A Strategic Perspective on the Corporate Tax Function and Tax Enforcement

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A Strategic Perspective on the Corporate Tax Function and Tax Enforcement

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Contents

I. Introduction

Strategic interactions between economic agents are deeply rooted in many economic contexts (Gibbons 1992). In the context of taxation, such interactions arise frequently—most prominently between taxpayers and tax authorities, whose incentives are often fundamentally misaligned. While tax payments reduce private wealth, they simultaneously increase tax revenues to finance public expenditures. This inherent tension creates adversarial dynamics shaping taxpayer and tax authority behavior (Slemrod 2019), and prior theoretical analyses have covered both individual and corporate taxpayers (e.g., Graetz et al. 1986, Reineke et al. 2025). For corporate taxpayers, however, the role of internal and external agents in shaping tax outcomes remains under-investigated. This stands in contrast to growing empirical evidence of individual agents' material impact on corporate tax outcomes (e.g., Belnap et al. 2024, Li and Okafor 2024), their relevance in practice (Niemann and Sailer 2023), and the rising specialization within the corporate tax function (Brühne and Schanz 2022, Giese et al. 2025). Therefore, this dissertation adopts a *strategic perspective* and theoretically investigates interactions among different economic agents both within and between the corporate tax function and tax enforcement.

Building this perspective requires a clear view of the organizational setting in which these interactions occur. In its narrow sense, the corporate tax function encompasses all activities performed by the tax department, including tax compliance and tax planning (Feller and Schanz 2017). For the purpose of this dissertation, *tax compliance* includes the act of reporting and paying taxes in accordance with tax laws (Boll 2014), including efforts to comply under conditions of legal uncertainty. *Tax planning* refers to intentional efforts made to reduce tax payments (Wilde and Wilson 2018), focusing here on legal strategies that may potentially be aggressive. Both tax compliance and tax planning activities can give rise to *tax risk*, which is uncertainty about future tax outcomes (Neuman et al. 2020). *Tax risk management* has recently gained prominence as a distinct yet interdependent activity alongside tax compliance and planning (Brühne and Schanz 2022). To carry out these activities, firms increasingly involve a broader set of internal and external agents beyond the traditional tax department.[1] Therefore, this dissertation adopts a broader understanding of the *corporate tax function* encompassing all agents who engage in tax-related activities on behalf of firms. These agents operate within increasingly structured environments that include procedural frameworks and technology tools that can empower or constrain certain activities, depending on their design and use. Importantly, the corporate tax function does not operate in isolation but interacts with tax enforcement, which significantly influences corporate tax risk exposure.

Tax enforcement takes place at various stages, beginning with tax audits and potentially continuing into tax disputes, which can arise in the aftermath of audits. Both stages can occur in national and international contexts. Similar to the corporate tax function, enforcement agents operate within structured institutional settings rather than in isolation. Their actions are embedded in procedural frameworks and supported or constrained by coordination mechanisms and technological tools that shape enforcement outcomes. While empirical evidence on (modern) enforcement tools and their effects is emerging (Eberhartinger et al. 2022, Kobilov 2025), it remains limited. Amid tightening fiscal constraints and limited tax authority budgets (Nessa et al. 2020), forward-looking theoretical predictions become increasingly important to understand how evolving enforcement tools can enhance efficient revenue collection. This also requires considering how firms strategically respond, including the novel strategies they adopt in reaction to these enforcement tools.

[1] In accordance with prevailing academic conventions, I use "firm" to refer to the entity in general but retain the term "corporate" in standard expressions such as "corporate tax planning" or "corporate tax function". This reflects standard phrasing rather than a strict legal distinction (see, e.g., Feller and Schanz 2017, Brühne and Schanz 2022).

The four studies of this dissertation by Dyck (A)[2], Dyck, Kourouxous and Lorenz (B)[3], and Dyck, Lorenz and Sureth-Sloane ((C)[4] and (D)[5]), are embedded in the unified context of offering strategic perspectives on different interactions within and between the corporate tax function and tax enforcement. All studies employ game-theoretic models to examine these interactions and include at least one strategic agent on both the corporate and the enforcement sides. In study (A), I highlight the role of boards of directors in managing tax risk by establishing procedures to oversee or encourage tax managers' planning activities. Thus, these agents jointly shape corporate tax planning, and I examine how policy-driven enforcement instruments (additional staffing or specialization and improving tax audit technologies) affect corporate tax planning and tax audit efficiency. Study (B) puts even greater emphasis on the strategic interactions on the enforcement side. We consider cross-border enforcement interactions by introducing tax authorities and their respective national auditors alongside a multinational firm. The analysis focuses on the institutional conditions under which joint tax audits arise and how the existence of joint tax audits as a coordinated enforcement instrument used by authorities affects tax audit efficiency.

While (A) and (B) take a deeper look at the enforcement side by examining national and international instruments to improve tax audit efficiency, (C) and (D) shift the focus toward the corporate tax function, emphasizing internal dynamics in the context of tax disputes. Study (C) scrutinizes the important role of external controversy experts, specialists consulted by firms in tax disputes, who strategically prepare and present information to persuade tax authorities. Specifically, we analyze the interdependent effects of two corporate practices to manage tax disputes, the use of controversy experts and tax technology for internal information provision, on tax planning efforts and corporate tax outcomes. Study (D) also focuses on practices to deal

[2] Dyck, Daniel. Corporate Tax Planning and Enforcement. *TRR 266 Accounting for Transparency Working Paper Series No. 186*, http://dx.doi.org/10.2139/ssrn.5186857.

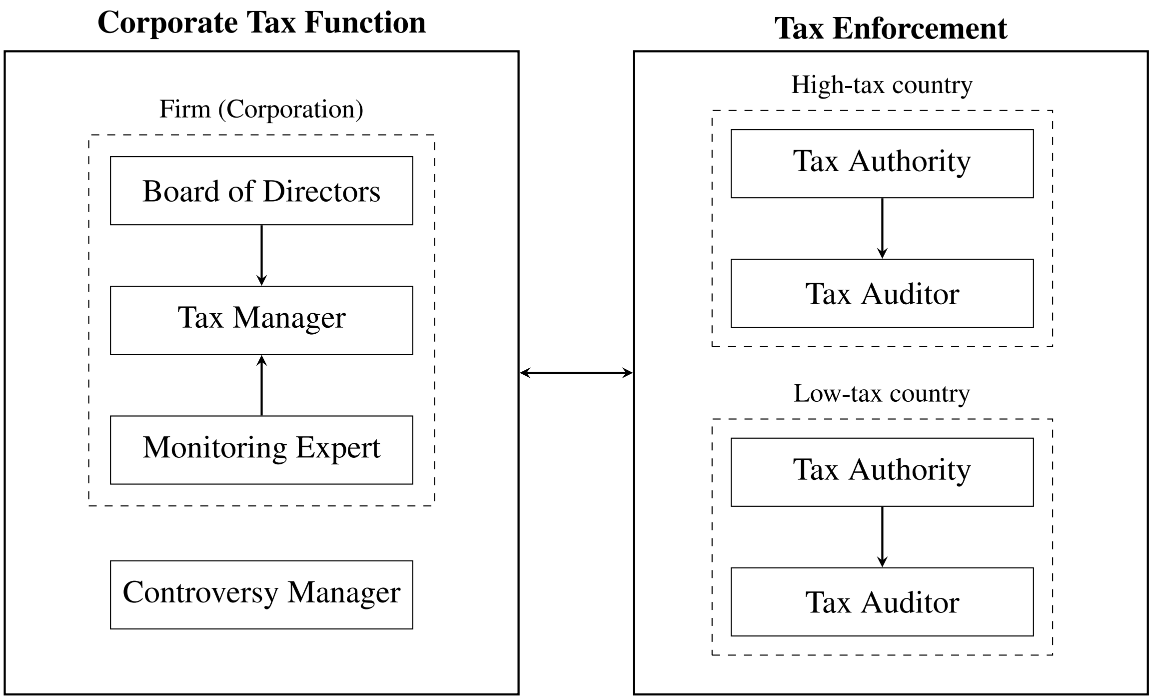
[3] Dyck, Daniel, Kourouxous, Thomas & Lorenz, Johannes. An Economic Analysis of Joint Tax Audits. *Working Paper*.

[4] Dyck, Daniel, Lorenz, Johannes & Sureth-Sloane, Caren. Tax Disputes – The Role of Technology and Controversy Expertise. *TRR 266 Accounting for Transparency Working Paper Series No. 101, WU International Taxation Research Paper Series No. 2022-11*, http://dx.doi.org/10.2139/ssrn.4214449.

[5] Dyck, Daniel, Lorenz, Johannes & Sureth-Sloane, Caren. Sloppiness in Tax Disputes – How to Prevent Litigation?. *Working Paper*.

with tax disputes, but considers a more compliance-based view of the corporate tax function. We examine whether and to what extent internal monitoring experts and improving documentation can mitigate sloppiness—the inaccurate preparation of supporting information during tax disputes—and thereby prevent litigation. Taken together, all studies illuminate novel strategic interactions in the corporate tax environment. The timing of strategic decisions on the enforcement side progressively moves later in the sequence from auditing decisions in (A) to litigation decisions in (D), with (B), (C), and (D) including aspects of tax disputes. The following Figure depicts all strategic agents considered in this dissertation.

Figure. Strategic agents in the corporate tax function and tax enforcement in this dissertation



The motivation in (A) to examine how different national tax enforcement instruments affect corporate tax planning and tax audit efficiency is grounded in growing concerns over substantial tax revenue losses due to risky corporate tax planning strategies (Heckemeyer and Overesch 2017, Riedel 2018). In response, policymakers increasingly rely on two prominent instruments. First, they introduce and enhance data-driven tax audit technologies, which provide auditors with additional information to assess risky corporate tax positions and planning strategies (Eberhartinger et al. 2022, OECD 2023). Second, they strengthen the human component of enforcement by increasing enforcement staff or enhancing their specialization (De Simone et al. 2023, Blaufus et al. 2025). I refer to this instrument as “strengthening tax enforcement”. At the same time, boards of directors are increasingly investing in TCFs (Tax Control Frameworks) as a governance tool to manage tax planning risks and reduce their exposure to enforcement. Since TCF investments are voluntary and vary across firms (Blaufus et al. 2023), they may either restrict undesired or facilitate desired risky tax planning. Correspondingly, the empirical literature provides mixed evidence on the role this governance tool might play in shaping corporate tax outcomes (e.g., Blaufus et al. 2023, Siglé et al. 2024). Ignoring this governance tool can lead to incomplete predictions about the efficiency implications of policy instruments.

(A) builds on a model with three strategic players: a board of directors, a tax manager, and a tax auditor. The board decides whether to invest in TCF quality upfront, weighing the costs and benefits of tax planning. The privately informed tax manager has incentives to implement a risky tax planning strategy, which requires costly effort and becomes harder with higher TCF quality. The tax auditor observes a tax report and receives a signal from the tax audit technology, based on which she decides whether to conduct a costly in-depth audit that fully reveals the underlying tax conditions. Strengthening tax enforcement is modeled as a reduction in audit costs, while improved audit technology is modeled as providing more informative signals about the implementation of a risky tax planning strategy, though it still requires an in-depth audit for verification. Tax audit efficiency is measured by the probability of auditing a risky tax planning strategy and the probability that such a strategy results in lost tax revenues.

The results in (A) show that strengthening tax enforcement consistently increases the audit probability of a risky tax planning strategy, thereby deterring the tax manager’s planning effort. These effects have opposing implications for the board’s tax risk exposure and thus its TCF investment, and I identify conditions under which TCF investment may decline. Nevertheless, the impact on tax planning effort dominates, such that corporate tax planning and, in turn, lost tax revenues consistently decrease. The results for the impact of improving audit technology quality critically depend on the strength of tax enforcement. Intuitively, although improved audit technology provides more informative signals, its positive effect on both efficiency measures is not automatic but depends on the tax auditor's willingness to act on the information. When the strength of tax enforcement is low, improved technology increases audit incentives and deters corporate tax planning, thereby enhancing audit efficiency. By contrast, when this strength is high, improved technology crowds out audit incentives. This leads to an increase in corporate tax planning and, ultimately, a reduction in tax audit efficiency. Notably, corporate tax planning may rise in response to technology improvements, especially among tax aggressive firms, underscoring that audit technologies can produce unintended consequences when auditors behave strategically.

In light of the overarching objective of this dissertation, the results in (A) underscore the need to account for 1) strategic enforcement agents when evaluating enforcement instruments and 2) firm-level heterogeneity that arises from disentangling boards' and tax managers' impact on corporate tax planning. In doing so, the study contributes to the strategic tax audit literature and sheds light on the "black box" of corporate tax planning. (A) also connects to governance research by showing that, unlike traditional accounting controls, a TCF may be employed not only to constrain but also to facilitate tax planning. Further, (A) introduces tax audit technology as a previously unexplored enforcement instrument in similar manager-auditor interactions in the financial accounting sphere.

Study (B) examines under what circumstances tax authorities use joint tax audits as a coordinated enforcement tool in cross-border transactions of a multinational firm and how such audits affect two key economic outcomes: the firm's expected tax payments and tax audit efficiency. Joint tax audits, where at least two tax authorities collaboratively audit transactions of a firm, have gained prominence in the international tax policy debate and are seen as a response to inconsistent applications of tax rules across jurisdictions, often resulting in double taxation. Several factors, including the complexity of cross-border tax transactions, unharmonized rules and tax competition drive these inconsistent applications (Rathke et al. 2020, Diller et al. 2025). Traditional instruments to prevent inconsistent applications and to address double taxation, such as Advance Pricing Agreements (APAs) or Mutual Agreement Procedures (MAPs), are often considered costly and time-consuming (OECD 2019). Despite policymakers' growing interest and early evidence from pilot projects suggesting their potential to prevent double taxation and improve timeliness (Braun et al. 2020), little is known about the institutional characteristics that determine the circumstances under which joint audits are expected to arise. In addition, the economic effects are not-well understood, particularly when considering that joint audits typically require higher administrative costs than national audits.

The model in (B) features a multinational firm that can report income to the tax authority in a low-tax or high-tax country, tax authorities' joint audit decisions, and, when joint tax audits are not established, two tax auditors' national audit decisions. Reporting income to the low-tax authority can constitute income shifting. After observing where income is reported, both authorities independently decide whether to opt for a joint audit, which is established only if both give their consent. While joint audits involve additional coordination costs for both net-revenue maximizing authorities, joint audits prevent double taxation and avoid authorities' costs associated with dispute resolution procedures ("inconsistency costs") when national audits would lead to double taxation. National tax auditors have implicit incentives to raise tax revenues but do not internalize the expected inconsistency costs in their decision-making.

Study (B) shows that the occurrence and efficiency of joint tax audits critically depend on the firm's residual double taxation risk in the absence of joint audits (e.g., after MAPs or national litigation). When this risk is low, joint audits are only established if they lower the tax authorities' coordination costs and expected inconsistency costs, which is our measure for tax audit efficiency. Thus, in this case, joint audits are always efficient when implemented. However, not all efficiency-enhancing joint audits are established because mutual consent is required, and the low-tax authority may block otherwise efficient audits. By contrast, when the residual double taxation risk is high, joint audits can occur more often as the firm alters its income-shifting strategy in anticipation of joint audits. Strikingly, joint audits can then be inefficient, particularly when the firm prefers them due to lower expected tax payments. In addition, even if joint tax audits would ultimately be efficient, either tax authority may block those efficient joint audits when the double taxation risk is high. Our results suggest that cost-sharing arrangements for joint audits should be tailored to the level of double taxation risk. When the risk is low, reallocating coordination costs among tax authorities can facilitate efficient joint audits by overcoming blocking by the low-tax authority. When the risk is high, involving firms in cost-sharing may improve audit efficiency, as firms have a strong interest in avoiding double taxation and may be willing to help cover coordination costs in exchange for greater certainty.

The results in (B) contribute to the overarching objective of the dissertation by underscoring strategic tensions (1) between tax authorities and their respective national auditors, (2) across tax authorities due to revenue competition, and (3) between the tax enforcement agents of each country and firms, the latter reflecting the traditional adversarial interaction. We contribute to the literature by providing a theoretical analysis of the economic effects of joint tax audits and their distinct institutional features compared to other dispute prevention and resolution mechanisms, such as bilateral APAs, or non-tax joint audit arrangements. We show that these institutional features have important regulatory implications, which are particularly relevant given the expanding global adoption of joint tax audits.

Study (C) investigates how firms strategically manage tax disputes by analyzing the role of controversy managers. These are external controversy experts who prepare and present tax-relevant information to persuade tax authorities in accordance with firms' interests (e.g., Acito and Nessa 2022). As tax authorities increasingly scrutinize firms' (risky) tax positions, tax disputes have become a central element of corporate tax strategy and are no longer viewed solely as a source of risk, but increasingly as a strategic lever to navigate complex tax environments and unlock value (PwC 2025). Thus, disputes expose firms to tax risk but also offer opportunities to defend positions and enhance overall tax performance. In parallel, internal tax technology plays an important role by providing tax managers with detailed information and early warning signals that help assess and monitor the defensibility of tax positions (Krupa and Mullaney 2025). However, tax managers may have personal incentives that go beyond simply passing on available information (Li and Okafor 2024). Summing up, the interdependent effects of controversy managers and tax technology and their impact on tax managers in shaping tax (dispute) outcomes have received limited attention.

Study (C) develops a model with three strategic players: a tax manager, a tax authority, and a potentially present controversy manager. The tax manager exerts tax planning effort given the imperfect signal of the firm's tax technology. This effort can facilitate a low tax report even when the technology indicates a high tax. A low tax report culminates in a tax dispute. In a tax dispute, the controversy manager can investigate and develop a substantiated tax opinion to persuade the tax authority to agree with the tax manager's initial low report. The tax authority considers this tax opinion, if provided by the controversy manager, which either supports or refutes the low report. If no controversy manager is involved, the authority enforces the tax liability based solely on the initial report.

