012; Ayers, Seidman, and Towery 2019). This suggests that while PLRs offer benefits, their impact on audit likelihood is more pronounced for smaller firms that are not already under a high-level of IRS scrutiny.

Second, we explore how a firm's existing level of tax avoidance influences the effectiveness of a PLR in mitigating future audit risk. It is plausible that firms with high tax avoidance (low cash effective tax rates) might still attract IRS attention regardless of a PLR, as the ruling addresses a specific transaction rather than the firm's overall tax strategy. In contrast, firms with low tax avoidance (high cash effective tax rates) have already signaled compliance to the IRS.

We partition firms into quartiles based on their within cohort three-year pre-treatment average cash effective tax rate. The results, shown in Panel B of Table 7, indicate that only firms in the medium-high quartile of tax avoidance experience a statistically significant reduction in future IRS audits. These results suggest that PLRs serve as a valuable signal to the IRS only when audit decisions are ambiguous, while firms with clearly aggressive or clearly conservative tax strategies do not gain the same audit-reducing benefits.

Finally, we address the potential concern that our results could be driven by the specific characteristics of reorganizations, given that a significant portion of PLRs in our sample relate to such events (54% as per Figure 1, Panel B). Reorganizations often entail substantial operational and financial changes that could independently affect audit likelihood. To isolate the effect of PLRs from these confounding factors, we re-run our analysis on a subsample that excludes PLRs related to reorganizations. We show in Table 8 that the results hold in this sample. We find a similar magnitude of reduction in audit probability (4.7%) for non-reorganization related PLRs, which is consistent with the findings from the full sample. This provides greater confidence that the observed reduction in audit risk is attributable to the PLR itself, rather than other contemporaneous major corporate events.

6. Conclusion

This study explores the use of PLRs by publicly traded U.S. firms and the implications for IRS audit risk. By constructing a novel dataset of PLR disclosures by public firms and employing a stacked difference-in-differences design, we provide the first large-sample evidence that such disclosures are associated with a statistically and economically significant reduction in future audit risk. This effect is concentrated among smaller firms and those with higher baseline effective tax rates, and it appears to be independent of changes in actual tax avoidance behavior. Our findings suggest that PLRs serve not only as tools to reduce uncertainty but also as signals of transparency that may influence the audit selection processes of resource-constrained tax authorities.

Our results carry important implications for both tax administration and corporate decision-making. For policymakers, the results suggest that structured voluntary disclosure programs, when properly designed, may enhance regulatory efficiency by aligning firms' incentives with enforcement priorities. For firms, the pursuit of a PLR may yield benefits beyond the transaction-specific ruling by reducing broader exposure to audit risk. This perspective reframes PLRs not merely as compliance tools, but as strategic levers within a broader tax risk management framework.

More broadly, this research advances the literature on corporate tax strategy, disclosure regimes, and the administrative dimensions of tax enforcement. By highlighting the signaling value embedded in voluntary, private tax disclosure, our findings contribute to a growing understanding of how disclosure-based governance mechanisms function in practice. As tax authorities continue to experiment with cooperative compliance models and pre-filing resolution mechanisms, expanding access to PLRs or analogous programs may serve as a viable pathway toward fostering mutual trust, reducing enforcement costs, and improving overall compliance outcomes.

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Appendix A. Variable Definitions.

Variable name	Description	Database
PLR$_{jt}$	Indicator equal to 1 for firm-year observations classified by fine-tuned LLM as having a PLR. See appendix B for a complete description.	Hand collected
First PLR$_{jt}$	Indicator equal to 1 for the first firm-year observation of a given firm is classified by fine-tuned LLM as having a PLR. See appendix B for a complete description.	Hand collected
Foreign PLR$_{jt}$	Indicator equal to 1 for firm-year observations classified by fine-tuned LLM as having at least one PLR with a foreign tax authority and no domestic PLRs. See appendix B for a complete description.	Hand collected
First Foreign PLR$_{jt}$	Indicator equal to 1 for the first firm-year observation of a given firm is classified by fine-tuned LLM as having a foreign PLR. See appendix B for a complete description.	Hand collected
Opinion Letter$_{jt}$	Indicator equal to 1 for firm-year observations classified by fine-tuned LLM as having an Opinion Letter. See appendix B for a complete description.	Hand collected
First Opinion Letter$_{jt}$	Indicator equal to 1 for the first firm-year a given firm is classified by fine-tuned LLM as having an Opinion Letter. See appendix B for a complete description.	Hand collected
PLR Reorganization	Indicator equal to 1 for PLR-firm-year observations classified by an LLM as being associated with firm reorganization activity. See appendix B for a complete description.	Hand collected
Post$_{tc}$	Indicator equal to 1 for firm-year observations after a cohort year.	Hand collected
IRS Audit$_{jt}$	An indicator variable equal to one if firm j discloses an ongoing IRS audit taking place for year t.	Armstrong (2023)
Cash ETR$_{jt}$	$\frac{txpd_{jt}}{pi_{jt} - spi_{jt}}$ Values of $Cash\ ETR_{jt} < 0$ are reset to equal 0. Values of $Cash\ ETR_{jt} > 1$ are reset to equal 1.	Compustat
GAAP ETR$_{jt}$	$\frac{txt_{jt}}{pi_{jt} - spi_{jt}}$ Values of $GAAP\ ETR_{jt} < 0$ are reset to equal 0. Values of $GAAP\ ETR_{jt} > 1$ are reset to equal 1.	Compustat
R&D$_{jt}$	$\frac{xrd_{jt}}{at_{jt}}$ Missing values of xrd_{jt} are reset to equal 0.	Compustat
R&D Missing$_{jt}$	Indicator equal to 1 for firm-year observations where xrd_{jt} were missing.	Compustat
Intangible Intensity$_{jt}$	$\frac{intan_{jt}}{at_{jt}}$ Missing values of $intan_{jt}$ are reset to equal 0.	Compustat
M&A$_{jt}$	$\frac{acq_{jt}}{ib_{jt}} > 0.1\ or\ \frac{do_{jt}}{ib_{jt}} > 0.1$ Indicator equal to 1 for firm-year observations where either of the two ratios are greater than 0.1 and zero otherwise.	Compustat