The results in (C) reveal that the controversy manager plays a dual role in a given dispute. In her tax reassurance role, she reduces the likelihood of false enforcement leading to tax overpayment. In her tax planning role, she increases the likelihood that the authority accepts a lower tax than the underlying conditions would suggest. Both roles operate in an endogenous dispute stage, where the controversy manager develops a tax opinion to influence the authority's enforcement decision. This endogeneity is central, as it creates a feedback effect that encourages the tax manager to engage in more tax planning. As a result, disputes become more likely, and the controversy manager effectively "creates her own demand". On the one hand, this rise in disputes increases the risk of unfavorable dispute outcomes. On the other hand, it enhances the chances of securing low final tax payments due to the controversy manager's reassurance and planning role in a given dispute. The net effect on unfavorable outcomes depends on the tax technology. If the technology is of low quality, the rising dispute frequency may dominate, resulting in more unfavorable outcomes. However, with intermediate or high-quality technology, she reduces unfavorable outcomes. Finally, we show that tax technology quality can either increase or decrease the likelihood of securing low final tax payments. Intermediate levels of technology quality often maximize the controversy manager's value added for securing those low payments.

Against the backdrop of the dissertation's main objective, study (C) theoretically examines the role of sophisticated controversy experts who try to persuade tax authorities to act in a firm's interest. It especially elucidates 1) feedback effects from interactions within the corporate tax function and 2) the interdependent effect of internal technologies and experts. (C) offers a foundation to analyze other phenomena in which persuading agents act subsequent to other strategic agents. In that vein, we are not aware of other studies that apply Bayesian persuasion models in a corporate tax setting, nor of work in the broader tax and accounting literature that considers strategic decisions preceding the persuasion stage. In addition, our model explains the empirical observation that experts facilitate tax planning (planning role) and compliance (reassurance role) without *assuming* these roles. From a regulatory perspective, we also find initial evidence that private information on the tax authority's side can particularly counteract the (presumably aggressive) tax planning role of these experts.

Finally, study (D) examines two corporate practices, improving documentation and involving internal monitoring experts, to address sloppiness in the preparation of supporting information during tax disputes and ultimately prevent litigation. (D) is motivated by the increasingly uncertain, complex and compliance-intensive tax environment that corporate tax functions and their agents face (Brühne and Schanz 2022, Giese et al. 2025). In this context, sloppiness can emerge, which results in an inaccurate preparation of information. Sloppiness has a factual dimension, arising from imperfect documentation that hinders the ability to accurately prepare supporting information, even when there is a willingness to comply. The strategic dimension occurs when tax managers rationally limit their compliance effort in non-routine disputes, weighing the associated costs. To address factual sloppiness, firms can improve their documentation quality, which serves as a key success factor during disputes. In parallel, a non-negligible number of firms engage internal monitoring experts (e.g., KPMG 2019). These experts offer guidance beyond the expertise of common tax managers but are themselves strategic agents. Anecdotal evidence suggests that while their accountability for dispute outcomes may undermine other managers' compliance incentives, their presence can also have a disciplining effect. This dual role, particularly in combination with documentation quality, highlights the need for a theoretical model to evaluate their impact.

The model in (D) has three players: a tax manager, a potentially involved monitoring expert, and a tax authority. The setting begins after the tax authority has challenged a tax position, culminating in a tax dispute. However, no player can predict a potential litigation outcome due to legal uncertainty. In response to the authority's challenge, the tax manager submits a final tax opinion, which can be sloppy, meaning that it may differ from the tax liability that would be revealed in adjudication. Without a monitoring expert, the tax opinion's degree of sloppiness depends on the tax manager's compliance effort and the documentation quality. With a monitoring expert, sloppiness can be further reduced if the expert exerts high dispute resolution effort. Based on the tax opinion, the authority either settles the dispute or initiates litigation. Litigation fully reveals whether the tax opinion has been in line with the underlying economic conditions.

The equilibrium analysis in (D) reveals two key findings. First, if a monitoring expert is involved, we find that improving low-quality documentation can increase the litigation probability. The reason is that improving documentation generally crowds out compliance efforts, which weakens the expert's dispute resolution incentives for low-quality documentation. The tax authority rationally incorporates these internal dynamics and more frequently initiates litigation as a response. Second, we show that the litigation probability can be higher in a tax department with a monitoring expert because high dispute resolution costs can erode the monitoring expert's dispute resolution incentives and thereby increase the litigation probability. Our results imply that in order to prevent litigation, firms should either rely on high-quality documentation without involving a monitoring expert or involve a monitoring expert when documentation quality is low.

Concerning the dissertation's main objective and the contribution to the literature, study (D) adds a new perspective by highlighting 1) the interdependent effect of internal documentation and experts in disputes at risk of litigation, 2) the shift in objectives that may occur when internal experts become part of the corporate tax function, and 3) compliance activities under legal uncertainty rather than focusing on opportunistic tax planning activities. In that vein, future research could consider sloppiness as an explanatory factor in other tax reporting and audit interactions.

In conclusion, this dissertation contributes to research on the strategic interactions among different economic agents both within and between the corporate tax function and tax enforcement. While prior research often disregards the various agents in and characteristics of the corporate tax function, I shed light on this "black box". Both the motivation and the contribution of each study, as well as their results, underline the importance of the strategic perspective, which can reveal unintended consequences of tax policy instruments or corporate practices to deal with the multifaceted sources of tax risk. The nature of theoretical modeling implies that the validity of the results crucially depends on the underlying, typically simplistic assumptions about the agents' objective functions, their available information, and the institutional setting. While these assumptions are essential to isolate mechanisms and clarify trade-offs, future research can take the studies of this dissertation and their assumptions as a starting point such that "analytical tax research [remains] alive and kicking" (Niemann and Sailer 2023, p. 1149).

References

Acito, A. A., & Nessa, M. (2022). Law Firms as Tax Planning Service Providers. *The Accounting Review*, *97*(4), 1–26.

Belnap, A., Hoopes, J. L., & Wilde, J. H. (2024). Who Really Matters in Corporate Tax? *Journal of Accounting and Economics*, *77*(1), 101609.

Blaufus, K., Bock, J., Peuthert, B., & Schwäbe, A. N. (2025). The Effect of Individual Tax Auditor Characteristics on Tax Audit Efficiency – Implications for Auditor Training and Allocation. *Journal of the American Taxation Association, forthcoming*, 1–26. https://doi.org/10.2308/JATA-2023-010

Blaufus, K., Reineke, J., & Trenn, I. (2023). Perceived Tax Audit Aggressiveness, Tax Control Frameworks and Tax Planning: An Empirical Analysis. *Journal of Business Economics*, *93*(3), 509–557.

Boll, K. (2014). Mapping Tax Compliance: Assemblages, Distributed Action and Practices: A New Way of Doing Tax Research. *Critical Perspectives on Accounting*, *25*(4-5), 293–303.

Braun, M., Eisgruber, T., Greil, S., & Schmitz, S. (2020). Joint Audits: The German Experience. *International Tax Review*, *31*, 23–25.

Brühne, A. I., & Schanz, D. (2022). Defining and Managing Corporate Tax Risk: Perceptions of Tax Risk Experts. *Contemporary Accounting Research*, *39*(4), 2861–2902.

De Simone, L., Stomberg, B., & Williams, B. (2023). Does Tax Enforcement Disparately Affect Domestic versus Multinational Corporations around the World? *Contemporary Accounting Research*, *40*(4), 2816–2845.

Diller, M., Lorenz, J., Schneider, G., & Sureth-Sloane, C. (2025). Is Tax Transfer Pricing Harmonization a Panacea? Real Effects of Global Tax Transparency and Standards Consistency. *The Accounting Review*, *100*(2), 71–102.

Eberhartinger, E., Safaei, R., Sureth-Sloane, C., & Wu, Y. (2022). Is Risk Profiling in Tax Audit Case Selection Rewarded? An Analysis of Corporate Tax Avoidance. *TRR 266 Accounting for Transparency Working Paper Series No. 60*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3911228

Feller, A., & Schanz, D. (2017). The Three Hurdles of Tax Planning: How Business Context, Aims of Tax Planning, and Tax Manager Power Affect Tax Expense. *Contemporary Accounting Research*, *34*(1), 494–524.

Gibbons, R. (1992). *A Primer in Game Theory*. FT Prentice Hall.

Giese, H., Lynch, D., Schulz, K. A., & Sureth-Sloane, C. (2025). The Effects of Tax Reform on Labor Demand within Tax Departments. *TRR 266 Accounting for Transparency Working Paper Series No. 171*. http://dx.doi.org/10.2139/ssrn.5068550

Graetz, M. J., Reinganum, J. F., & Wilde, L. L. (1986). The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement. *Journal of Law, Economics, & Organization*, *2*(1), 1–32.

Heckemeyer, J. H., & Overesch, M. (2017). Multinationals' Profit Response to Tax Differentials: Effect Size and Shifting Channels. *Canadian Journal of Economics/Revue canadienne d'économique*, *50*(4), 965–994.

Kobilov, B. (2025). Technology-Enabled Enforcement. *UNC Tax Symposium*, *Working Paper (unpublished)*.

KPMG. (2019). The Global Tax Disputes Environment. https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2019/10/the-global-tax-disputes-environment.pdf

Krupa, T., & Mullaney, M. (2025). The Use of Artificial Intelligence in Decision-Making: Evidence from the Effectiveness of Corporate Tax Strategies. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4710463

Li, J., & Okafor, O. N. (2024). Tax Employee Careers and Corporate Tax Outcomes. *European Accounting Review, forthcoming*, 1–26. https://doi.org/10.1080/09638180.2024.2386144

Nessa, M., Schwab, C. M., Stomberg, B., & Towery, E. M. (2020). How do IRS Resources Affect the Corporate Audit Process? *The Accounting Review*, *95*(2), 311–338.

Neuman, S. S., Omer, T. C., & Schmidt, A. P. (2020). Assessing Tax Risk: Practitioner Perspectives. *Contemporary Accounting Research*, *37*(3), 1788–1827.

Niemann, R., & Sailer, M. (2023). Is Analytical Tax Research Alive and Kicking? Insights from 2000 until 2022. *Journal of Business Economics*, *93*(6-7), 1149–1212.

OECD. (2019). Joint Audit 2019 – Enhancing Tax Co-operation and Improving Tax Certainty, 1–75. https://www.oecd.org/en/publications/joint-audit-2019-enhancing-tax-co-operation-and-improving-tax-certainty_17bfa30d-en.html

OECD. (2023). Tax Administration 2023: Comparative Information on OECD and other Advanced and Emerging Economies, 1–174. https://www.oecd.org/ctp/tax-administration-23077727.htm

PwC. (2025). Global Tax Controversy and Dispute Resolution Survey. https://www.pwc.com/gx/en/services/tax/tax-controversy-dispute-resolution-survey.html

Rathke, A. A., Rezende, A. J., & Watrin, C. (2020). Classification of Transfer Pricing Systems Across Countries. *International Economics*, *164*, 151–167.

Reineke, R., Weiskirchner-Merten, K., & Wielenberg, S. (2025). Real Effects of the Enforcement of Anti-Avoidance Regulation. *WU International Taxation Research Paper Series No. 2023-01*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4352522

Riedel, N. (2018). Quantifying International Tax Avoidance: A Review of the Academic Literature. *Review of Economics*, *69*(2), 169–181.

Siglé, M. A., Goslinga, S., van der Hel, L. E. C. J. M., & Wilson, R. J. (2024). Tax Control and Corporate VAT Compliance: An Empirical Assessment of the Moderating Role of Tax Strategy. *Journal of International Accounting, Auditing and Taxation*, *57*, 100655.

Slemrod, J. (2019). Tax Compliance and Enforcement. *Journal of Economic Literature*, *57*(4), 904–954.

Wilde, J. H., & Wilson, R. J. (2018). Perspectives on Corporate Tax Planning: Observations from the Past Decade. *The Journal of the American Taxation Association*, *40*(2), 63–81.

II. Studies of the Dissertation

Corporate Tax Planning and Enforcement*

Daniel Dyck†

Abstract

This study investigates how strategic interactions between corporate tax planning and tax enforcement are affected by two policy instruments: strengthening tax enforcement by increasing the number or specialization of enforcement staff and improving tax audit technologies. I employ an economic model with a board of director's investment in a Tax Control Framework (TCF) and a tax manager's tax planning effort jointly shaping corporate tax planning and a tax auditor's technology-based audit decision. I show that the board only invests in the TCF when the enforcement environment is sufficiently strict, because it trades off the costs and benefits of tax planning. Since strengthening tax enforcement decreases tax planning effort, the result can be less investment in a TCF in a strict enforcement environment, implying that TCF investment and enforcement can be strategic substitutes. Strikingly, I identify conditions under which improvements in tax audit technology increase corporate tax planning and impair tax audit efficiency, due to a crowding out of audit incentives. This result contradicts the view that improving audit technologies is universally effective, particularly in tax authorities with adequate or highly specialized staffing.

Keywords: tax control framework, tax planning, tax risk management, tax audit technology, tax enforcement
JEL classification: H26, H32, M42, M48, C72

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1. Introduction

Numerous empirical studies show that firms engage in tax planning to decrease their tax liabilities (Hanlon and Heitzman 2010, Wilde and Wilson 2018). Tax planning encompasses a continuum of strategies, ranging from risk-free tax-favored real activities to risky tax maneuvers (Hanlon and Heitzman 2010, Blouin 2014). Risky tax planning strategies can result in significant lost tax revenues for countries (Heckemeyer and Overesch 2017, Riedel 2018), and thus policymakers worldwide are seeking to improve tax enforcement by targeting these risky strategies (Slemrod 2019). For example, the Inflation Reduction Act of 2022 has allocated about $80 billion to the U.S. Internal Revenue Service to facilitate improved enforcement (Mehboob 2022, Picchi 2024). However, recent budget cuts have renewed concerns about the agency's and its auditors' enforcement abilities (Sholli 2025).

Given the limited resources and national instruments available, two primary instruments are typically employed to improve tax enforcement. First, data-driven tax audit technologies provide tax auditors with additional information to assess firms' (risky) tax positions and tax planning strategies (Eberhartinger et al. 2022, OECD 2023).[1] Second, strengthening tax enforcement—by increasing enforcement staff (De Simone et al. 2023) or enhancing their specialization (Blaufus et al. 2025)—improves individual auditors' capacity to conduct audits, ceteris paribus. While there is a common understanding *that* these instruments change external tax enforcement by auditors, it is less recognized that they also impact firms' internal tax enforcement through investment in their Tax Control Framework (TCF).[2] In addition, it is unclear *how* these instruments differentially affect external and internal tax enforcement.

[1]Eberhartinger et al. (2022) report that about 90% of the tax authorities in their sample used risk profiling for tax audit case selection in 2017, which may be one component of a tax audit technology. Countries using risk-profiling include Austria, Spain, and the United States, with notable exceptions being China, Germany, and Japan. The interviewed corporate tax specialists in KPMG (2023) respond that 83% of their jurisdictions' tax authorities use technology and data to risk assess taxpayers or issues.

[2]A TCF can be defined as the "entirety of corporate practices implemented by a firm to identify, evaluate, manage, mitigate, monitor, and control corporate tax risk and to establish a beneficial internal information environment" (Brühne and Schanz 2022, p. 35). The terms "TCF" (OECD 2016, Blaufus et al. 2023, Siglé et al. 2024), "Tax Compliance Management System" (Blaufus and Trenn 2018, Schulz and Sureth-Sloane 2024), and "tax risk management" (Wunder 2009, Brühne and Schanz 2022) are used interchangeably in the literature.

I employ an economic model to investigate how corporate tax planning, which is the outcome of investments in a TCF and tax planning effort, and the audit strategy of a tax auditor are affected by two key policy instruments: the strengthening of tax enforcement and the improvement of the quality of tax audit technology. In subsequent analyses, I study how the two policy instruments affect tax audit efficiency.

The study is timely as firms increasingly implement TCFs to manage tax planning risks and unexpected enforcement outcomes (Brühne and Schanz 2022, Blaufus et al. 2023, Siglé et al. 2024). One key practice, as part of a TCF, is the implementation of a tax risk reporting line from the tax department to the board of directors, through which the board shapes its desired level of risky tax planning (Brühne and Schanz 2022, Blaufus et al. 2023). Aside from best practices on how to establish a TCF (OECD 2016, EY 2023), investments in a TCF are voluntary and vary across firms (Blaufus et al. 2023), which comports with the reality of varying firm-level costs of tax planning (Wilde and Wilson 2018). Thus, explicitly considering the TCF's risk management function allows for a deeper understanding of heterogeneous corporate tax planning outcomes and the efficacy of tax policy instruments.[3]

My model incorporates these features. It involves three strategic players: a board of directors (it), a tax manager (he), and a tax auditor (she). The board can either invest in TCF quality upfront to manage its tax risk exposure from risky tax planning or choose a minimum TCF quality to facilitate risky tax planning. Risky tax planning is conducted by a privately informed tax manager, who aims to decrease the reported tax. He can exert effort to implement a risky tax planning strategy, where a higher quality TCF makes implementation more difficult. The tax auditor observes the tax report and an additional, noisy signal from the tax audit technology. The signal indicates whether a risky tax planning strategy was implemented and thus whether an

[3]While theoretical studies neglect the role TCF investments have on corporate tax planning and enforcement, empirical studies on this interaction do not provide a clear picture. Siglé et al. (2024) find that higher TCF quality generally increases compliance but can increase intentional noncompliance (i.e., risky tax planning) in firms with an aggressive tax strategy and a low-quality TCF. Gallemore and Labro (2015) indicate that higher TCF quality could increase tax planning, as it likely relates to an improved internal information environment. Armstrong et al. (2015) indicate that a higher TCF quality as an instrument for effective governance might induce tax planning toward an optimum. These studies view the TCF as a determinant of tax planning. Blaufus et al. (2023) highlight that the TCF quality depends on the perceived tax audit environment and find that perceived audit aggressiveness is positively associated with the quality of TCFs but is not associated with devoted tax planning resources.

in-depth audit is promising. An in-depth audit is costly for the tax auditor, but perfectly reveals whether a risky tax planning strategy was implemented.[4]

In the model, the main factor that determines the strength of tax enforcement is the tax auditor's opportunity cost of auditing. For example, this audit cost can change when the number or expertise of tax auditors in a tax authority changes (Nessa et al. 2020, De Simone et al. 2023, Blaufus et al. 2025, Kobilov 2025). The decisive driver of the quality of the tax audit technology is the sophistication of the IT tools and predictive models that condense corporate information from a variety of sources into a "red flag" or "green flag" (Eberhartinger et al. 2022, OECD 2023). These information sources can include information exchange agreements among tax authorities (Casi et al. 2020), private country-by-country reports (Joshi 2020, Martini et al. 2025), or financial statement information (Mills et al. 2010, Bozanic et al. 2017). While strengthening tax enforcement reduces audit costs, enhanced audit technologies provide better information to identify risky tax strategies but nevertheless require a tax auditor's personal judgment in an in-depth audit. Thus, while independent ex ante, the effects of these instruments on tax audit efficiency become interlinked when considering strategic audit decisions.[5]

I show that a strict tax enforcement environment is necessary to elicit the board's TCF investment above a minimum quality. Intuitively, the board considers the firm's costs and benefits of tax planning. Only in a strict enforcement environment are the expected costs of risky tax planning extensive, incentivizing the board to restrict a tax manager's planning effort through the TCF. In a lenient environment, the board facilitates risky tax planning through minimum TCF quality. The enforcement environment determines the tax manager's and tax auditor's trade-offs. In a lenient one, the effects of the TCF on the tax planning effort and audit decision are muted, while in a strict one, the TCF additionally shapes both tax planning effort and the audit decision.