Tax Havens$_{jt}$	Indicator variable equal to 1 if a firm reports having a subsidiary in a tax haven during a given year and zero otherwise.	Following Dyreng and Lindsey (2009)
MNC$_{jt}$	Indicator variable equal to 1 if firm has foreign income and 0 otherwise.	Compustat
BTM$_{jt}$	$\frac{ceq_{jt}}{csho_{jt} \times prcc\_f_{jt}}$	Compustat
Size$_{jt}$	$\log(at_{jt})$	Compustat
ROA$_{jt}$	$\frac{pi_{jt}}{at_{jt}}$	Compustat
Sales Growth$_{jt}$	$\frac{sale_{jt} + sale_{jt-1}}{sale_{jt-1}}$	Compustat
Leverage$_{jt}$	$\frac{dlc_{jt} + dltt_{jt}}{at_{jt}}$	Compustat
UTB$_{jt}$	$\frac{txtubend_{jt}}{at_{jt}}$	Compustat
Disclosure Length$_{jt}$	Total number of words in the tax footnote or MDA section. This measure is logged in regression analysis.	Text of Tax Note from 10-K
Disclosure Uncertainty$_{jt}$	Percentage (values between 0 and 100) of uncertainty-related words in the tax footnote or MDA section based on the Loughran-McDonald Master Dictionary.	Text of Tax Note from 10-K
Disclosure Numbers$_{jt}$	Total number of standalone numbers in the tax footnote or MDA section. This measure is logged in regression analysis.	Text of Tax Note from 10-K

Appendix B. Details on AI Identification of PLRs.

To identify firm-level disclosures related to Private Letter Rulings (PLRs), we implemented a multi-step text analysis pipeline leveraging both rule-based filtering and fine-tuned large language models. This appendix outlines the procedure used to construct the dataset of PLR-related firm-year observations.

We began by collecting 10-K filings from the Loughran-McDonald (LM) corpus, which provides clean and standardized access to SEC filings. For 10-Q and 8-K filings, we relied on the master index files available directly through the SEC's EDGAR website to locate and retrieve the relevant documents. While 10-K filings provided the most comprehensive tax-related disclosures, 10-Q and 8-K filings were included to ensure coverage of interim and event-driven disclosures.

Using a regular expression-based parser, we scanned all 10-K, 10-Q, and 8-K filings for a targeted bag-of-words related to PLRs. For each match, we extracted a fixed-length window of text consisting of 300 characters before and 300 characters after the identified keyword to preserve contextual information. The bag-of-words included the following terms: private letter ruling, PLR, private ruling, letter ruling, ruling received, ruling issued, unfavorable ruling, favorable ruling, IRS ruling, Internal Revenue Service ruling, IRS letter, ruling sought, IRS determination, IRS decision, IRS guidance, IRS approval, tax ruling, tax guidance, tax determination, tax decision, tax authority ruling, IRS private letter determination, tax position ruling, IRS interpretative ruling, tax compliance determination, IRS private guidance, IRS administrative ruling, and opinion letter.

To classify these excerpts, we fine-tuned OpenAI's GPT-4o-mini model following the approach of de Kok (2024). A random sample of 150 excerpts was hand-labeled to serve as ground truth. Of these, 100 were used for training and 50 for validation. The model was fine-tuned for three epochs using a learning rate multiplier of 2. The training loss was 0.104, with a validation loss of 0.059 and a final full validation loss of 0.060, indicating strong performance and generalization.

Each excerpt was evaluated using a standardized prompt designed to elicit structured answers to 15 classification questions. These questions captured whether the text discussed a PLR or tax-related opinion letter, whether the ruling was favorable or pending, the year, month, jurisdiction of the ruling, whether the ruling applied to the company itself or to another firm, and captured the tax circumstances of the issue.

To further strengthen our confidence in the model and prompt, we manually deployed the fine-tuned model on the 50 observations from the validation set and compared the AI response to our hand-labeled responses. This analysis showed that the fine-tuned model achieved a 96% accuracy at the firm-year–keyword level.