[4] I focus on large firms that implement risky tax planning strategies and invest in TCFs. These firms are typically under permanent audit. Thus, in this paper, the tax auditor's audit decision always refers to an in-depth audit decision of a tax position.

[5] I acknowledge that some tax audit technologies aim at improving audit processes of routine tax positions. However, I exclusively focus on the increasingly prevalent technologies that provide additional information to identify non-routine, risky positions and strategies. More broadly, the model relates to the interplay between human judgment and technology, for example, in the financial auditing domain (Samiolo et al. 2024).

I find that strengthening tax enforcement incentivizes the tax auditor to audit more often. The reason is that she audits only if the evidence from the tax audit technology is sufficiently favorable, and strengthening tax enforcement decreases her required evidence to audit. This creates an enforcement effect on tax planning, which deters the tax manager's planning effort. In a strict enforcement environment, the audit probability becomes high enough to elicit the board's TCF investment. Then, strengthening tax enforcement further increases the audit probability and investment incentives (external incentive effect), while the decreasing tax planning effort decreases investment incentives (internal incentive effect). Which of the effects dominates depends on how much the enforcement effect deters the tax manager's planning. Notably, I find that, when the internal incentive effect is strong and the strength of tax enforcement is high, strengthening tax enforcement decreases TCF investment. This finding highlights that internal and external tax enforcement can be strategic substitutes.

Next, I show that the impact of improving the tax audit technology is interlinked with the strength of tax enforcement. The key reason is that this improvement affects the tax auditor's relative importance of type I errors (auditing when no risky tax planning strategy is implemented) and type II errors (failing to audit a risky tax planning strategy). In particular, when the strength of tax enforcement is lower, the improvement increases audit incentives. However, when the strength of tax enforcement is higher, the improvement crowds out audit incentives. In equilibrium, the tax manager rationally infers the impact on the audit incentives, and he decreases (increases) tax planning effort if the strength of tax enforcement is sufficiently low (high). This result is striking on three dimensions. First, audit technology improvement would unambiguously deter tax planning effort if the auditor was nonstrategic. Second, the implications of technology improvement for tax planning effort and audit strategy are generally robust to changes in the enforcement environment. Third, the impact of technology improvement on tax planning effort determines the impact on overall corporate tax planning, even when TCF investment and tax planning effort produce opposing effects. Interestingly, an increase in tax planning as a response to technology improvement is more likely for tax-aggressive firms, suggesting heterogeneous tax planning responses across firms.

In additional analyses, I study how strengthening tax enforcement and improving the audit technology affect tax audit efficiency. Like Blaufus et al. (2024), I use two equilibrium measures for tax audit efficiency: the audit probability of a risky tax planning strategy and the probability of lost tax revenues. Across both, my results suggest that strengthening tax enforcement increases tax audit efficiency. By contrast, I show that improving audit technologies impairs tax audit efficiency when the strength of tax enforcement is sufficiently high. These results imply that improving tax audit technologies cannot always serve as a substitute for strengthening tax enforcement. While conventional wisdom would suggest that improving technologies must be complemented by sufficient capacities for enforcement staff, I identify a potential downside of this complementarity: a crowding out of audit incentives. This surprising result underscores the importance of considering strategic tax auditors when evaluating policy instruments.

I contribute to the literature in three ways. First, I contribute to the literature on strategic tax audits that examines different determinants and outcomes of tax audits both for individual (e.g., Graetz et al. 1986, Beck and Jung 1989, Sansing 1993) and corporate taxpayers (e.g., Mills et al. 2010, De Simone et al. 2013, Diller et al. 2025). One of the studies most closely related to mine is Sansing (1993). He examines how additional information from a tax audit technology affects individual taxpayer audits and identifies the optimal quality of the audit technology. While I model the audit technology similarly, my study differs because it explicitly considers how TCF investments and tax planning efforts endogenously arise in a corporate taxpayer context. In this context, I show that the effect of audit technology depends on the strength of tax enforcement, and that the adverse effect of technology is particularly likely for tax-aggressive firms.

Second, I contribute to the literature on financial misreporting, which is influenced by, among other things, board oversight (e.g., Laux 2010) and interactions of regulatory enforcement with internal controls (e.g., Schantl and Wagenhofer 2021) or with strategic auditors (e.g., Shibano 1990, Pae and Yoo 2001). While tax planning efforts (TCF investments) relate to financial misreporting (investments in internal controls), the tax setting differs in two important ways. First, the board might want to facilitate risky tax planning through a minimum TCF investment, as tax planning may increase firm value. Thus, unlike investments in internal controls (e.g., Schantl and Wagenhofer 2025), the board's TCF investment only occurs when the enforcement environment is sufficiently strict.[6] Second, I consider a strategic tax auditor, which allows me to additionally study the impact of tax audit technologies as a distinct enforcement instrument.[7] I thus add to Ewert and Wagenhofer (2019) by providing a deeper understanding of the differential effects of (tax) enforcement instruments.

Finally, I contribute to examining the black box of tax planning. I respond to the call of Dyreng and Maydew (2018) and show that corporate tax planning is influenced by a tax manager's planning effort and the board's investment in the TCF. This view of corporate tax planning is consistent with studies that highlight tax managers' crucial role in tax planning (Armstrong et al. 2012, Feller and Schanz 2017, Belnap et al. 2024, Li and Okafor 2024) and the board's role in tax risk management (Donohoe et al. 2014, Armstrong et al. 2015, Beasley et al. 2021, Brühne and Schanz 2022, Blaufus et al. 2023). Providing a unifying theory that considers all dimensions of tax planning costs as conceptualized by Wilde and Wilson (2018), I show that corporate tax planning is a consequence of tax enforcement and its distinct instruments (Hoopes et al. 2012, Ayers et al. 2019, Nessa et al. 2020, Eberhartinger et al. 2022, De Simone et al. 2023, Reineke et al. 2025).

2. Model

2.1. Model setup

I employ an economic model with a board of directors (it), a tax manager (he), and a strategic tax auditor (she), all of whom are risk neutral. The board oversees and manages the firm's overall activities. I focus on its role in overseeing and managing the tax manager's tax planning and reporting. The firm consists of a deterministic after-tax income $\mu > 0$ from other economic

[6]Formally, the internal control literature focuses on interior quality levels (see also Pae and Yoo 2001, Patterson and Smith 2007 and Gao and Zhang 2019). A notable exception is Schantl and Wagenhofer (2021), where a manager's investment in internal controls can involve a minimum quality, depending on regulatory standards. Unlike their paper, I focus on strategic tax enforcement and its role for voluntary TCF investment.

[7]In most studies analyzing financial misreporting, enforcement is a random technology (Laux and Stocken 2018, Ewert and Wagenhofer 2019, Schantl and Wagenhofer 2025), with Schantl and Wagenhofer (2020) being a notable exception studying a strategic regulatory enforcer.

activities and a representative uncertain tax position, resulting in a low or high tax liability $T \in \{T_L = 0, T_H\}$ with equal prior probability $\Pr(0) = \Pr(T_H) = 1/2$, and $T_H > 0$.[8] Like in Sansing (1993) and McClure (2023), the joint distribution of μ and T is assumed to be arbitrary.

An "uncertain tax position" refers to a tax position whose assessment is subject to interpretation, where it is unclear from observing this position in the tax return how it should be assessed (De Simone et al. 2013). The tax liability T would reflect the auditor's assessment after an in-depth audit, which I refer to as the benchmark tax (similarly, see Martini et al. 2025). The benchmark tax differs from the true tax, which would be ultimately identified through adjudication, and captures that there is a wide range of legal tax liabilities.[9] Typical examples include uncertainty about whether an expense qualifies for a tax credit or the deductibility of a tax expense (Sansing 1993, Mills et al. 2010, De Waegenaere et al. 2015) and which transfer pricing methods should be applied in an income shifting context, resulting in two point estimates (Reineke et al. 2023). For expositional convenience, I only focus on the tax consequences of the uncertain tax position reflected in T.[10]

Tax planning and investment in a TCF. At time $t = 2$, the tax manager receives a private signal $\tau \in \{\tau_L = 0, \tau_H\}$ about the benchmark tax. For simplicity, the signal is assumed to be perfect (i.e., $\tau = T$). The tax manager must file a tax return, in which he reports the tax $r \in \{r_L = 0, r_H\}$ to the tax auditor. If $\tau = 0$, the tax manager can be sure that a report $r_L = 0$ will be accepted by the auditor. Thus, he reports $r_L = 0$ at time $t = 3$, with the associated cost being normalized to zero. However, if $\tau = \tau_H$, the tax manager may choose an unobservable tax planning effort $a \in (0, 1)$, which increases the probability that a risky tax planning strategy is

[8] Considering a representative uncertain tax position is for ease of exposition. Typically, there are several tax positions that must be filed via the tax return (Rhoades 1999, De Simone et al. 2013, McClure 2023). An alternative interpretation would be that the firm possesses strong facts $T_L = 0$ (a risk-free tax planning opportunity) or weak facts T_H (a risky tax planning opportunity) when claiming the uncertain tax position.

[9] The setting includes aggressive tax planning but excludes tax evasion. In addition, to avoid an overly complex model, I assume that the tax manager does not challenge a tax auditor's audit adjustment to the benchmark tax if a risky tax planning strategy has been implemented. Analyses of an additional dispute stage can be found, for example, in Jung (1995), Dyck et al. (2025) and Martini et al. (2025).

[10] Other studies explicitly consider how pre-tax income or earnings are generated, either before or simultaneously with the tax planning decision. In Jacob et al. (2019), pre-tax earnings are the uncertain realization of a productive effort by the CEO, while in Reineke et al. (2025), pre-tax income is the realization of a risky investment. With respect to these studies, my setting more adequately reflects scenarios where the generation of earnings precedes tax planning (Chen and Chu 2005, Crocker and Slemrod 2005, Jacob et al. 2019).

implemented.[11] This implementation involves a tax report $r_L = 0 < \tau_H$, in which case the tax manager obtains a utility benefit normalized to 1. The tax planning effort is privately costly to the tax manager and involves tax planning implementation costs $a^2/2$. These costs include, for example, preparing documentation and convincing the board or other tax compliance employees (Feller and Schanz 2017, Wilde and Wilson 2018, Reineke et al. 2025). Personal costs from an uncovered risky tax planning strategy are explicitly considered below.

Reasons for the tax manager's objective may include a (personal) preference for meeting a targeted low effective tax rate (Armstrong et al. 2012), the tax department being structured as a profit center (Robinson et al. 2010), or reputational concerns arising from the labor market (Li and Okafor 2024). I treat the tax manager's objective as given and focus on the board's TCF investment to manage tax risks on behalf of the firm.[12] This comports with studies highlighting tax actors' personal incentives beyond performance-based contracts (Kohlhase and Wielhouwer 2023, Li and Okafor 2024) and the resulting obstacles of these contracts (Li and Okafor 2024).

The TCF serves as a tool through which the board can set the tone at the top for tax risk management (Brühne and Schanz 2022, Blaufus et al. 2023), thereby guiding corporate tax planning toward the desired tax risk level (Armstrong et al. 2015). The board invests in the TCF with quality $q \in [0, 1)$ upfront at time $t = 1$, where the TCF proportionally reduces the

[11] If the tax manager's signal is about the current (future) tax liability, he chooses an ex post (ex ante) tax planning effort as defined by Feller and Schanz (2017). Therefore, I more generally use the term "tax planning effort" with the limitation that ex ante tax planning is rejected, for example, due to lack of economic substance, while there are indeed ex ante tax planning strategies that are not rejected and thus lead to lower tax rates in the long run (Dyreng et al. 2008, Gallemore and Labro 2015, Christensen et al. 2022). Alternatively, one could consider the implementation of a tax planning strategy and an unobservable effort to sustain the strategy separately (Reineke et al. 2025). This would more closely relate to a hidden action instead of hidden information game in the spirit of Shibano (1990). However, to make the function of a TCF as clear as possible and to avoid making unclear assumptions about how the TCF affects the tax planning effort and the tax auditor's benefit of uncovering a tax planning strategy, my model design choice is more adequate.

[12] Studies that explicitly analyze the role of performance contracts in tax planning or minimization include Chen and Chu (2005), Crocker and Slemrod (2005), and Jacob et al. (2019). However, these studies neglect other important features that influence corporate tax outcomes, such as strategic tax auditing decisions and the role of TCFs. Further, my approach resembles accounting settings that study the role of internal controls, given managers' exogenous manipulation incentives (e.g., Schantl and Wagenhofer 2025). While I acknowledge that there may be interactions between performance-based pay and oversight via internal controls (e.g., Laux 2010, Kräkel and Schöttner 2024), my model reveals the maximum effect controls might have in a tax setting.

probability of the implementation of a risky tax planning strategy:

$$\Pr(r_L = 0|\tau_H) = (1-q)a. \tag{1}$$

TCF quality q is observed by the tax manager, but is unobservable to the tax auditor. For example, the board may establish a tax risk reporting line, through which it is informed about tax planning strategies and tax risks at regular intervals (Brühne and Schanz 2022, Blaufus et al. 2023). It might also explicitly assign tax compliance responsibilities to other tax employees (Brühne and Schanz 2022, Dyck et al. 2025), who internally monitor tax planning strategies. The board's main incentive for TCF investment comes from managing the expected corporate costs and penalties from an uncovered risky tax planning strategy, which are also considered below. For expositional convenience only, the board is assumed to be benevolent.[13]

Establishing and maintaining the TCF is costly to the board, which considers costs $q^2/4$. The costs include opportunity costs of participating in tax risk meetings and costs for hiring tax consultants to implement the TCF and guarantee its effectiveness. Importantly and unique to the tax setting, a tax manager's planning effort may benefit the board if the risky planning strategy is implemented and persists after the audit decision (e.g., Hoopes et al. 2012). Hence, a minimum TCF investment to facilitate risky tax planning (i.e., $q^* = 0$) might be optimal for the board, depending on the characteristics of the enforcement environment.

Audit decision. At time $t = 4$, the tax auditor observes the tax report r, as in traditional strategic tax audit settings (e.g., Blaufus et al. 2024). In addition, she receives a noisy signal y about the benchmark tax T from the tax audit technology. The signal may be the output of comprehensive analyses of past tax return data through IT tools (Eberhartinger et al. 2022, OECD 2023), information exchange agreements among tax authorities (e.g., Casi et al. 2020), or financial statement information used by sophisticated tax authorities (Mills et al. 2010, Bozanic et al. 2017). I formalize the signal similar to Schantl and Wagenhofer (2020) and Sansing

[13]Generally, the model is agnostic about whether the board is benevolent or considers additional personal incentives in the TCF investment decision. In the former case, the board's expected utility equals firm value. In the latter case, the board's expected utility captures personal costs from risky tax planning and effort costs.

(1993) as $y = \eta T + \varepsilon$. ε is a standard normally distributed error term, that is, $\varepsilon \sim N(0,1)$, with probability density function $f(\varepsilon)$ and cumulative distribution function $F(\varepsilon)$. I interpret a higher η as enhanced quality of the tax audit technology, because a higher η allows the tax auditor to better identify whether the signal was obtained from a low or high benchmark tax. While the signal y is only observed by the auditor, its existence and properties and the date it emerges are common knowledge.[14]

Upon observing r and y, the tax auditor decides whether to conduct an in-depth audit of the uncertain tax position. If she audits, she perfectly reveals and enforces T at time $t = 5$.[15] In particular, her incentive to audit arises from receiving a personal benefit $b > 0$ if she uncovers a risky tax planning strategy $r_L = 0 < T_H$. This is because, typically, tax auditors are evaluated based on the additional tax revenue they generate (Blaufus et al. 2024, Blaufus et al. 2025). An audit involves (opportunity) costs $c \in (0,b)$, which might vary significantly across jurisdictions, depending on, for example, the total amount of enforcement staff in an agency (Nessa et al. 2020, Kobilov 2025). As the number of enforcement staff increases, an individual tax auditor is responsible for less firms, all else equal, decreasing her opportunity cost of auditing. In case the tax auditor does not audit, she accepts the tax report, which comports with similar (tax) audit settings (e.g., Ewert and Wagenhofer 2019, Blaufus et al. 2024). As I show later, her audit decision is a threshold decision in which she audits if the signal y exceeds a threshold $\rho \in (-\infty, \infty)$ and does not audit otherwise.

If the auditor uncovers a risky tax planning strategy, the tax manager and the board incur additional enforcement-related costs and penalties. For the tax manager, the penalty $k^M \in (0,1)$ includes future compliance costs from correcting the tax return or unfavorable career outcomes, such as turnover while working in the firm or longer employment gaps after exiting the firm (Li and Okafor 2024). For the board, the costs from an uncovered risky tax planning strategy are

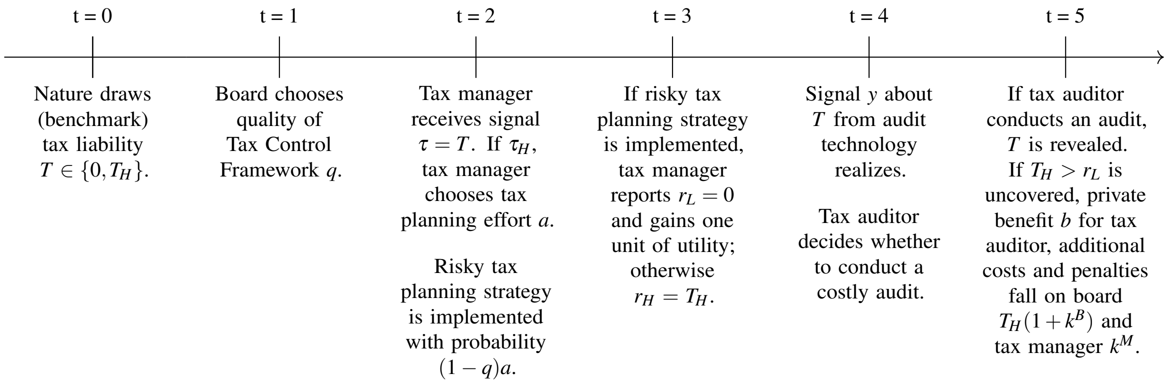
[14] It is reasonable to assume that corporate taxpayers know the average quality η of the tax audit technology. This knowledge can come from previous audits, consulting tax advisors, or the expertise within the corporate tax department. In addition, there are tax authorities that are transparent regarding (parts of) their audit technology (Eberhartinger et al. 2022).

[15] The model could be extended to allow for a perfect revelation but imperfect enforcement of T, reflecting that implemented risky tax planning strategies can be sustained with positive probability. However, the effect of this modeling choice can be similarly observed in a reduction of board penalties k^B.

twofold. First, the firm has to pay the owed tax liability T_H, which decreases its after-tax income. Second, the board incurs a further penalty $k^B(T_H - T_L) = k^B T_H$, which proportionally increases in the size of the tax planning strategy. $k^B > 0$ captures all firm-specific extra costs, such as interest or penalty payments associated with the repayment of the tax liability, reputational costs, consumer backlash, administrative costs from preparing restatements, or legal liability associated with non-compliance (Graham et al. 2014, Jacob et al. 2019, Neuman et al. 2020, Brühne and Schanz 2022, Reineke et al. 2025). k^B thus captures the heterogeneity in firm-level tax planning costs identified in the literature (Wilde and Wilson 2018).

Figure 1 summarizes the sequence of events.

Figure 1. Timeline



2.2. Discussion of assumptions

2.2.1. Tax audit technology

The tax audit technology generates a random signal y drawn from a normal distribution; that is, $y \sim N(\eta T, 1)$, where $\eta > 0$ captures the quality of the audit technology. Modeling the tax audit technology in this way has three benefits. First, the tax auditor's audit decision becomes a threshold decision, where she bases the decision on the received evidence. The tax audit technology either produces a "red flag" (i.e., $y > \rho$) or a "green flag" (i.e., $y \leq \rho$), which comports with information-based audit decisions that account for auditors' personal verification (Sansing 1993, Eberhartinger et al. 2022, Kobilov 2025). Second, the normal distribution has the appealing characteristic that it has identical support for the low and high benchmark tax and that it exhibits the Monotone Likelihood Ratio Property. Due to the continuous distribution, a unique audit threshold determines the audit decision.[16] Third, in line with Sansing (1993), I assume that enhanced audit technology quality (increase in η) is reflected in a mean-shift of the normal distribution. This modeling choice has the intuitive feature that, holding ρ fixed (nonstrategic tax auditor), an increase in η unambiguously increases the audit probability of a risky tax planning strategy; that is, $\frac{\partial(1-F(\rho-\eta T_H))}{\partial\eta} > 0$. Alternatively, enhanced audit technology could reduce the variance of normally distributed signals (Patterson 1993).[17] However, the mean-shift better reflects the purpose of these technologies, which target risky strategies and thus improve discrimination of tax liabilities rather than estimating exact tax liabilities.

2.2.2. Sequence of events

Like other internal control settings, the board establishes a TCF before the tax manager decides on his tax planning effort. This assumption reflects that the TCF is typically designed as a preventive tool to manage tax risks. If the board establishes the TCF simultaneously with the tax manager's planning effort, the same equilibrium remains. If the TCF were designed after the tax manager's planning effort, the board's posterior belief and thus TCF quality decision would be based on a preliminary tax planning report, which resembles other settings with multiple monitors (e.g., Ewert and Wagenhofer 2019, Schantl and Wagenhofer 2020). However, this sequence of events would not adequately reflect the purpose of a TCF.

2.2.3. Information and probability structure

I assume that the tax manager's information about the benchmark tax is perfect ($\tau = T$). Alternatively, suppose that the tax manager's information is correct with probability $\Pr(\tau_H|T_H) = \Pr(\tau_L|T_L) = \alpha \in (1/2, 1]$, and the TCF can only identify whether the tax report comports with

[16] Sansing (1993) considers a logistic distribution with location parameter ηT and scale parameter 1. I use the familiar normal distribution with continuous support, which has been used in the audit literature (e.g., Newman and Noel 1989, Patterson 1993) and more recently by Schantl and Wagenhofer (2020). For a more general characterization of audit technologies inducing a unique audit threshold, see Shibano (1990).

[17] This modeling choice would create a less intuitive, ambiguous effect on this audit probability in addition to the prevailing ambiguous impact on the posterior likelihood of auditing $\Pr(T_H|0, \rho; a, q)$.

the tax manager's private information. In that case, the tax manager would still benefit only from choosing a tax planning effort if the signal is τ_H. Further, the penalties from revealed risky tax planning k^M and k^B would be incurred with probability $\alpha(1 - F(\rho - \eta T_H))$, which increases with α. This assumption would weaken the enforcement effect on tax planning and the external incentive effect for TCF investment, extending the range in which a lenient enforcement environment is obtained. The tax auditor's audit decision remains a threshold decision, where her benefit of conducting an audit of r_L decreases with the tax manager's uncertainty: $\frac{\partial \Pr(T_H|0,\rho;a,q)}{\partial \alpha} > 0$. While the players' equilibrium strategies depend on α, the fundamental relation of the equilibrium strategies on each other nevertheless persists.

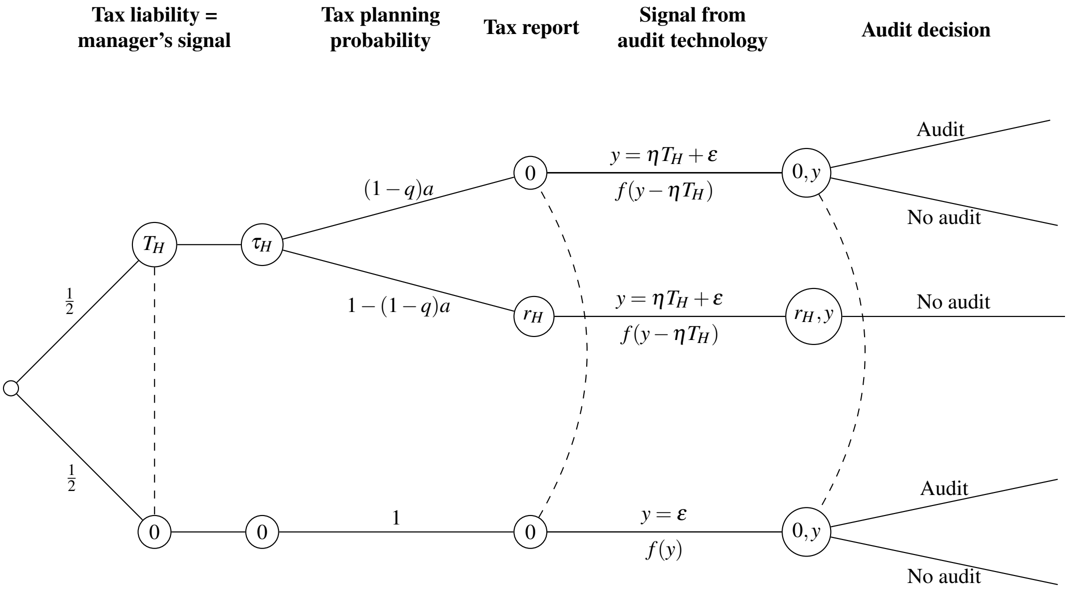
Further, I assume that the low and high tax occur with equal probability (i.e., $\Pr(T_L) = \Pr(T_H) = 1/2$). Assuming otherwise would affect the players' equilibrium strategies similar to the explained effects of a tax manager's imperfect private information α, and is also used in other internal control settings (e.g., Schantl and Wagenhofer 2025).

3. Equilibrium

In this section, I establish the equilibrium to examine how strengthening tax enforcement and improving tax audit technology affect the equilibrium behavior, namely TCF investment, tax planning effort, and the audit decision. Figure 2 depicts a reduced game tree without dominated strategies, in which the board's TCF investment q and tax manager's planning effort a are summarized into the probability that a risky tax planning strategy is implemented.

The equilibrium is defined as follows.

Figure 2. Reduced game tree without dominated strategies



Definition. *An equilibrium consists of the board's investment in the TCF* $q \in [0,1)$, *the tax manager's tax planning effort* $a \in (0,1)$, *and the tax auditor's audit threshold* $\rho \in (-\infty,\infty)$, *such that:*

i) The board chooses q to maximize its expected utility, consisting of the expected tax payments, the expected costs and penalties of an uncovered risky tax planning strategy, and the costs of TCF investment, given rational conjectures of the tax manager's planning effort $\hat{a}$ *and the tax auditor's audit threshold* $\hat{\rho}$.

ii) Conditional on τ, *the tax manager chooses a to maximize his expected utility, consisting of the expected personal benefit from an implemented risky tax planning strategy, the expected penalty from an uncovered risky strategy, and the tax planning costs, given the board's TCF investment q and rational conjectures of the auditor's audit threshold* $\hat{\rho}$.

iii) Conditional on r and y, the tax auditor conducts an in-depth audit of the uncertain tax position if her conditionally expected personal benefit of uncovering a risky tax planning strategy exceeds her audit cost, given rational conjectures of the board's TCF investment $\hat{q}$ *and the tax manager's planning effort* $\hat{a}$.

All players' strategies depend on the conjectures of how the other players behave in equilibrium, which is indicated by a hat on the decision variables. The game is solved by backward induction, starting with the tax auditor's audit decision, then determining the tax manager's tax planning effort, and finally the board's investment in the TCF. All formal proofs are given in the Appendix.

3.1. Tax auditor's audit decision

The tax auditor never audits when the tax manager reports r_H, because she obtains a personal benefit $b > c$ only from uncovering a risky tax planning strategy (i.e., tax manager reports r_L but $T = T_H$). However, upon observing $r_L = 0$ and the signal y from the tax audit technology, she updates her belief about uncovering a risky tax planning strategy. Conjecturing the board's TCF investment $\hat{q}$ and the tax manager's planning effort $\hat{a}$, an audit is beneficial if

$$\Pr\left(T_H | 0, y; \hat{a}, \hat{q}\right) b = \frac{(1-\hat{q})\hat{a} f(y-\eta T_H)}{(1-\hat{q})\hat{a} f(y-\eta T_H) + f(y)} b \geq c. \tag{2}$$

As mentioned above, the tax auditor's audit decision is a threshold decision, which can be seen from how $\Pr\left(T_H | 0, y; \hat{a}, \hat{q}\right)$ changes with respect to y.

Lemma 1. $\Pr\left(T_H | 0, y; \hat{a}, \hat{q}\right)$ *strictly increases in* y *for any* $\hat{q} \in [0,1)$ *and* $\hat{a} \in (0,1)$.

The result in Lemma 1 is due to the Monotone Likelihood Ratio Property and resembles how the threshold decision is obtained in Sansing (1993) and Schantl and Wagenhofer (2020). Intuitively, it means that a higher signal y is more indicative of $T_H > 0$ than of $T_L = 0$, conditional on that $r_L = 0$ was reported. The threshold value $\rho \in (-\infty, \infty)$ is implicitly given by

$$\frac{(1-\hat{q})\hat{a} f(\rho-\eta T_H)}{(1-\hat{q})\hat{a} f(\rho-\eta T_H) + f(\rho)} b = c. \tag{3}$$

Thus, the tax auditor audits tax report $r_L = 0$ if $y > \rho$ and does not audit if $y \leq \rho$. Due to the assumption $c \in (0,b)$, there always exists an interior solution for ρ for any $\hat{a} \in (0,1)$ and $\hat{q} \in [0,1)$. Also, in line with intuition, the probability of uncovering a risky tax planning strategy

$\Pr(T_H|0,y;\hat{a},\hat{q})$ increases with $\hat{a}$ and decreases with $\hat{q}$. The latter insight seems to accord with regulatory proposals encouraging firms to improve their TCF (OECD 2016, Eberhartinger and Zieser 2021, Siglé et al. 2024). However, these proposals neglect two important aspects that this study illuminates. First, the characteristics of the tax enforcement environment drive the decision to invest in the TCF. Second, the audit decision is influenced by the indirect effects of an investment in the TCF and the tax planning effort on the conditional probability of uncovering a risky tax planning strategy. Both aspects are crucial for an overall assessment of these regulatory proposals and other instruments aimed at improving tax audit efficiency.

3.2. Tax manager's tax planning effort

The tax manager always reports $r_L = 0$ if his signal indicates a low benchmark tax $\tau_L = 0$. If his signal is τ_H, he has a tax planning incentive and can obtain one unit of utility if the risky tax planning strategy is implemented, which occurs with probability $(1-q)\,a$. However, if the risky strategy is implemented and the tax auditor audits, the tax manager incurs a penalty $k^M \in (0,1)$, which occurs with conjectured probability $(1-q)\,a\,(1-F(\hat{\rho}-\eta T_H))$. Overall, conditional on τ_H, the tax manager chooses the optimal tax planning effort solving:

$$\max_a \,(1-q)a-(1-q)a\,(1-F(\hat{\rho}-\eta T_H))\,k^M - a^2/2\,. \tag{4}$$

The tax manager's optimal tax planning effort is thus

$$a = (1-q)(1-(1-F(\hat{\rho}-\eta T_H))\,k^M). \tag{5}$$

Observe that the upper bound for k^M ensures that the optimal tax planning effort is always interior. Holding $\hat{\rho}$ fixed, the tax planning effort decreases in q, since an enhanced TCF decreases the likelihood that a risky tax planning strategy is implemented. I refer to this as the internal control effect on tax planning. In addition, holding q fixed, the tax planning effort decreases with the audit probability of a risky tax planning strategy, which I subsequently refer to as the enforcement effect on tax planning. Policymakers typically focus on how policy instruments affect the enforcement effect on tax planning without considering the internal control effect. I scrutinize this additional interaction.

3.3. Board's investment in the Tax Control Framework

Given the board's ex ante information about the benchmark tax and conjecturing the tax planning effort $\hat{a}$ and the audit threshold $\hat{\rho}$, the board maximizes its expected utility by choosing the optimal quality of the TCF q. An increase in the TCF quality decreases the probability that a risky tax planning strategy is implemented. This results in an increase in expected tax payments and respectively decreases the board's expected utility, because an implemented risky tax planning strategy which remains unaudited improves the firm's financial performance. This disadvantage of increasing the TCF quality is reflected in $\frac{1}{2}\left(1-(1-q)\,\hat{a}\right)T_H$. However, a higher quality TCF has the advantage that it decreases the expected corporate costs and penalties from an uncovered risky tax planning strategy, which is reflected in $\frac{1}{2}(1-q)\,\hat{a}\left(1-F\left(\hat{\rho}-\eta T_H\right)\right)T_H\left(1+k^B\right)$. This trade-off emphasizes the well-known notion that tax planning has costs and benefits (e.g., Armstrong et al. 2015) and that the board uses the TCF to manage tax risk (Brühne and Schanz 2022, Blaufus et al. 2023). Overall, the board solves

$$\max_{q}\ \mu-\frac{1}{2}T_H\left((1-(1-q)\hat{a})+(1-F(\hat{\rho}-\eta T_H))(1-q)\hat{a}(1+k^B)\right)-q^2/4. \tag{6}$$

The board's optimal investment is thus

$$q=\max\left\{0,T_H\hat{a}\left(\left(1-F(\hat{\rho}-\eta T_H)\right)\left(1+k^B\right)-1\right)\right\}. \tag{7}$$

For an investment in the TCF to occur (i.e., $q>0$), the board's expected benefit from risky tax planning needs to be sufficiently low compared to the expected costs and penalties, so that $\left(1-F\left(\hat{\rho}-\eta T_H\right)\right)\left(1+k^B\right)-1>0$. Only then will the tax planning effort and the resulting tax risk exceed the level the board will accept. The next observation emphasizes the importance of this condition for the board's investment in the TCF.

Observation. *The board invests in the TCF if* $\left(1-F\left(\hat{\rho}-\eta T_H\right)\right)\left(1+k^B\right)-1\equiv\omega\left(\hat{\rho}\right)>0$.