Next, using a zero-shot approach with a gpt-4o model, we sorted each firm-year observation where our model identified a tax circumstance into one of 50 pre-determined tax circumstances. See prompt 2 below for a full list of these categories.

Applying these models and prompts across all identified text windows, we classified each excerpt and then merged the results at the firm-year level with financial data from Compustat and other sources. After merging and filtering to retain valid observations, the final sample consisted of 1,392 (1,798) firm-year observations with PLR (Opinion Letter)-related disclosures. These firm-year records serve as the basis for our empirical analyses.

Prompt 1 PLR/Opinion Letter Classifier:

"Analyze the provided text window from 10K disclosures for the fiscal year ended {['datadate'])} and respond to the following 15 questions in order:

1. Does the text discuss a private letter ruling (PLR)?
2. Does the text indicate that the company has an active PLR from a tax authority?
3. Does the text indicate what month the PLR was received?
4. Does the text indicate what year the PLR was received?
5. Does the text indicate what the PLR number is (e.g., PLR 201997381)?
6. Does the text indicate that the company is waiting to receive a PLR?
7. Does the company indicate it was an unfavorable PLR?
8. Is the text referencing a PLR received by another company?
9. From the text, what is the tax situation that the PLR is addressing?
10. What country is this PLR associated with?
11. Does the text discuss a tax-related opinion letter (OL)?
12. Does the text indicate that the company is waiting to receive an OL?
13. Does the company indicate it was an unfavorable OL?
14. From the text, what is the tax situation that the OL is addressing?
15. What is the name of the firm the OL is associated with?

When responding, strictly adhere to the following format for each question:

1. Yes = 1, No = 0
2. Yes = 1, No = 0
3. If yes, respond with the month ##. If not, NA
4. If yes, respond with the year ####. If not, NA
5. If yes, respond with the PLR Number. If not, NA
6. Yes = 1, No = 0
7. Unfavorable = 1, not unfavorable = 0
8. Yes = 1, No = 0
9. Respond with as concise language as possible. For example, it is preferred to use a common acronym or the IRC code; if that is not possible, limit the description to 1–3 words. If no clear answer, NA
10. Respond with the country ISO code

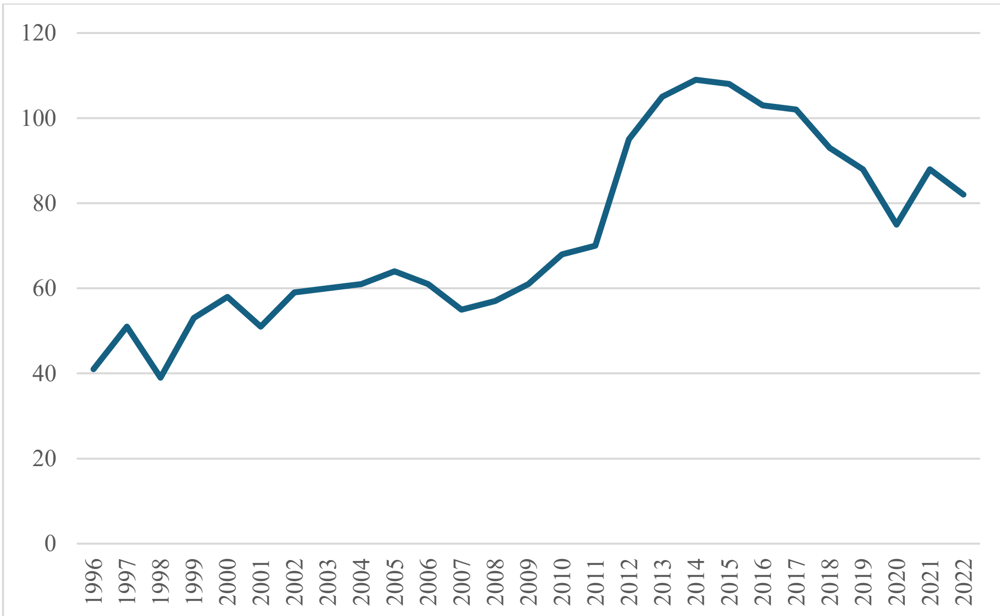
11. Yes = 1, No = 0
12. Yes = 1, No = 0
13. Unfavorable = 1, not unfavorable = 0
14. Respond with as concise language as possible. For example, it is preferred to use a common
acronym or the IRC code; if that is not possible, limit the description to 1–3 words. If no clear
answer, NA
15. Respond with the firm name. If no firm, NA"

Prompt 2 Tax Categorization:

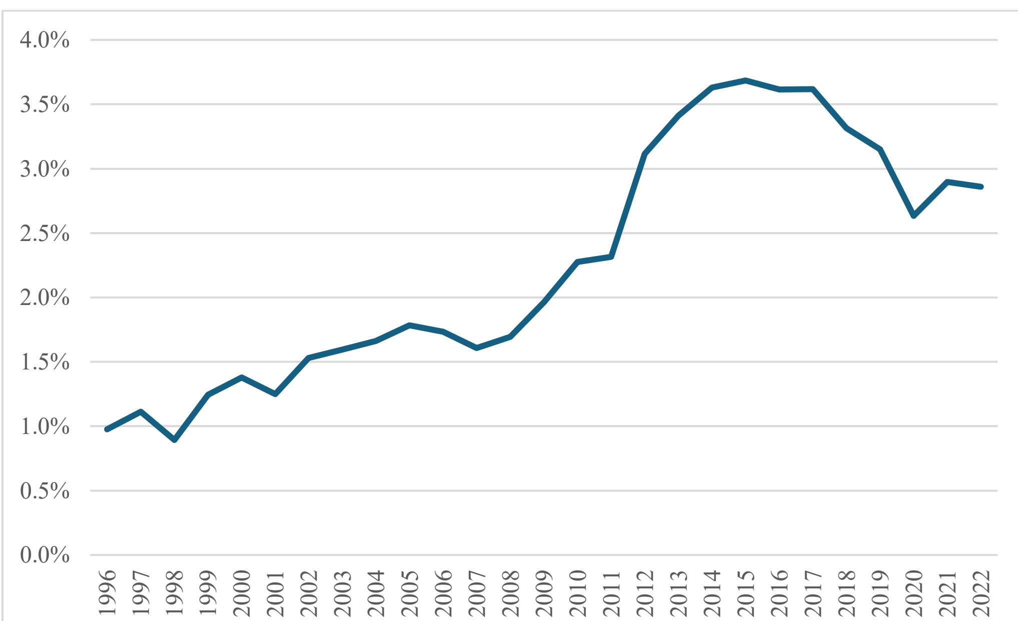
"Analyze the provided 10K filing excerpt and the related private letter ruling tax situation. Categorize the instance into one of the following: Normalization, Investment Tax Credit (ITC), Depreciation, Estates and Trusts, Deductions and Benefits, Payroll Taxes, Mergers and Reorganizations, Distributions, Dividend and Dividend Tax Issues, Deferred Items, Like Kind Exchanges, REIT, ESOP & ESOT, Federal Income Tax, Spinoffs and Splits, Qualified Settlement Fund (QSF), Retirement and Pension, Transaction, S Corporation, Deductibility, Revenue Recognition, Tax Credits, Tax Refund, Franchise Tax, Lease, Debt and Debt Management, Series C Exchange, Change in Accounting Method, Share Distribution, Dividend Reinvestment, Transactions Related to Stock Options, Notes or Indenture Issuance, Trading Restrictions, Share Exchange, Ownership Change, Tax Sharing and Separation, Facility Sale, Tax Exemption, Employee Benefit Plan, Tax Loss Carryforward, Repurchase, Regulated Investment Corp, Other. Use tax code references (e.g., §163 for interest deduction limitation) to inform context. If the excerpt lacks context for the PLR, respond with NA. Respond with only assigned category. Text Excerpt: {text_excerpt} | Tax Situation: {tax_situation}."

Figure 1. PLR Prevalence Over Time

Panel A. Raw Number of PLRs



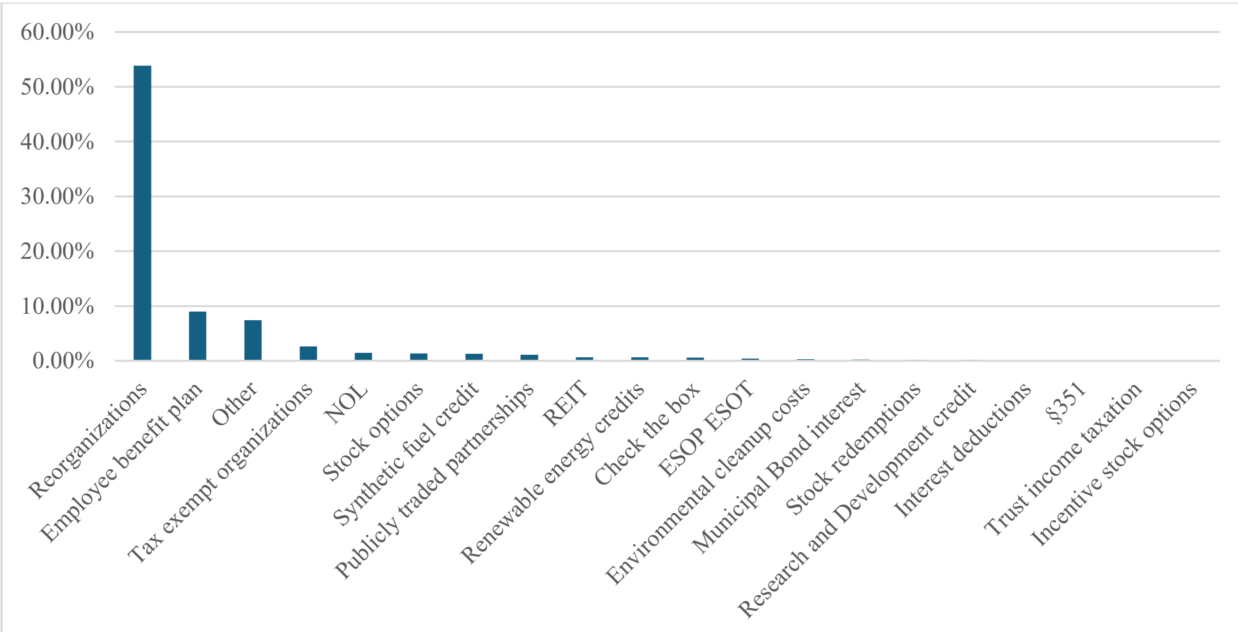
Panel B. PLR Prevalence over time (Percentage of Firm-years)