The observation can be observed straightforwardly from equation (7). It implies that two firms facing an identical enforcement environment, represented by the audit probability of a risky tax planning strategy $1-F(\hat{\rho}-\eta T_H)$, can have heterogeneous TCF investments due to the heterogeneity in the firm-specific costs of uncovered tax planning k^B. When $\omega(\hat{\rho})>0$, observe that, holding $\hat{a}$ fixed, a higher audit probability incentivizes more TCF investment. I will refer to this as the external incentive effect on TCF investment. Further, holding $\hat{\rho}$ fixed, a higher tax planning effort $\hat{a}$ also increases the board's TCF investment. I will refer to this as the internal incentive effect. Conversely, if $\omega(\hat{\rho})\leq 0$, the board would select a minimum quality for the TCF (i.e., $q=0$) to facilitate risky tax planning effort by the tax manager.

3.4. Unique equilibrium

Next I establish the properties of the equilibrium. The theorem states the optimal strategies, enforcing all conjectures ($\hat{q}=q, \hat{a}=a, \hat{\rho}=\rho$).

Theorem 1. *When the tax enforcement environment is lenient with* $\omega(\rho^*)\leq 0$ *or strict with* $\omega(\rho^*)>0$ *and* $k^B\leq \overline{\overline{k}}^B$*, the equilibrium entails the following strategies.*

i) The board invests in the TCF with quality

$$q^*=\begin{cases} 0, & \omega(\rho^*)\leq 0 \\ \frac{T_H\gamma(\rho^*)\omega(\rho^*)}{1+T_H\gamma(\rho^*)\omega(\rho^*)}, & \omega(\rho^*)>0. \end{cases}$$

ii) Conditional on τ_H*, the tax manager chooses a tax planning effort*

$$a^*=\begin{cases} \gamma(\rho^*), & \omega(\rho^*)\leq 0 \\ \frac{\gamma(\rho^*)}{1+T_H\gamma(\rho^*)\omega(\rho^*)}, & \omega(\rho^*)>0. \end{cases}$$

iii) If the tax auditor observes r_H in the tax return, she does not audit. Otherwise she audits if $y > \rho^*$, where $\rho^* \in (-\infty, \infty)$ is implicitly defined by

$$0 = \begin{cases} \frac{1}{1+\frac{1}{\gamma(\rho^*)}\frac{f(\rho^*)}{f(\rho^*-\eta T_H)}} b - c, & \omega(\rho^*) \leq 0 \\ \frac{1}{1+\frac{[1+T_H\gamma(\rho^*)\omega(\rho^*)]^2}{\gamma(\rho^*)}\frac{f(\rho^*)}{f(\rho^*-\eta T_H)}} b - c, & \omega(\rho^*) > 0. \end{cases}$$

The terms used in the theorem are defined as

$$\omega(\rho^*) \equiv (1 - F(\rho^* - \eta T_H))(1 + k^B) - 1,$$

$$\gamma(\rho^*) \equiv 1 - (1 - F(\rho^* - \eta T_H)) k^M,$$

$$\overline{\overline{k}}^B \equiv \frac{1 + T_H \gamma(\rho^*) F(\rho^* - \eta T_H)}{T_H \gamma(\rho^*) [1 - F(\rho^* - \eta T_H)]}.$$

Theorem 1 shows that the equilibrium crucially depends on whether the board has an incentive to invest in the TCF. When the enforcement environment is lenient (strict), this induces a minimum TCF investment $q = 0$ (a positive TCF investment $q > 0$). The upper bound on the penalties $\overline{\overline{k}}^B$ reasonably describes a setting of risky legal tax planning rather than illegal tax evasion, and ensures a unique solution in the strict enforcement environment.

The strength of tax enforcement, captured in the tax auditor's opportunity cost of an audit c, directly influences $\omega(\rho^*)$ and thus has an important role for which enforcement environment applies. Suppose for example that c is exorbitantly high ($c \to b$). Then auditing never occurs ($F(\rho^* - \eta T_H) \to 1$), and the board has no incentive to invest more than the minimum quality, independent of the size of k^B, as long as k^B is finite. Likewise, suppose that auditing is costless ($c \to 0$), and thus the auditor would always audit a low report ($F(\rho^* - \eta T_H) \to 0$). Then, even if k^B is very small, the board would invest in the TCF. Thus, there always exists a critical value $\bar{c}_\omega \in (0, b)$ for any finite k^B that induces a change in the enforcement environment. The following lemma summarizes the result.

Lemma 2. *For any finite* $k^B > 0$*, there exists a threshold value* $\overline{c}_\omega \in (0, b)$*, such that, if* $c \geq \overline{c}_\omega$*, the enforcement environment is lenient, and if* $c < \overline{c}_\omega$*, the enforcement environment is strict.* $\overline{c}_\omega$ *is implicitly defined by* $\omega(\rho^*(\overline{c}_\omega)) = 0$ *and strictly increases in* k^B*.*

Lemma 2 implies that regulators can create an environment for any firm where the board invests in the TCF by, for example, increasing the amount or expertise of enforcement personnel and thus reducing a tax auditor's audit cost c. This result comports with recent survey and empirical evidence (Blaufus et al. 2023, EY 2023), which describes that tax audits are perceived as more aggressive and boards react by investing in the firm's TCF.

From a policymaker perspective, it is essential to understand how strengthening tax enforcement and enhancing the quality of tax audit technology affect the equilibrium strategies and important economic outcomes. The outcomes I consider are the corporate tax planning probability CTP, the audit probability of a risky tax planning strategy AP, and the probability of lost tax revenues for the tax authority LTR. These outcomes are given by

$$CTP^* = \frac{1}{2} + \frac{1}{2}(1 - q^*)a^*, \tag{8}$$

$$AP^* = 1 - F(\rho^* - \eta T_H), \tag{9}$$

$$LTR^* = \frac{1}{2}(1 - q^*)a^* F(\rho^* - \eta T_H). \tag{10}$$

As CTP directly depends on the board's TCF quality investment and the tax manager's tax planning effort, it represents an important corporate outcome encompassing risk-free tax planning with probability $\Pr(T_L) = 1/2$ and risky tax planning with probability $\Pr(T_H) = \frac{1}{2}(1 - q^*)a^*$. Further, I interpret AP and LTR as fundamental measures for tax audit efficiency (Blaufus et al. 2024), which directly depend on the tax auditor's audit threshold.

4. Results

4.1. Strengthening tax enforcement

In this section, I show how strengthening tax enforcement affects the equilibrium strategies, which arises when the tax auditor's audit cost c decreases. Policymakers can achieve decreasing audit costs, for example, by employing additional enforcement staff or increasing the expertise of tax auditors through training courses.

Proposition 1. *Strengthening tax enforcement (a decrease of c) has the following effects:*

(i) In a lenient enforcement environment ($c > \overline{c}_\omega$), the board's investment in the TCF is unaffected. In a strict enforcement environment ($c < \overline{c}_\omega$), there exist threshold values $\overline{k}^M \in (1/2, 1)$ and $\overline{c}_c^q \in (0, \overline{c}_\omega)$ such that:

a) If the tax manager's penalty is small $k^M < \overline{k}^M$, the board's investment in the TCF strictly increases (q^* strictly increases);

b) If the tax manager's penalty is large $k^M > \overline{k}^M$, the investment strictly increases (q^* strictly increases) if the strength of tax enforcement is relatively low ($c > \overline{c}_c^q$), and the investment strictly decreases (q^* strictly decreases) if the strength of tax enforcement is relatively high ($c < \overline{c}_c^q$);

(ii) The tax manager engages in less tax planning (a^* strictly decreases);

(iii) The tax auditor audits the uncertain tax position more often when she observes $r_L = 0$ (ρ^* strictly decreases).

Proposition 1 (ii) and (iii) yield intuitive results. Upon observing $r_L = 0$, the tax auditor audits the uncertain tax position for signals from the audit technology $y \geq \rho^*$. When the audit cost c decreases, her expected benefit of auditing exceeds the costs for more signals, decreasing her required evidence to audit ρ^*. As a result, the audit probability of a risky tax planning strategy and thus the tax manager's expected penalty k^M increases. This enforcement effect unambiguously deters his tax planning effort, independent of whether the internal control effect is muted or not.

The effect of strengthening tax enforcement on TCF investment is more intricate and depends on the enforcement environment. This is visible in the equilibrium condition:

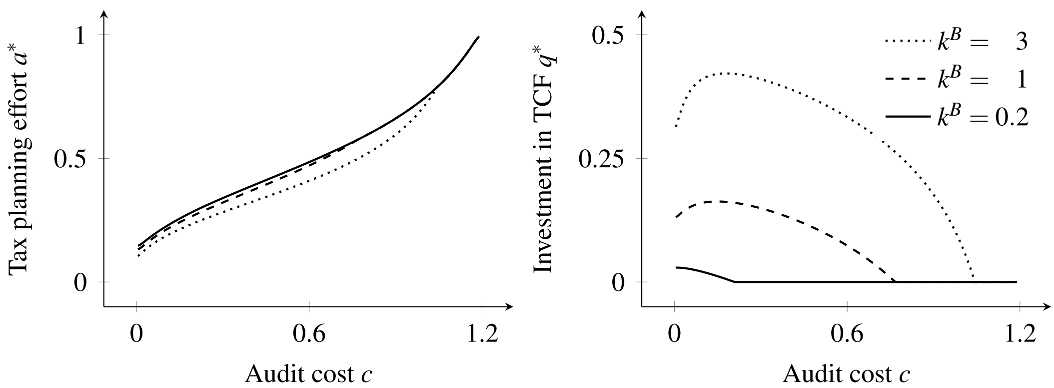
$$q^* = T_H \underbrace{a^*}_{\substack{\text{Internal incentive} \\ \text{effect}}} \underbrace{\left(\left(1 - F\left(\rho^* - \eta T_H\right)\right)\left(1 + k^B\right) - 1\right)}_{\text{External incentive effect}}. \tag{11}$$

Proposition 1 (i) establishes that the board's investment in the TCF remains unaffected in a lenient enforcement environment ($c > \overline{c}_\omega$). The reason is that the external incentive effect is negative, implying that the board wants to facilitate risky tax planning through a minimum TCF quality $q^* = 0$. Even though strengthening tax enforcement also fosters the external incentive effect in a lenient enforcement environment and thus the board's tax planning benefits decrease, the decreasing benefits are yet insufficient to incentivize a TCF investment.

In a strict enforcement environment ($c < \overline{c}_\omega$), the external incentive effect turns positive and induces TCF investment. Two countervailing effects determine the impact of strengthening tax enforcement: First, for a given tax planning effort, the decreasing audit threshold incentivizes the board to manage its tax risk exposure downward through TCF investment (external incentive effect). Second, for a given audit threshold, the decreasing tax planning effort decreases investment incentives, as the tax manager strives to adjust tax planning toward the board's desired level of risk (internal disincentive effect). I identify conditions when either the internal or the external incentive effect dominates. When the enforcement effect on tax planning and thus the internal disincentive effect is sufficiently weak $k^M < \overline{k}^M$, strengthening tax enforcement unambiguously increases the board's TCF investment (Proposition 1 (i) part a)). A necessary condition for the opposite effect on TCF investment is that the internal disincentive effect is sufficiently strong $k^M > \overline{k}^M$ ((i) part b)). Then the relative importance of the internal and external incentive effect additionally depends on the strength of tax enforcement. When the strength of tax enforcement is low in a strict enforcement environment ($\overline{c}_c^q < c < \overline{c}_\omega$), the external incentive effect dominates such that TCF investment increases. In this case, the board's TCF investment (internal enforcement) complements external enforcement via tax audits. When the strength of tax enforcement is relatively high ($c < \bar{c}_c^q$), the internal disincentive effect dominates such that TCF investment decreases. Thus, contrary to regulatory expectations, I identify conditions under which internal enforcement via the TCF and external enforcement are strategic substitutes.

Figure 3 illustrates the results from Proposition 1 for varying levels of board penalties.

Figure 3. Effects of strengthening tax enforcement on tax planning effort and TCF investment



Notes: This figure illustrates Proposition 1 for three different levels of board penalties k^B. The figure shows that a decrease in audit costs c (i.e., strengthening tax enforcement) unambiguously decreases the tax manager's planning effort. Further, for $k^B = 1$ (dashed line) and $k^B = 3$ (dotted line), the board's TCF investment is an inversely U-shaped function in a strict enforcement environment, while for $k^B = 0.2$ (straight line), decreasing audit costs unambiguously increase TCF investment. The figure also demonstrates that higher board penalties increase the domain in which a TCF investment occurs (Lemma 2). The other parameters are chosen as $b = 1.2, k^M = 0.85, T_H = 1, \eta = 1.5$.

4.2. Increasing the quality of the tax audit technology

Next I establish how an increase in the tax audit technology quality η affects the equilibrium strategies. For example, regulators can establish enhanced tax audit technologies by equipping tax authorities with sophisticated IT tools, which process tax information from a variety of sources (e.g., information exchange agreements among tax authorities, financial statement information, private country-by-country reports) to risk-assess firms' tax positions.

Proposition 2. *Increasing the quality of the tax audit technology (an increase of* η*) has the following effects:*

(i) There exist unique threshold values $\overline{k}^M \in (1/2, 1)$ *and* $\overline{c}^a_\eta \in (0, b)$ *such that:*

a) If the tax manager's penalty is small $k^M < \overline{k}^M$*, the board's investment in the TCF increases (*q^* *increases) if the strength of tax enforcement is sufficiently low (*$c > \overline{c}^a_\eta$*), and the investment decreases (*q^* *decreases) if the strength of tax enforcement is sufficiently high (*$c < \overline{c}^a_\eta$*);*

b) If the tax manager's penalty is large $k^M > \overline{k}^M$*, the investment may increase or decrease, independent of the strength of tax enforcement;*

(ii) There exists a unique threshold value $\overline{c}^a_\eta \in (0, b)$ *such that: If the strength of tax enforcement is sufficiently low (*$c > \overline{c}^a_\eta$*), the tax manager engages in less tax planning (*a^* *strictly decreases), or if it is sufficiently high (*$c < \overline{c}^a_\eta$*), he engages in more tax planning (*a^* *strictly increases);*

(iii) There exist threshold values $\underline{c}^\rho_\eta$*,* $\overline{c}^\rho_\eta \in (0, b)$ *with* $\underline{c}^\rho_\eta \leq \overline{c}^\rho_\eta$*, and* $\overline{k}^B_2 > 0$ *such that:*
If the strength of tax enforcement is sufficiently low $(c > \overline{c}^\rho_\eta)$*, the tax auditor audits more often when she observes* $r_L = 0$ *(*ρ^* *strictly decreases), or if the strength is sufficiently high (*$c < \underline{c}^\rho_\eta$*), she audits less often when she observes* $r_L = 0$ *(*ρ^* *strictly increases). For* $k^B < \overline{k}^B_2$*, the strength-dependent threshold is unique (*$\underline{c}^\rho_\eta = \overline{c}^\rho_\eta$*).*

Proposition 2 generally establishes that the effect of tax audit technology quality η is interlinked with the strength of tax enforcement. With regard to the effect on the tax planning effort in (ii), the non-trivial impact of η is independent of the enforcement environment and thus whether the board invests in the TCF or not. To understand this result, observe the equilibrium condition determining the tax planning effort:

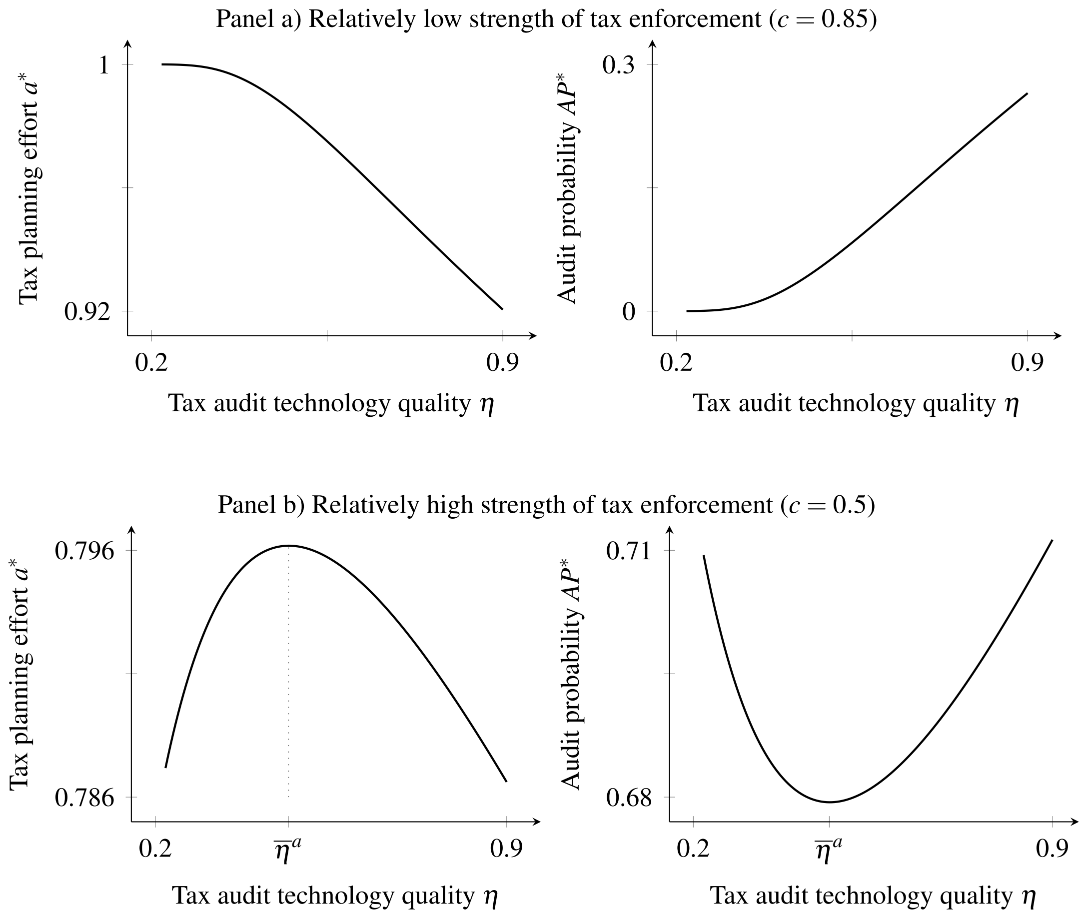
$$a^* = \underbrace{(1-q^*)}_{\text{Internal control effect}} \quad \underbrace{(1-(1-F(\rho^*-\eta T_H))\,k^M)}_{\text{Enforcement effect}}. \tag{12}$$

To begin, let us consider a lenient enforcement environment in which the internal control effect is muted. Then, the enforcement strength-dependent impact of tax audit technology quality η is solely driven by its impact on the enforcement effect. The impact on the enforcement effect can be decomposed into a direct and an indirect effect. First, holding the audit threshold constant (i.e., nonstrategic tax auditor), an increase in η unambiguously increases the tax manager's expected penalty (direct effect), weakening his tax planning incentives. Second, an increase in η also indirectly affects the tax auditor's conditional probability of uncovering a risky tax planning strategy and thus her trade-off between a type I error (auditing a tax position where no risky strategy was implemented $r_L = T_L$) and a type II error (failing to audit a risky strategy $r_L < T_H$). When the strength of tax enforcement is sufficiently low (high), the effect of η on the type II error (type I error) dominates, providing (crowding out) audit incentives. The tax manager rationally anticipates this indirect effect and, in equilibrium, the ambiguous impact prevails and depends on a unique threshold value $\overline{c}_{\eta}^{a}$. Figure 4 demonstrates these effects when the strength of tax enforcement is low (panel a) or high (panel b) in a lenient environment.

In a strict enforcement environment, the tax manager additionally anticipates the impact of η on the internal control effect, while the impact on the enforcement effect is still at work. The internal control effect can also be decomposed into two sub-effects. First, holding the audit threshold ρ fixed, an increase in η directly fosters the external incentive effect and thus the board's TCF investment incentives, which decreases the tax manager's willingness to engage in tax planning. Second, an increase in η has an indirect effect on TCF investment incentives, as the decreasing (increasing) audit threshold translates into increasing (decreasing) TCF investment incentives if the strength of tax enforcement is low (high). Overall, the second sub-effect dominates and induces a board's enforcement strength-dependent equilibrium response, and, via the internal control effect, an enforcement strength-dependent reaction by the tax manager. Strikingly, the unique threshold $\overline{c}_{\eta}^{a}$ captures the nontrivial enforcement and internal control effects simultaneously.

Next, consider the effect of increasing the technology quality η on TCF investment q^* (Proposition 2 (i)). The intuition is similar to the effect of η on the tax planning effort. Two

Figure 4. Effects of tax audit technology quality on tax planning effort and audit probability



Notes: This figure illustrates Proposition 2 (ii). η is restricted to be in the interval $\eta \in (0.2, 0.9)$ to guarantee a lenient enforcement environment when $c = 0.5$. Also, in a lenient environment, observe that we have $a^* = 1 - AP^* \cdot k^M$, highlighting the inverse patterns of tax planning effort a^* and audit probability AP^*. Panel a) shows that an increase in the tax audit technology quality η unambiguously decreases the tax manager's tax planning effort a^* and increases the audit probability AP^* if the strength of tax enforcement is low ($c = 0.85$) in a lenient enforcement environment (i.e., relatively low). Panel b) highlights that tax planning effort increases (audit probability decreases) if the strength of tax enforcement is relatively high ($c = 0.5$) and the status quo tax audit technology quality is low $\eta < \overline{\eta}^a \approx 0.47$ if $c = 0.5$. The upper bound $\overline{\eta}^a$ arises because, for a given strength of tax enforcement, $\overline{c}^a_\eta$ decreases in η (see Corollary 1). The other parameters are chosen as $b = 1.2, k^M = 0.3, T_H = 1, k^B = 0.4 < \underline{k}^B$.

key differences are important. First, the threshold value $\overline{c}_\eta^a$ in part a) represents how η affects the internal and external incentive effect as presented in equation (11). When the internal incentive effect is sufficiently weak (i.e., $k^M \leq \overline{k}^M$), $\overline{c}_\eta^a$ fully captures how the effect of η on q^* is interlinked with the strength of tax enforcement. However, q^* need not *strictly* increase or decrease, as this additionally depends on the enforcement environment (Lemma 2). Depending on the size of board penalties, q^* only *weakly* increases or decreases.[18] Second, when $k^M > \overline{k}^M$, the direction of the enforcement strength-dependent effect can flip, as the internal disincentive becomes more important than the external incentive effect when $c < \overline{c}_c^q$ (Proposition 1, (i)). Then, depending on a jurisdiction's prevailing quality of tax audit technology that also determines $\overline{c}_c^q(\eta)$, an increase of η can (dis-)incentivize TCF investment, independent of the strength of tax enforcement. Figure 5 below numerically illustrates the results.[19]

Audit technology quality η also yields an enforcement strength-dependent impact on the audit threshold ρ^* (Proposition 2 (iii)). Consider low board penalties $k^B < \overline{k}_2^B$, such that $\overline{c}_\omega$ is small (Lemma 2), and the lenient environment obtains for many values $c > \overline{c}_\omega$. Then, the intuition for the enforcement-strength dependent result resembles the one for the tax planning effort in (ii). The difference is, however, that the adverse effect of η on the tax auditor's audit incentives is even stronger, as we have $\overline{c}_\eta^a < \underline{c}_\eta^\rho = \overline{c}_\eta^\rho$. Hence, unlike an increasing tax planning effort, an increasing audit threshold also occurs in situations with $\overline{c}_\eta^a < c < \underline{c}_\eta^\rho = \overline{c}_\eta^\rho$. With high board penalties $k^B > \overline{k}_2^B$, I can only establish a partial result regarding the impact of η, because the TCF investment becomes relatively more important and directly and indirectly affects ρ^*. In any case, ρ^* increases if the strength of tax enforcement is sufficiently high ($c < \underline{c}_\eta^\rho$), and ρ^* decreases if the strength is sufficiently low ($c > \overline{c}_\eta^\rho$). If the strength takes an intermediate value

[18] For example, if $k^B < \underline{k}^B$ ($\underline{k}^B$ is defined in the proof of Proposition 2 for $c > \overline{c}_\omega$), q^* weakly decreases if $c \in (\overline{c}_\omega, \overline{c}_\eta^a)$ and strictly decreases if $c < \overline{c}_\omega$. If $k^B > \underline{k}^B$, q^* strictly increases for $c \in (\overline{c}_\eta^a, \overline{c}_\omega)$ and weakly increases for $\overline{c}_\omega < c$.

[19] The graphs on the left-hand side in Figure 5 particularly illustrate the case $k^M > \overline{k}^M$. Panel a) shows that TCF investment is inversely U-shaped in tax audit technology quality η when the strength of tax enforcement is relatively low. The decreasing part in η particularly occurs because the threshold $\overline{c}_\eta^a$ is a function of η, as will be explained in more detail below. Panel b) shows that TCF investment has both a U-shaped (with a local minimum) and inversely U-shaped part (with a local maximum) in η when the strength of tax enforcement is relatively high. Further numerical simulations suggest that the latter pattern is not generalizable. For example, the local minima in panel b) drop out when plotting q^* for $c = 0.15$, all else equal, leading again to an inversely U-shaped TCF investment function in η.

$\underline{c}_\eta^\rho < c < \overline{c}_\eta^\rho$, the effect on ρ^* cannot be unambiguously identified, but additional simulations suggest that an increase of ρ^* occurs in most feasible situations.

Proposition 2 especially highlights two adverse effects of enhancing tax audit technology quality: an increasing tax planning effort and an increasing audit threshold. The adverse effects occur if the strength of tax enforcement is sufficiently high, and can occur independent of the individual enforcement environment a board with costs k^B faces. In general, a sufficiently high strength of tax enforcement is more likely to be observed in tax authorities of developed as compared to developing countries (Kobilov 2025). Notably, the adverse results obtain for a *marginal* increase in audit technology quality. Due to the model's complexity, the enforcement-strength dependent threshold value $\overline{c}_\eta^a$ also depends on η. The higher the level of η for a given strength of tax enforcement, the lower is the likelihood for a relatively high strength of tax enforcement. Corollary 1 formally establishes the result.

Corollary 1. *If a sufficiently low strength of tax enforcement is given ($c < \overline{c}_\eta^a(\eta)$), an increasing tax planning effort a^* is the result of enhancing low quality tax audit technologies ($\eta < \overline{\eta}^a$). This response is more likely in firms with lower enforcement-related tax planning costs k^B.*

The observation explains the u-shaped functions in Figure 4, panel b). Concerning empirical studies, the observation implies that adverse effects are likely to be observed if the strength of tax enforcement is sufficiently high and if audit technology qualities are additionally poor. Interestingly, I show that this adverse effect is more likely for firms with lower enforcement-related tax planning costs k^B. In empirical studies, these firms are likely to be identified as more "tax aggressive" (De Waegenaere et al. 2015).

4.3. Effects on economic outcomes

Next I examine the implications of strengthening tax enforcement and improving the tax audit technology quality on three economic outcomes: the corporate tax planning probability, the audit probability of a risky tax planning strategy, and the lost tax revenues. Proposition 3 summarizes the results with respect to all economic outcomes.

Proposition 3. *The corporate tax planning probability CTP^*, the audit probability of a risky tax planning strategy AP^*, and the lost tax revenues LTR^*, are affected as follows:*

(i) Strengthening tax enforcement (a decrease of c) decreases the corporate tax planning probability, increases the audit probability of a risky tax planning strategy, and decreases the lost tax revenues;

(ii) There exists a unique threshold value $\overline{c}^a_\eta \in (0,b)$ such that increasing the tax audit technology quality (an increase of η)

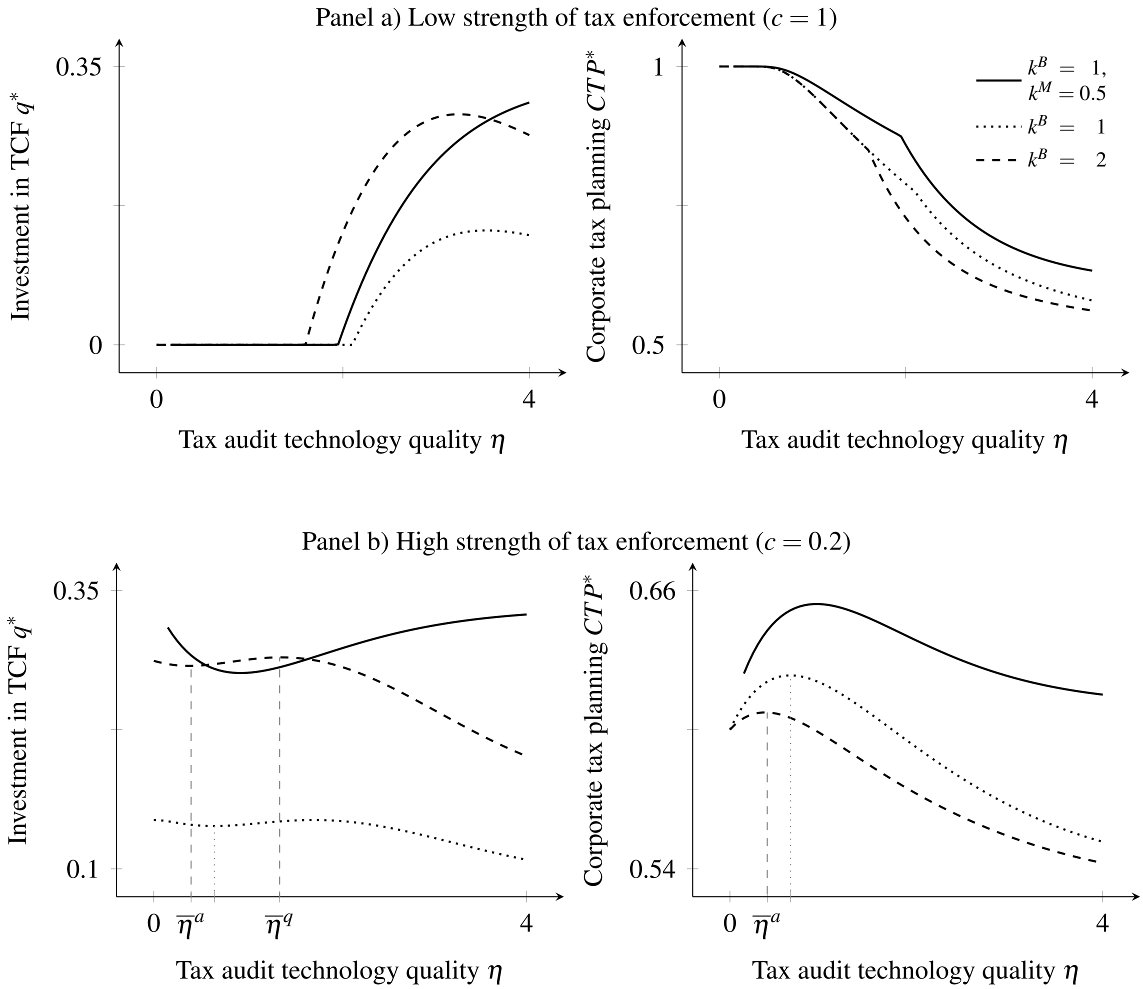
a) decreases the corporate tax planning probability, increases the audit probability of a risky tax planning strategy, and decreases the lost tax revenues if the strength of tax enforcement is sufficiently low ($c > \overline{c}^a_\eta$),

b) increases the corporate tax planning probability, decreases the audit probability of a risky tax planning strategy, and increases the lost tax revenues if the strength of tax enforcement is sufficiently high ($c < \overline{c}^a_\eta$).

Proposition 3 (i) implies that strengthening tax enforcement unambiguously decreases corporate tax planning CTP^*. Although this result is intuitive, the economics are more intricate, as a decreasing tax planning effort and an increasing TCF investment can occur simultaneously and have opposing effects on CTP^* (Proposition 1 (i) and (ii)). My results indicate that the impact on the tax planning effort dominates, such that corporate tax planning decreases. By contrast, Proposition 3 (ii) identifies situations in which corporate tax planning increases when tax audit technology quality η improves, particularly if the strength of tax enforcement is sufficiently high. While the individual effects of η on TCF investment do not follow a straightforward pattern, particularly when $k^M > \overline{k}^M$, I show that the direction of the audit technology's impact follows the same pattern as for the tax manager's planning effort. This result aligns with tax managers' crucial role in corporate tax planning (Feller and Schanz 2017, Belnap et al. 2024). Figure 5 illustrates these insights.

Further, I show that strengthening tax enforcement increases tax audit efficiency (measured by audit probability AP^* and lost tax revenues LTR^*). Both results are intuitive, as, first,

Figure 5. Effects of tax audit technology quality on TCF investment and corporate tax planning



Notes: This figure illustrates Propositions 2 (i) and 3, and Corollary 1. The left graph illustrates the effect of increasing tax audit technology quality η on TCF investment q^*, and the right graph on the corporate tax planning probability CTP^*. The tax manager's planning effort a^* and the lost tax revenues LTR^* (the audit probability of a risky tax planning strategy AP^*) follow the same pattern (follows the inverse pattern) as $CTP^*(\eta)$. The results are illustrated for high tax manager penalties ($k^M = 0.9$) with low ($\underline{k}^B < k^B = 1$, dotted lines) and high board penalties ($k^B = 2$, dashed lines). In addition, the solid line depicts how the low board penalty case changes when $k^M = 0.5 < \overline{k}^M$ is guaranteed. If the strength of tax enforcement is low ($c = 1$, panel a), an increase in η unambiguously decreases CTP^*, and unambiguously increases q^* only for $k^M = 0.5$. For $k^M = 0.9$, q^* first increases and then decreases in η, as at some sufficiently high η, we get $c = 1 < \overline{c}^q_c(\eta)$. If the strength of tax enforcement is high ($c = 0.2$, panel b), CTP^* increases (decreases) for $\eta < \overline{\eta}^a$ ($\eta > \overline{\eta}^a$), with the inverse pattern for q^* only occurring when $k^M = 0.5$. Observe that for $k^B = 1$, the domain for the adverse effect of η is greater ($\overline{\eta}^a|_{k^B=1} > \overline{\eta}^a|_{k^B=2}$), suggesting that the efficacy of this policy instrument is weaker for firms with lower vis-à-vis higher enforcement-induced costs from tax planning. Lastly, for $c = 0.2$ and $k^M = 0.9$, the direction of the effect of η on q^* flips two times, as for $\eta < \overline{\eta}^a$, we have $\overline{c}^a_\eta(\eta) > 0.2 > \overline{c}^q_c(\eta)$, for $\overline{\eta}^a < \eta < \overline{\eta}^q$, we additionally get $0.2 > \overline{c}^a_\eta(\eta)$, and for $\overline{\eta}^q < \eta$, we have $\overline{c}^a_\eta(\eta) > c > \overline{c}^q_c(\eta)$. The other parameters are $b = 1.2$ and $T_H = 1$.

the increasing AP^* is solely determined through the impact on the auditor's audit threshold (Proposition 1 (iii)), and second, the impact on LTR^* is the combined effect of the unambiguous effects on audit probability AP^* and corporate tax planning CTP^*. Proposition 3 (ii) indicates that the impact of increasing the quality of tax audit technology η on both tax audit efficiency measures depends on a unique threshold $\bar{c}^a_\eta$. This result obtains even though the impact of technology quality on the audit threshold cannot be unambiguously identified. Most importantly, the impact on AP^* is uniquely interlinked with the strength of tax enforcement. As LTR^* comprises the combined impact of increasing audit technology quality on AP^* and CTP^*, the economic consequences again depend on enforcement strength-dependent threshold $\bar{c}^a_\eta$.

Two final aspects should be emphasized. First, the key driver for the enforcement strength-dependent efficiency implications is the tax auditor's trade-off between a type I and type II error. While she infers the effects of the quality of tax audit technology on overall corporate tax planning, including TCF investment, the board's TCF investment cannot mitigate the undesirable effects of the quality of tax audit technology for corporate tax planning and tax audit efficiency. Second, internal and external tax enforcement can be strategic substitutes whenever the enforcement effect on tax planning is sufficiently strong ($k^M > \bar{k}^M$). Thus, the increasingly observable TCF investment of firms does not reliably indicate tax audit efficiency.