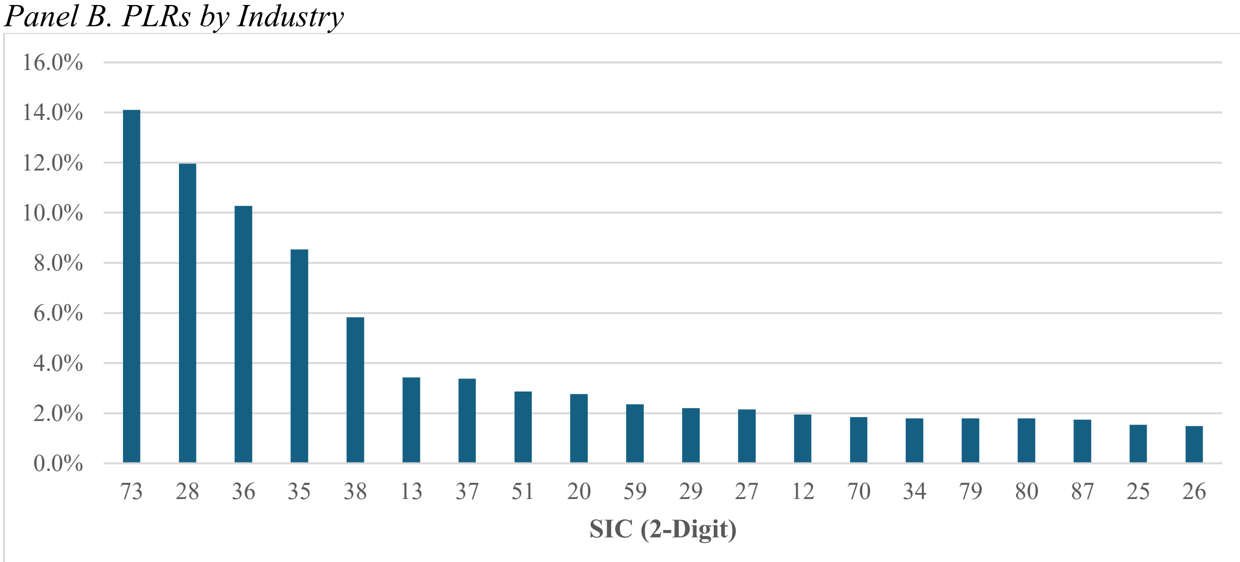
Notes. This figure presents the prevalence of PLRs over time. Panel A graphs the raw number of PLR disclosures in each year of our sample. Panel B graphs the percentage of firm-years disclosing PLRs in each year of our sample.

Figure 2. PLR Topics and Industries

Panel A. PLRs by Category

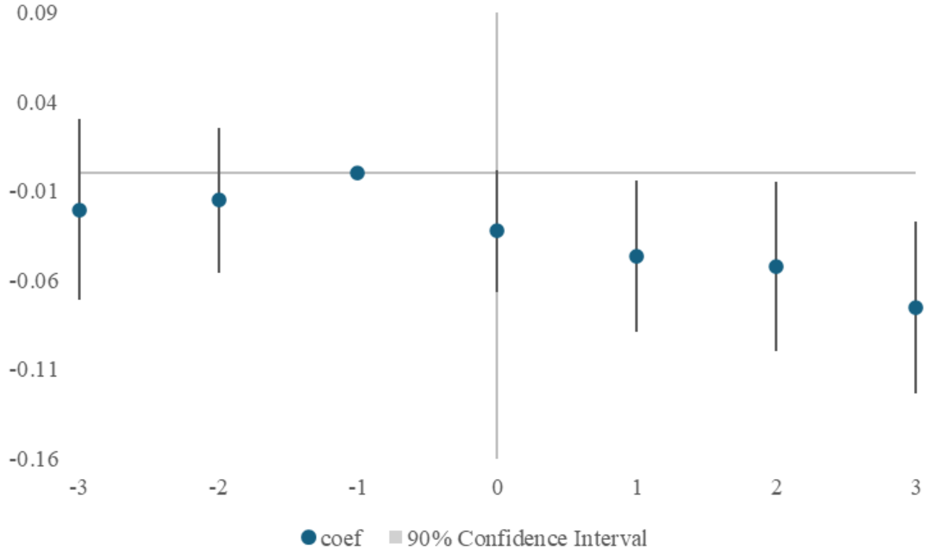


Panel B. PLRs by Industry



Notes. This figure presents PLR prevalence by PLR topic (Panel A) and industry (Panel B). We use ChatGPT to classify PLRs into topics and tabulate the 20 most common in Panel A. Panel B illustrates the 20 industries with the highest proportion disclosing PLRs.

Figure 3. Event Time First PLR and IRS Audits



Notes. This figure plots annual coefficients from our stacked DiD in Table 4. We present 90% confidence intervals in gray around each coefficient.