5. Conclusions

This study investigates strategic interactions between corporate tax planning and tax enforcement. Contrary to previous theoretical models, the model incorporates two important and contemporary features. First, the board of directors can invest in the firm's Tax Control Framework (TCF) to manage tax risks associated with tax planning. Second, tax enforcement decisions are based on additional information from sophisticated tax audit technologies.

I find that a strict tax enforcement environment is necessary to induce TCF investment. Policymakers can create an enforcement environment in which a TCF as an internal enforcement device is voluntarily established by any firm. However, since internal and external enforcement can be strategic substitutes, internal enforcement can be misleading about tax audit efficiency. Further, I show that strengthening tax enforcement by increasing the number of specialized enforcement staff improves tax audit efficiency. Yet this can be challenging (or costly) when skilled enforcement staff is scarce, as seen recently in many countries. My results imply that improvements in tax audit technology are an effective alternative instrument when the strength of tax enforcement is lower, such as in many developing countries. However, especially when the strength of tax enforcement is higher, such as in many developed countries, these improvements increase corporate tax planning and hurt tax audit efficiency, due to a crowding out of audit incentives.

Lastly, I derive empirically testable predictions. First, the effect of strengthening tax enforcement on TCF investment depends on the prevailing strength of tax enforcement: If the prevailing level is low, TCF investment is unaffected. If it is intermediate, investment increases, while if it is high, the firm's and the manager's characteristics determine whether more or less investment occurs. Second, the impact of improvements in audit technologies also depends on the prevailing strength of tax enforcement. If the prevailing level is low, firms' effective tax rates increase. If the level is high, effective tax rates decrease, which should be particularly pronounced for tax-aggressive firms and when audit technologies are also poor.

References

Armstrong, C. S., Blouin, J. L., Jagolinzer, A. D., & Larcker, D. F. (2015). Corporate Governance, Incentives, and Tax Avoidance. *Journal of Accounting and Economics*, *60*(1), 1–17.

Armstrong, C. S., Blouin, J. L., & Larcker, D. F. (2012). The Incentives for Tax Planning. *Journal of Accounting and Economics*, *53*(1-2), 391–411.

Ayers, B. C., Seidman, J. K., & Towery, E. M. (2019). Tax Reporting Behavior Under Audit Certainty. *Contemporary Accounting Research*, *36*(1), 326–358.

Beasley, M. S., Goldman, N. C., Lewellen, C. M., & McAllister, M. (2021). Board Risk Oversight and Corporate Tax-planning Practices. *Journal of Management Accounting Research*, *33*(1), 7–32.

Beck, P. J., & Jung, W.-O. (1989). Taxpayers' Reporting Decisions and Auditing under Information Asymmetry. *The Accounting Review*, *64*(3), 468–487.

Belnap, A., Hoopes, J. L., & Wilde, J. H. (2024). Who Really Matters in Corporate Tax? *Journal of Accounting and Economics*, *77*(1), 101609.

Blaufus, K., Bock, J., Peuthert, B., & Schwäbe, A. N. (2025). The Effect of Individual Tax Auditor Characteristics on Tax Audit Efficiency – Implications for Auditor Training and Allocation. *Journal of the American Taxation Association, forthcoming*, 1–26. https://doi.org/10.2308/JATA-2023-010

Blaufus, K., Reineke, J., & Trenn, I. (2023). Perceived Tax Audit Aggressiveness, Tax Control Frameworks and Tax Planning: An Empirical Analysis. *Journal of Business Economics*, *93*(3), 509–557.

Blaufus, K., Schöndube, J. R., & Wielenberg, S. (2024). Information Sharing between Tax and Statutory Auditors: Implications for Tax Audit Efficiency. *European Accounting Review*, *33*(2), 545–568.

Blaufus, K., & Trenn, I. (2018). Tax Compliance Management–Ergebnisse einer Befragung mittelständischer Unternehmen. *Steuer und Wirtschaft*, *95*(1), 42–59.

Blouin, J. L. (2014). Defining and Measuring Tax Planning Aggressiveness. *National Tax Journal*, *67*(4), 875–899.

Bozanic, Z., Hoopes, J. L., Thornock, J. R., & Williams, B. M. (2017). IRS Attention. *Journal of Accounting Research*, *55*(1), 79–114.

Brühne, A. I., & Schanz, D. (2022). Defining and Managing Corporate Tax Risk: Perceptions of Tax Risk Experts. *Contemporary Accounting Research*, *39*(4), 2861–2902.

Casi, E., Spengel, C., & Stage, B. M. (2020). Cross-border Tax Evasion After the Common Reporting Standard: Game Over? *Journal of Public Economics*, *190*, 104240.

Chen, K.-P., & Chu, C. Y. C. (2005). Internal Control versus External Manipulation: A Model of Corporate Income Tax Evasion. *Rand Journal of Economics*, *36*(1), 151–164.

Christensen, D. M., Kenchington, D. G., & Laux, R. C. (2022). How Do Most Low ETR Firms Avoid Paying Taxes? *Review of Accounting Studies*, *27*(2), 570–606.

Crocker, K. J., & Slemrod, J. (2005). Corporate Tax Evasion with Agency Costs. *Journal of Public Economics*, *89*(9-10), 1593–1610.

De Simone, L., Sansing, R. C., & Seidman, J. K. (2013). When are Enhanced Relationship Tax Compliance Programs Mutually Beneficial? *The Accounting Review*, *88*(6), 1971–1991.

De Simone, L., Stomberg, B., & Williams, B. (2023). Does Tax Enforcement Disparately Affect Domestic versus Multinational Corporations around the World? *Contemporary Accounting Research*, *40*(4), 2816–2845.

De Waegenaere, A., Sansing, R. C., & Wielhouwer, J. L. (2015). Financial Accounting Effects of Tax Aggressiveness: Contracting and Measurement. *Contemporary Accounting Research*, *32*(1), 223–242.

Diller, M., Lorenz, J., Schneider, G., & Sureth-Sloane, C. (2025). Is Tax Transfer Pricing Harmonization a Panacea? Real Effects of Global Tax Transparency and Standards Consistency. *The Accounting Review*, *100*(2), 71–102.

Donohoe, M. P., McGill, G. A., & Outslay, E. (2014). Risky Business: The Prosopography of Corporate Tax Planning. *National Tax Journal*, *67*(4), 851–874.

Dyck, D., Lorenz, J., & Sureth-Sloane, C. (2025). Tax Disputes - The Role of Technology and Controversy Expertise. *TRR 266 Accounting for Transparency Working Paper Series No. 101*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4214449

Dyreng, S. D., Hanlon, M., & Maydew, E. L. (2008). Long-run Corporate Tax Avoidance. *The Accounting Review*, *83*(1), 61–82.

Dyreng, S. D., & Maydew, E. L. (2018). Virtual Issue on Tax Research Published in the Journal of Accounting Research. *Journal of Accounting Research*, *56*(2), 311.

Eberhartinger, E., Safaei, R., Sureth-Sloane, C., & Wu, Y. (2022). Is Risk Profiling in Tax Audit Case Selection Rewarded? An Analysis of Corporate Tax Avoidance. *TRR 266 Accounting for Transparency Working Paper Series No. 60*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3911228

Eberhartinger, E., & Zieser, M. (2021). The Effects of Cooperative Compliance on Firms' Tax Risk, Tax Risk Management and Compliance Costs. *Schmalenbach Journal of Business Research*, *73*(1), 125–178.

Ewert, R., & Wagenhofer, A. (2019). Effects of Increasing Enforcement on Financial Reporting Quality and Audit Quality. *Journal of Accounting Research*, *57*(1), 121–168.

EY. (2023). Why Tax Governance Is Key in an Era of More Tax Risk and Controversy. https://www.ey.com/en_gl/insights/tax/why-tax-governance-is-key-in-an-era-of-more-tax-risk-and-controversy

Feller, A., & Schanz, D. (2017). The Three Hurdles of Tax Planning: How Business Context, Aims of Tax Planning, and Tax Manager Power Affect Tax Expense. *Contemporary Accounting Research*, *34*(1), 494–524.

Gallemore, J., & Labro, E. (2015). The Importance of the Internal Information Environment for Tax Avoidance. *Journal of Accounting and Economics*, *60*(1), 149–167.

Gao, P., & Zhang, G. (2019). Accounting Manipulation, Peer Pressure, and Internal Control. *The Accounting Review*, *94*(1), 127–151.

Graetz, M. J., Reinganum, J. F., & Wilde, L. L. (1986). The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement. *Journal of Law, Economics, & Organization*, *2*(1), 1–32.

Graham, J. R., Hanlon, M., Shevlin, T., & Shroff, N. (2014). Incentives for Tax Planning and Avoidance: Evidence from the Field. *The Accounting Review*, *89*(3), 991–1023.

Hanlon, M., & Heitzman, S. (2010). A Review of Tax Research. *Journal of Accounting and Economics*, *50*(2-3), 127–178.

Heckemeyer, J. H., & Overesch, M. (2017). Multinationals' Profit Response to Tax Differentials: Effect Size and Shifting Channels. *Canadian Journal of Economics/Revue canadienne d'économique*, *50*(4), 965–994.

Hoopes, J. L., Mescall, D., & Pittman, J. A. (2012). Do IRS Audits Deter Corporate Tax Avoidance? *The Accounting Review*, *87*(5), 1603–1639.

Jacob, M., Rohlfing-Bastian, A., & Sandner, K. (2019). Why Do Not All Firms Engage in Tax Avoidance? *Review of Managerial Science*, *15*(2), 459–495.

Joshi, P. (2020). Does Private Country-by-Country Reporting Deter Tax Avoidance and Income Shifting? Evidence from BEPS Action Item 13. *Journal of Accounting Research*, *58*(2), 333–381.

Jung, W.-O. (1995). Tax Litigation, Tax Reporting Game, and Social Costs. *Journal of the American Taxation Association*, *17*(2), 1–19.

Kobilov, B. (2025). Technology-Enabled Enforcement. *UNC Tax Symposium*, *Working Paper (unpublished)*.

Kohlhase, S., & Wielhouwer, J. L. (2023). Tax and Tariff Planning through Transfer Prices: The Role of the Head Office and Business Unit. *Journal of Accounting and Economics*, *75*(2-3), 101568.

KPMG. (2023). Navigating the Global Tax Disputes Landscape. https://kpmg.com/xx/en/our-insights/transformation/navigating-the-global-tax-disputes-landscape.html

Kräkel, M., & Schöttner, A. (2024). Performance Pay, Internal Control, and Corporate Misconduct. *TRR 266 Accounting for Transparency Working Paper Series No. 139*. https://ssrn.com/abstract=4709206

Laux, V. (2010). Effects of Litigation Risk on Board Oversight and CEO Incentive Pay. *Management Science*, *56*(6), 938–948.

Laux, V., & Stocken, P. C. (2018). Accounting Standards, Regulatory Enforcement, and Innovation. *Journal of Accounting and Economics*, *65*(2-3), 221–236.

Li, J., & Okafor, O. N. (2024). Tax Employee Careers and Corporate Tax Outcomes. *European Accounting Review, forthcoming*, 1–26. https://doi.org/10.1080/09638180.2024.2386144

Martini, J. T., Niemann, R., Simons, D., & Voeller, D. (2025). Incentive Effects of Tax Transparency: Does Country-by-Country Reporting Call for Arbitration? *Journal of Accounting and Public Policy*, *49*, 107278.

McClure, C. G. (2023). How Costly is Tax Avoidance? Evidence from Structural Estimation. *The Accounting Review*, *98*(6), 353–380.

Mehboob, D. (2022). US Boosts IRS Budget to Improve IT and Enforcement. *International Tax Review*. https://www.internationaltaxreview.com/article/2ahtk1dkqvhnt3gkwmww0/direct-tax/us-boosts-irs-budget-to-improve-it-and-enforcement

Mills, L. F., Robinson, L. A., & Sansing, R. C. (2010). FIN 48 and Tax Compliance. *The Accounting Review*, *85*(5), 1721–1742.

Nessa, M., Schwab, C. M., Stomberg, B., & Towery, E. M. (2020). How do IRS Resources Affect the Corporate Audit Process? *The Accounting Review*, *95*(2), 311–338.

Neuman, S. S., Omer, T. C., & Schmidt, A. P. (2020). Assessing Tax Risk: Practitioner Perspectives. *Contemporary Accounting Research*, *37*(3), 1788–1827.

Newman, P., & Noel, J. (1989). Error Rates, Detection Rates, and Payoff Functions in Auditing. *Auditing: A Journal of Practice & Theory*, *8*(2), 50–63.

OECD. (2016). Co-operative Tax Compliance: Building Better Tax Control Frameworks, 1–38. https://read.oecd-ilibrary.org/taxation/co-operative-tax-compliance_9789264253384-en#page4

OECD. (2023). Tax Administration 2023: Comparative Information on OECD and other Advanced and Emerging Economies, 1–174. https://www.oecd.org/ctp/tax-administration-23077727.htm

Pae, S., & Yoo, S.-W. (2001). Strategic Interaction in Auditing: An Analysis of Auditors' Legal Liability, Internal Control System Quality, and Audit Effort. *The Accounting Review*, *76*(3), 333–356.

Patterson, E. R. (1993). Strategic Sample Size Choice in Auditing. *Journal of Accounting Research*, *31*(2), 272–293.

Patterson, E. R., & Smith, J. R. (2007). The Effects of Sarbanes-Oxley on Auditing and Internal Control Strength. *The Accounting Review*, *82*(2), 427–455.

Picchi, A. (2024). IRS Says Its Number of Audits Is About to Surge. Here's Who the Agency Is Targeting. https://www.cbsnews.com/detroit/news/irs-plans-audit-increase-who-will-be-targeted/?intcid=CNM-00-10abd1h

Reineke, R., Weiskirchner-Merten, K., & Wielenberg, S. (2023). When Do Firms Use One Set of Books in an International Tax Compliance Game? *Review of Accounting Studies*, *28*(3), 1856–1885.

Reineke, R., Weiskirchner-Merten, K., & Wielenberg, S. (2025). Real Effects of the Enforcement of Anti-Avoidance Regulation. *WU International Taxation Research Paper Series No. 2023-01*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4352522

Rhoades, S. C. (1999). The Impact of Multiple Component Reporting on Tax Compliance and Audit Strategies. *The Accounting Review*, *74*(1), 63–85.

Riedel, N. (2018). Quantifying International Tax Avoidance: A Review of the Academic Literature. *Review of Economics*, *69*(2), 169–181.

Robinson, J. R., Sikes, S. A., & Weaver, C. D. (2010). Performance Measurement of Corporate Tax Departments. *The Accounting Review*, *85*(3), 1035–1064.

Samiolo, R., Spence, C., & Toh, D. (2024). Auditor Judgment in the Fourth Industrial Revolution. *Contemporary Accounting Research*, *41*(1), 498–528.

Sansing, R. C. (1993). Information Acquisition in a Tax Compliance Game. *The Accounting Review*, *68*(4), 874–884.

Schantl, S. F., & Wagenhofer, A. (2020). Deterrence of Financial Misreporting when Public and Private Enforcement Strategically Interact. *Journal of Accounting and Economics*, *70*(1), 101311.

Schantl, S. F., & Wagenhofer, A. (2021). Optimal Internal Control Regulation: Standards, Penalties, and Leniency in Enforcement. *Journal of Accounting and Public Policy*, *40*(3), 106803.

Schantl, S. F., & Wagenhofer, A. (2025). Punishing Firms for Their Managers' Misreporting. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4337009

Schulz, K. A., & Sureth-Sloane, C. (2024). Tax Compliance Management Systeme in deutschen Betriebsprüfungen – Eine Analyse praktischer Erfahrungen. *Steuer und Wirtschaft*, *101*(4), 335–353.

Shibano, T. (1990). Assessing Audit Risk from Errors and Irregularities. *Journal of Accounting Research*, *28 (Supplement)*, 110–140.

Sholli, S. (2025). IRS Employees 'Worried about Job Security' Amid Layoff Uncertainty. *International Tax Review*. https://www.internationaltaxreview.com/article/2eho1vwndb7u7nbby5szk/direct-tax/irs-employees-worried-about-job-security-amid-uncertainty-following-layoffs

Siglé, M. A., Goslinga, S., van der Hel, L. E. C. J. M., & Wilson, R. J. (2024). Tax Control and Corporate VAT Compliance: An Empirical Assessment of the Moderating Role of Tax Strategy. *Journal of International Accounting, Auditing and Taxation*, *57*, 100655.

Slemrod, J. (2019). Tax Compliance and Enforcement. *Journal of Economic Literature*, *57*(4), 904–954.

Wilde, J. H., & Wilson, R. J. (2018). Perspectives on Corporate Tax Planning: Observations from the Past Decade. *The Journal of the American Taxation Association*, *40*(2), 63–81.

Wunder, H. F. (2009). Tax Risk Management and the Multinational Enterprise. *Journal of International Accounting, Auditing and Taxation*, *18*(1), 14–28.