Table 1. Sample Selection

Panel A: Full Sample

	Firm-years
All Compustat firm-years	237,968
Drop financial firms and utilities and missing sich	(63,035)
Drop if missing key variable	(142,685)
Drop duplicate observations	(28)
Drop singleton observations	(255)
Full Sample	31,965

Panel B: PLR Firm-years

	Firm-years
PLRs in Any Compustat Firm-year	6,688
Drop financial firms and utilities and missing sich	(1,528)
Drop if missing key variable	(4,054)
Drop duplicate observations	0
Drop singleton observations	(13)
PLR Firm-years	1,093

Notes. This table presents the sample selection criteria for our full samples (Panel A) as well as details on the number of PLR firm-years (Panel B). The sample period covers 2000-2019.

Table 2. Descriptive Statistics

Panel A. Full Sample

Variable	*Mean*	*St Dev*	*p25*	*Median*	*p75*
PLR	0.034	0.182	0.000	0.000	0.000
Opinion Letter	0.035	0.183	0.000	0.000	0.000
IRS Audit	0.169	0.375	0.000	0.000	0.000
Sales Growth	0.128	0.461	-0.029	0.068	0.186
R&D	0.045	0.092	0.000	0.003	0.054
Intangible Intensity	0.175	0.191	0.012	0.107	0.284
M&A	0.284	0.451	0.000	0.000	1.000
Tax Havens	0.399	0.490	0.000	0.000	1.000
MNC	0.518	0.500	0.000	1.000	1.000
BTM	0.532	0.799	0.249	0.448	0.746
Size	6.238	2.080	4.824	6.270	7.647
ROA	-0.011	0.380	-0.017	0.055	0.113
Leverage	0.224	0.266	0.014	0.173	0.331
UTB	0.007	0.129	0.000	0.000	0.005
Cash ETR	0.191	0.213	0.000	0.148	0.301
GAAP ETR	0.246	0.217	0.011	0.269	0.364
Observations	31,965				

Panel B. PLR Firm-years

Variable	*Mean*	*St Dev*	*p25*	*Median*	*p75*
PLR	1.000	0.000	1.000	1.000	1.000
IRS Audit	0.248	0.432	0.000	0.000	0.000
Foreign PLR	0.113	0.317	0.000	0.000	0.000
Sales Growth	0.084	0.391	-0.035	0.053	0.152
R&D	0.033	0.064	0.000	0.003	0.037
Intangible Intensity	0.221	0.204	0.039	0.171	0.354
M&A	0.368	0.482	0.000	0.000	1.000
Tax Havens	0.569	0.495	0.000	1.000	1.000
MNC	0.655	0.476	0.000	1.000	1.000
BTM	0.453	0.734	0.231	0.433	0.688
Size	7.450	1.810	6.217	7.542	8.684
ROA	0.026	0.227	-0.004	0.055	0.101
Leverage	0.260	0.246	0.082	0.229	0.362
UTB	0.009	0.022	0.000	0.001	0.009
Cash ETR	0.204	0.227	0.017	0.147	0.304
GAAP ETR	0.245	0.229	0.028	0.236	0.360
Observations	1,093				

Panel C. T-Tests of Mean

Variable	*PLR Mean*	*Non-PLR Mean*	*Difference*	*P-Value*
IRS Audit	0.249	0.166	0.083	0.000
Sales Growth	0.084	0.130	-0.046	0.001
R&D	0.033	0.046	-0.013	0.000
Intangible Intensity	0.221	0.174	0.047	0.000
M&A	0.368	0.281	0.086	0.000
Tax Havens	0.569	0.393	0.176	0.000
MNC	0.655	0.514	0.141	0.000
BTM	0.452	0.535	-0.082	0.001
Size	7.452	6.196	1.256	0.000
ROA	0.026	-0.013	0.039	0.001
Leverage	0.261	0.222	0.038	0.000
UTB	0.009	0.007	0.002	0.686
Cash ETR	0.204	0.190	0.014	0.037
GAAP ETR	0.245	0.246	-0.001	0.880
Observations	1,093	30,872		

Panel D. Pearson and Spearman Correlations

	PLR	*Opinion Letter*	*Sales Growth*	*R&D*	*Intangible Intensity*	*M&A*	*Tax Havens*	*MNC*	*BTM*	*Size*	*ROA*	*Leverage*	*UTB*	*Cash ETR*	*GAAP ETR*
PLR	1.00	0.41	-0.02	-0.01	0.05	0.03	0.07	0.05	-0.01	0.11	0.00	0.04	0.05	0.01	-0.01
Opinion Letter	0.41	1.00	-0.02	-0.02	0.06	0.05	0.05	0.03	-0.02	0.10	-0.01	0.06	0.05	0.01	0.00
Sales Growth	-0.02	-0.01	1.00	0.01	0.06	0.12	-0.02	-0.03	-0.19	0.04	0.28	-0.04	-0.11	0.05	0.07
R&D	-0.03	-0.03	0.06	1.00	0.06	-0.07	0.16	0.26	-0.19	-0.17	-0.17	-0.25	0.11	-0.20	-0.28
Intangible Intensity	0.05	0.05	0.02	-0.08	1.00	0.34	0.22	0.24	-0.05	0.28	0.04	0.19	0.19	0.14	0.03
M&A	0.03	0.05	0.02	-0.13	0.31	1.00	0.13	0.12	0.00	0.23	0.17	0.10	0.06	0.19	0.13
Tax Havens	0.07	0.05	-0.04	-0.01	0.17	0.13	1.00	0.49	-0.09	0.45	0.10	0.07	0.29	0.13	-0.01
MNC	0.05	0.03	-0.06	0.04	0.18	0.12	0.49	1.00	-0.06	0.35	0.08	0.00	0.33	0.13	-0.03
BTM	-0.02	-0.02	-0.07	-0.14	-0.04	-0.01	-0.07	-0.05	1.00	-0.09	-0.23	-0.10	-0.04	0.01	0.07
Size	0.11	0.10	-0.06	-0.30	0.23	0.22	0.44	0.36	-0.03	1.00	0.26	0.33	0.33	0.27	0.17
ROA	0.02	0.01	-0.02	-0.43	0.04	0.13	0.10	0.12	0.14	0.36	1.00	-0.17	0.05	0.50	0.43
Leverage	0.03	0.04	0.00	-0.03	0.11	0.02	0.00	-0.06	-0.30	0.07	-0.35	1.00	0.02	-0.05	-0.02
UTB	0.00	0.00	-0.01	0.03	0.00	-0.01	0.01	0.02	-0.02	-0.02	-0.05	-0.01	1.00	0.09	-0.03
Cash ETR	0.01	0.01	-0.07	-0.20	0.07	0.12	0.08	0.09	0.05	0.18	0.21	-0.09	-0.01	1.00	0.45
GAAP ETR	0.00	0.01	-0.05	-0.25	0.02	0.09	0.01	0.01	0.07	0.17	0.24	-0.06	-0.02	0.33	1.00

Notes. This table presents descriptive statistics for the full sample (Panel A), the PLR sub-sample (Panel B), T-tests difference of means (Panel C), and Pearson and Spearman correlations (Panel D). All variables are defined in Appendix A.

Table 3. Determinants of PLRs

	(1)	(2)	(3)	(4)
Dependent Variable	*PLR*	*PLR*	*PLR*	*PLR*
R&D	-0.008	-0.011	0.018	0.018
	(-0.58)	(-0.78)	(0.87)	(0.87)
Sales Growth	-0.005**	-0.005**	-0.006***	-0.006***
	(-2.08)	(-2.10)	(-2.89)	(-2.91)
Intangible Intensity	0.010	0.010	-0.022	-0.022
	(1.03)	(1.01)	(-1.37)	(-1.37)
M&A	0.004	0.004	0.003	0.003
	(1.35)	(1.39)	(1.24)	(1.27)
Tax Havens	0.006	0.006	0.000	0.000
	(1.44)	(1.39)	(0.07)	(0.04)
MNC	0.001	0.001	-0.006	-0.006
	(0.41)	(0.39)	(-1.07)	(-1.08)
BTM	-0.002	-0.002	-0.003	-0.003
	(-0.96)	(-0.93)	(-1.39)	(-1.37)
Size	0.008***	0.008***	0.007**	0.007**
	(7.41)	(7.49)	(2.13)	(2.20)
ROA	-0.008*	-0.007*	-0.002	-0.001
	(-1.95)	(-1.79)	(-0.47)	(-0.36)
Leverage	0.004	0.004	-0.009	-0.009
	(0.56)	(0.56)	(-1.02)	(-1.03)
Cash ETR	-0.004		-0.000	
	(-0.59)		(-0.01)	
GAAP ETR		-0.011*		-0.009*
		(-1.93)		(-1.68)
Constant	-0.021***	-0.019***	0.000	0.001
	(-3.56)	(-3.23)	(0.01)	(0.04)
Observations	31,965	31,965	31,965	31,965
R-squared	0.016	0.016	0.330	0.330
Firm FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Notes. This table presents the determinants analysis for PLR observations. ***, **, * denotes statistical significance at the 1%, 5%, or 10% level, respectively. T-statistics based on standard errors clustered by firm are presented below the coefficients in parentheses. All variables are defined in Appendix A.

Table 4. Main Results

PLRs and IRS Audits and Tax Outcomes

	(1)	(2)	(3)	(4)
Dependent Variables	*IRS Audit*	*GAAP ETR*	*Cash ETR*	*UTB*
First PLR x Post	-0.039**	0.001	-0.004	0.001
	(-2.012)	(0.095)	(-0.363)	(0.808)
Observations	105,565	105,565	105,565	44,646
R-squared	0.529	0.261	0.260	0.770
Controls	Yes	Yes	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes	Yes	Yes
S.E. Clustered by	Firm	Firm	Firm	Firm

Notes. This table presents the results of our main analysis of the relation between PLRs and IRS audits and other tax outcomes. Our specification is an entropy-balanced stacked difference-in-differences. ***, **, * denotes statistical significance at the 1%, 5%, or 10% level, respectively. T-statistics based on standard errors clustered by firm are presented below the coefficients in parentheses. All variables are defined in Appendix A.

Table 5. Comparison with Foreign PLRs and Opinion Letters

Panel A. Foreign PLRs and IRS Audits

	(1)	(2)
Dependent Variables	*IRS Audit*	*IRS Audit*
First PLR x Post	-0.045**	
	(-2.307)	
First Foreign PLR x Post		0.028
		(0.387)
Observations	105,505	103,964
R-squared	0.531	0.547
Controls	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes
S.E. Clustered by	Firm	Firm

Panel B. Opinion Letters and IRS Audits

	(1)	(2)	(3)	(4)
Dependent Variables	*IRS Audit*	*GAAP ETR*	*Cash ETR*	*UTB*
First Opinion Letter x Post	-0.013	0.003	-0.007	0.001
	(-0.658)	(0.339)	(-0.741)	(1.061)
Observations	101,498	101,498	101,498	101,498
R-squared	0.500	0.261	0.248	0.241
Controls	Yes	Yes	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes	Yes	Yes
S.E. Clustered by	Firm	Firm	Firm	Firm

Notes. This table presents the results of our supplemental analysis of the relation between Foreign PLRs and IRS audits (Panel A) and Opinion Letters and IRS audits and other tax outcomes (Panel B). Our specification is an entropy-balanced stacked difference-in-differences. ***, **, * denotes statistical significance at the 1%, 5%, or 10% level, respectively. T-statistics based on standard errors clustered by firm are presented below the coefficients in parentheses. All variables are defined in Appendix A.

Table 6. Disclosure effects

	(1)	(2)
	Tax Footnote	*MD&A*
Dependent Variable	*Disclosure Uncertainty*	*Disclosure Uncertainty*
First PLR x Post	-0.089***	0.028
	(-3.153)	(-0.957)
Observations	61,476	56,044
R-squared	0.752	0.730
Controls	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes
S.E. Clustered by	Firm	Firm

Notes. This table presents the results of our supplemental analysis of the relation between PLRs and the tax footnote (Column 1) and PLRs and MD&A Disclosure (Column 2). Our specification is an entropy-balanced stacked difference-in-differences. ***, **, * denotes statistical significance at the 1%, 5%, or 10% level, respectively. T-statistics based on standard errors clustered by firm are presented below the coefficients in parentheses. All variables are defined in Appendix A.

Table 7. Cross-sectional tests

Panel A. Size

	(1)	(2)	(3)	(4)
Dependent Variable	*IRS Audit*			
Size Quintile	*1*	*2*	*3*	*4*
First PLR x Post	-0.049**	-0.101***	-0.012	-0.020
	(-1.980)	(-3.139)	(-0.281)	(-0.602)
Observations	22,787	24,105	25,077	25,675
R-squared	0.430	0.442	0.442	0.610
Controls	Yes	Yes	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes	Yes	Yes
S.E. Clustered by	Firm	Firm	Firm	Firm

Panel B. Tax Avoidance

	(1)	(2)	(3)	(4)
Dependent Variable		*IRS Audit*		
Avoidance Quintile	*1*	*2*	*3*	*4*
First PLR x Post	-0.042	-0.005	-0.066**	-0.017
	(-1.440)	(-0.140)	(-2.306)	(-0.326)
Observations	25,004	25,190	25,083	24,653
R-squared	0.564	0.554	0.599	0.485
Controls	Yes	Yes	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes	Yes	Yes
S.E. Clustered by	Firm	Firm	Firm	Firm

Notes. This table presents the results of our cross-sectional analysis of the relation between PLRs and IRS audits across size quartiles (Panel A) and tax avoidance quartiles (Panel B). In Panel A, quartile one contains the smallest firms and quartile four contains the largest firms. In Panel B, quartile one contains the firms with the highest pre-treatment 3-year average cash ETR, and quartile four contains the firms with the lowest pre-treatment 3-year average cash ETR. Our specification is an entropy-balanced stacked difference-in-differences. ***, **, * denotes statistical significance at the 1%, 5%, or 10% level, respectively. T-statistics based on standard errors clustered by firm are presented below the coefficients in parentheses. All variables are defined in Appendix A.

Table 8. Non-reorg PLRs and IRS Audit

	(1)	(2)	(3)	(4)
Dependent Variables	*IRS Audit*	*GAAP ETR*	*Cash ETR*	*UTB*
First PLR x Post	-0.047**	-0.003	-0.008	0.001
	(-2.236)	(-0.320)	(-0.702)	(0.670)
Observations	105,452	105,452	105,452	44,579
R-squared	0.524	0.265	0.267	0.779
Controls	Yes	Yes	Yes	Yes
Firm-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Year-Cohort Fixed Effects	Yes	Yes	Yes	Yes
S.E. Clustered by	Firm	Firm	Firm	Firm

Notes. This table presents the results of our subsequent analysis of the relation between PLRs and IRS audits and other tax outcomes removing PLRs associated with reorganizations. Our specification is an entropy-balanced stacked difference-in-differences. ***, **, * denotes statistical significance at the 1%, 5%, or 10% level, respectively. T-statistics based on standard errors clustered by firm are presented below the coefficients in parentheses. All variables are defined in Appendix A.