Appendix

Lemma 1

Note that $y \sim N(\eta T, 1)$, which is equivalent to $y = \eta T + \varepsilon$ with $\varepsilon \sim N(0,1)$. Then, the probability density and cumulative distribution function are given by

$$f(y - \eta T) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}(y - \eta T)^2\right),$$
$$F(y - \eta T) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{y} \exp\left(-\frac{1}{2}(y - \eta T)^2\right) dy = \frac{1}{2}\operatorname{erfc}\left(\frac{\eta T - y}{\sqrt{2}}\right),$$

where $\operatorname{erfc}(\cdot)$ is the complementary error function. As $\Pr(T_H|0,y;\hat{a},\hat{q}) = \frac{(1-\hat{q})\hat{a} f(y-\eta T_H)}{(1-\hat{q})\hat{a} f(y-\eta T_H)+f(y)} = \frac{1}{1+\frac{1}{(1-\hat{q})\hat{a}}\frac{f(y)}{f(y-\eta T_H)}}$, the derivative of $\Pr(T_H|0,y;\hat{a},\hat{q})$ with respect to y is given by

$$\frac{\delta}{\delta y}\left\{\frac{1}{1+\frac{1}{(1-\hat{q})\hat{a}}\frac{f(y)}{f(y-\eta T_H)}}\right\} = \frac{\delta}{\delta y}\left\{\frac{1}{1+\frac{1}{(1-\hat{q})\hat{a}}\exp\left(-\frac{1}{2}\left(y^2-(y-\eta T_H)^2\right)\right)}\right\}$$
$$= \frac{\delta}{\delta y}\left\{\frac{1}{1+\frac{1}{(1-\hat{q})\hat{a}}\exp\left(-\frac{\eta T_H}{2}(2y-\eta T_H)\right)}\right\} = \eta T_H \frac{\frac{1}{(1-\hat{q})\hat{a}}\exp\left(-\frac{\eta T_H}{2}(2y-\eta T_H)\right)}{\left[1+\frac{1}{(1-\hat{q})\hat{a}}\exp\left(-\frac{\eta T_H}{2}(2y-\eta T_H)\right)\right]^2}$$
$$= \eta T_H \Pr(T_H|0,y;\hat{a},\hat{q})\left(1-\Pr(T_H|0,y;\hat{a},\hat{q})\right) > 0.$$

This result stems from the Monotone Likelihood Ratio Property.

Theorem 1

I start with the equilibrium in a lenient enforcement environment, assuming $\omega(\rho) \leq 0$. Equating the decision variables with their rational conjectures ($a = \hat{a}, \rho = \hat{\rho}, q = \hat{q} = 0$),[20] the equilibrium is defined by the system of equations (3), (5), and (7):

$$a = (1-q)(1-(1-F(\rho-\eta T_H))k^M),$$
$$c = \frac{(1-q)af(\rho-\eta T_H)}{(1-q)af(\rho-\eta T_H)+f(\rho)}\, b.$$

[20] I insert $q = 0$ later to implicitly characterize an equilibrium in which the TCF quality q is exogenous.

Rearranging the above equations yields

$$\Phi_a = \frac{1}{a}(1-q)(1-(1-F(\rho-\eta T_H))k^M)-1=0,$$
$$\Phi_\rho = \frac{(1-q)af(\rho-\eta T_H)}{(1-q)af(\rho-\eta T_H)+f(\rho)}-\frac{c}{b}=0.$$

The Jacobian matrix (i.e., the matrix of partials of the two equilibrium conditions) with respect to a and ρ is

$$J_1 = \begin{pmatrix} \frac{\partial \Phi_a}{\partial a} & \frac{\partial \Phi_a}{\partial \rho} \\ \frac{\partial \Phi_\rho}{\partial a} & \frac{\partial \Phi_\rho}{\partial \rho} \end{pmatrix},$$

where

$\frac{\partial \Phi_a}{\partial a} = -\frac{1}{a^2}(1-q)(1-(1-F(\rho-\eta T_H))k^M) < 0,$

$\frac{\partial \Phi_a}{\partial \rho} = \frac{1}{a}(1-q)f(\rho-\eta T_H)k^M > 0,$

$$\frac{\partial \Phi_\rho}{\partial a} = (1-q)\underbrace{\frac{f(\rho-\eta T_H)f(\rho)}{((1-q)af(\rho-\eta T_H)+f(\rho))^2}}_{:=G>0} = (1-q)G > 0,$$

$\frac{\partial \Phi_\rho}{\partial \rho} = \eta T_H(1-q)aG > 0.$

Observe that $Det(J_1) = \frac{\partial \Phi_a}{\partial a}\frac{\partial \Phi_\rho}{\partial \rho} - \frac{\partial \Phi_a}{\partial \rho}\frac{\partial \Phi_\rho}{\partial a} = -\frac{G}{a}\left[\eta T_H \gamma(\rho) + f(\rho-\eta T_H)k^M\right] < 0$, where $\gamma(\rho) \equiv 1-(1-F(\rho-\eta T_H))k^M$. Thus, there exists a single solution. Also, note that, for any $a \in (0,1)$ and exogenous $q \in [0,1)$,

$$\lim_{\rho\to\infty} \Phi_\rho = 1-\frac{c}{b} > 0 \text{ and } \lim_{\rho\to-\infty} \Phi_\rho = -\frac{c}{b} < 0,$$

due to $c \in (0,b)$. Since Φ_ρ is continuous, this implies that the audit threshold ρ must have a real solution in a lenient enforcement environment. Also, because $k^M \in (0,1)$ and the audit probability $1-F(\rho-\eta T_H) \in (0,1)$, a is also interior for any ρ. Thus, both ρ and a are interior. Inserting $q=0$ in equation (5), I obtain $a=\gamma(\rho)$. The condition for the audit threshold is obtained by inserting $q=0$ and $a=\gamma(\rho)$ in equation (3).

Next, I derive the equilibrium strategies in a strict enforcement environment with $\omega(\rho) \equiv (1-F(\rho-\eta T_H))\left(1+k^B\right)-1>0$. Equating all decision variables with their rational conjectures ($q=\hat{q}>0, a=\hat{a}, \rho=\hat{\rho}$), the equilibrium is defined by the system of equations (3), (5), and (7):

$$
\begin{aligned}
a &= (1-q)(1-(1-F(\rho-\eta T_H))k^M), \\
q &= T_H a\left((1-F(\rho-\eta T_H))(1+k^B)-1\right), \\
c &= \frac{(1-q)af(\rho-\eta T_H)}{(1-q)af(\rho-\eta T_H)+f(\rho)}\, b.
\end{aligned}
$$

Rearranging the above equations yields

$$
\begin{aligned}
\Phi_a &= \frac{1}{a}(1-q)(1-(1-F(\rho-\eta T_H))k^M)-1=0, \\
\Phi_q &= \frac{1}{q}a\left((1-F(\rho-\eta T_H))(1+k^B)-1\right)-\frac{1}{T_H}=0, \\
\Phi_\rho &= \frac{(1-q)af(\rho-\eta T_H)}{(1-q)af(\rho-\eta T_H)+f(\rho)}-\frac{c}{b}=0.
\end{aligned}
$$

The Jacobian matrix, that is, the matrix of partials of the three equilibrium conditions with respect to a, q and ρ, is

$$
J_2 = \begin{pmatrix}
\frac{\partial \Phi_a}{\partial a} & \frac{\partial \Phi_a}{\partial q} & \frac{\partial \Phi_a}{\partial \rho} \\
\frac{\partial \Phi_q}{\partial a} & \frac{\partial \Phi_q}{\partial q} & \frac{\partial \Phi_q}{\partial \rho} \\
\frac{\partial \Phi_\rho}{\partial a} & \frac{\partial \Phi_\rho}{\partial q} & \frac{\partial \Phi_\rho}{\partial \rho}
\end{pmatrix}.
$$

where

$\frac{\partial \Phi_a}{\partial a} = -\frac{1}{a^2}(1-q)(1-(1-F(\rho-\eta T_H))k^M)<0,$

$\frac{\partial \Phi_a}{\partial q} = -\frac{1}{a}(1-(1-F(\rho-\eta T_H))k^M)<0$

$\frac{\partial \Phi_a}{\partial \rho} = \frac{1}{a}(1-q)f(\rho-\eta T_H)k^M>0$

$\frac{\partial \Phi_q}{\partial a} = \frac{1}{q}\left((1-F(\rho-\eta T_H))(1+k^B)-1\right)>0$

$\frac{\partial \Phi_q}{\partial q} = -\frac{1}{q^2}a\left((1-F(\rho-\eta T_H))(1+k^B)-1\right)<0$

$\frac{\partial \Phi_q}{\partial \rho} = -a\frac{1}{q}(1+k^B)f(\rho-\eta T_H)<0$

$\frac{\partial \Phi_\rho}{\partial a} = (1-q)\frac{f(\rho-\eta T_H)f(\rho)}{((1-q)af(\rho-\eta T_H)+f(\rho))^2} = (1-q)G > 0$
$\frac{\partial \Phi_\rho}{\partial q} = -aG < 0$
$\frac{\partial \Phi_\rho}{\partial \rho} = \eta T_H(1-q)aG > 0$

The determinant of J_2 is
$Det(J_2) = \frac{\partial \Phi_a}{\partial a}\frac{\partial \Phi_q}{\partial q}\frac{\partial \Phi_\rho}{\partial \rho} + \frac{\partial \Phi_a}{\partial q}\frac{\partial \Phi_q}{\partial \rho}\frac{\partial \Phi_\rho}{\partial a} + \frac{\partial \Phi_a}{\partial \rho}\frac{\partial \Phi_q}{\partial a}\frac{\partial \Phi_\rho}{\partial q} - \frac{\partial \Phi_a}{\partial \rho}\frac{\partial \Phi_q}{\partial q}\frac{\partial \Phi_\rho}{\partial a} - \frac{\partial \Phi_a}{\partial a}\frac{\partial \Phi_q}{\partial \rho}\frac{\partial \Phi_\rho}{\partial q} - \frac{\partial \Phi_a}{\partial q}\frac{\partial \Phi_q}{\partial a}\frac{\partial \Phi_\rho}{\partial \rho}$.
Inserting and simplifying yields

$$
\begin{aligned}
Det(J_2) = \frac{1-q}{q}G \times \Big\{ & 2\left(1+k^B\right) f(\rho-\eta T_H)(1-(1-F(\rho-\eta T_H))k^M) \\
& + \frac{1-q}{q}\left((1-F(\rho-\eta T_H))(1+k^B)-1\right)\left(\eta T_H(1-(1-F(\rho-\eta T_H))k^M)+f(\rho-\eta T_H)k^M\right) \\
& + \left((1-F(\rho-\eta T_H))(1+k^B)-1\right)\left(\eta T_H(1-(1-F(\rho-\eta T_H))k^M)-f(\rho-\eta T_H)k^M\right) \Big\}.
\end{aligned}
$$

$Det(J_2)$ is proportional to the bracket term. Further simplification using $\omega(\rho)$ and $\gamma(\rho)$ yields

$$Det(J_2) \propto 2\, q\, f(\rho-\eta T_H)\left[\left(1+k^B\right)\gamma(\rho) - k^M\omega(\rho)\right] + \omega(\rho) f(\rho-\eta T_H)k^M + \quad (13)$$

$$T_H\gamma(\rho)\,\omega(\rho)\,\eta\ . \quad (14)$$

Note that (14) is unambiguously positive. Further, note that (13) is positive for any $\rho \in (-\infty,\infty)$ if $k^B \leq \bar{\bar{k}}^B$ guarantees $q \leq 1/2$. Then, $Det(J_2) > 0$ is given. The upper bound $\bar{\bar{k}}^B$ is defined as

$$\bar{\bar{k}}^B \equiv \frac{1+T_H\gamma(\rho)F(\rho-\eta T_H)}{T_H\gamma(\rho)\left[1-F(\rho-\eta T_H)\right]}. \quad (15)$$

Simultaneously solving $\Phi_a = 0$ and $\Phi_q = 0$, the only feasible solution for q and a can be shown to be:

$$
\begin{aligned}
a &= \frac{\gamma(\rho)}{1+T_H\gamma(\rho)\,\omega(\rho)}, \\
q &= \frac{T_H\gamma(\rho)\,\omega(\rho)}{1+T_H\gamma(\rho)\,\omega(\rho)}.
\end{aligned}
$$

Observe that a and q are always interior for any $\omega(\rho) \in (0,\infty)$ and any $\gamma(\rho) \in (0,1)$, which is guaranteed by $k^M \in (0,1)$. The assumption $k^B \leq \overline{\overline{k}}^B$ guarantees that, in equilibrium, Φ_ρ varies monotonically for all $\rho \in (-\infty,\infty)$ in a strict enforcement environment. Then, there exists a unique solution $\rho \in (-\infty,\infty)$, implying a unique interior solution $a \in (0,1)$ and $q \in (0,1/2]$. Overall, the equilibrium condition for the audit threshold is obtained by inserting the interior solution for q and a in equation (3). As will become clear from the later analyses, $\overline{\overline{k}}^B = 1/\left[T_H\left(1-k^M\right)\right]$ if $k^M \leq \overline{k}^M := \frac{1+k^B}{1+2k^B}$ and $\overline{\overline{k}}^B = \left.\frac{1+T_H\gamma(\rho)F(\rho-\eta T_H)}{T_H\gamma(\rho)[1-F(\rho-\eta T_H)]}\right|_{\rho=\rho(\overline{c}_c^q)}$ if $k^M > \overline{k}^M$.

Lemma 2

The result $\frac{d\rho^*}{dc} > 0$ and thus $\frac{d(1-F(\rho^*-\eta T_H))}{dc} < 0$ is shown in the proof of Proposition 1 (iii). When evaluated at $\omega(\rho^*)+\kappa = 0$ with $\kappa > 0$ being sufficiently small, k^B strictly increases $\omega(\rho^*)+\kappa$ as $\frac{d\rho^*}{dk^B} = 0$ in a lenient enforcement environment. Thus, $\overline{c}_\omega$ increases in k^B.

Proposition 1 and 2

To begin, I show the results for a lenient enforcement environment (assuming $c > \overline{c}_\omega$), then for a strict enforcement environment (assuming $c < \overline{c}_\omega$), and lastly, summarize the result as established in Propositions 1 and 2. Since the mechanics of both Propositions' proofs are identical, I show them together. Where necessary, I use the index 1 (2) for a lenient (strict) enforcement environment.

Lenient enforcement environment Using a two-variable version of the Implicit Function Theorem for an arbitrary parameter $z \in \{c,\eta\}$, I solve the following system of equations for $\frac{da^*}{dz}$ and $\frac{d\rho^*}{dz}$:

$$J_1 \cdot \begin{pmatrix} \frac{da^*}{dz} \\ \frac{d\rho^*}{dz} \end{pmatrix} = -\begin{pmatrix} \frac{\partial \Phi_a}{\partial z} \\ \frac{\partial \Phi_\rho}{\partial z} \end{pmatrix}.$$

This yields

$$\frac{da^*}{dz} = \left[-\frac{1}{Det(J_1)}\right]\left\{\frac{\partial \Phi_\rho}{\partial \rho^*}\frac{\partial \Phi_a}{\partial z} - \frac{\partial \Phi_a}{\partial \rho^*}\frac{\partial \Phi_\rho}{\partial z}\right\} \propto \frac{\partial \Phi_\rho}{\partial \rho^*}\frac{\partial \Phi_a}{\partial z} - \frac{\partial \Phi_a}{\partial \rho^*}\frac{\partial \Phi_\rho}{\partial z},$$
$$\frac{d\rho^*}{dz} = \left[-\frac{1}{Det(J_1)}\right]\left\{\frac{\partial \Phi_a}{\partial a^*}\frac{\partial \Phi_\rho}{\partial z} - \frac{\partial \Phi_\rho}{\partial a^*}\frac{\partial \Phi_a}{\partial z}\right\} \propto \frac{\partial \Phi_a}{\partial a^*}\frac{\partial \Phi_\rho}{\partial z} - \frac{\partial \Phi_\rho}{\partial a^*}\frac{\partial \Phi_a}{\partial z}.$$

A change in c only affects Φ_ρ, as $\frac{\partial \Phi_\rho}{\partial c} = -\frac{1}{b} < 0$ and $\frac{\partial \Phi_a}{\partial c} = 0$. This directly translates into $\frac{da^*}{dc} > 0$ due to $-\frac{\partial \Phi_a}{\partial \rho}\frac{\partial \Phi_\rho}{\partial c} > 0$ (see (ii)) and $\frac{d\rho^*}{dc} > 0$ due to $\frac{\partial \Phi_a}{\partial a}\frac{\partial \Phi_\rho}{\partial c} > 0$ (see (iii)). $\frac{dq^*}{dc} = 0$ follows immediately from $c > \overline{c}_\omega$ (see (i)). This shows Proposition 1 if $c > \overline{c}_\omega$.

The effect of a change in η is less straightforward. Note that

$$\frac{\partial \Phi_a}{\partial \eta} = (1-q)\frac{k^M}{a}\frac{\partial F(\rho - \eta T_H)}{\partial \eta} = -(1-q)\frac{k^M}{a}T_H f(\rho - \eta T_H) < 0,$$
$$\frac{\partial \Phi_\rho}{\partial \eta} = -\Pr(T_H|0,\rho;a,q)(1-\Pr(T_H|0,\rho;a,q))\frac{\partial - \frac{\eta T_H}{2}(2\rho - \eta T_H)}{\partial \eta}$$
$$= \Pr(T_H|0,\rho;a,q)(1-\Pr(T_H|0,\rho;a,q))T_H(\rho - \eta T_H).$$

Then, the effect of η on a^* is given by

$$\frac{da^*}{d\eta} \propto \frac{\partial \Phi_\rho}{\partial \rho}\frac{\partial \Phi_a}{\partial \eta} - \frac{\partial \Phi_a}{\partial \rho}\frac{\partial \Phi_\rho}{\partial \eta} = G(1-q^*)^2 f(\rho^* - \eta T_H)k^M T_H(-\eta T_H - (\rho^* - \eta T_H)) \propto -\rho^*$$

Implicitly define $\overline{c}^\#$ as $\rho^*\left(\overline{c}^\#\right) = \eta T_H > 0$. Since $\lim_{c\to 0} -\rho^* = \infty$ and $\lim_{c\to\overline{c}^\#} -\rho^* = -\eta T_H$, and considering $\frac{d\rho^*}{dc} > 0$, there exists a unique threshold value $\overline{c}^a_\eta \in (0, \overline{c}^\#)$ with $\overline{c}^\# < b$, such that if $c > \overline{c}^a_\eta$ ($c < \overline{c}^a_\eta$), it follows that $\frac{da^*}{d\eta} < 0$ ($\frac{da^*}{d\eta} > 0$). From Lemma 2, recall that $\overline{c}_\omega$ strictly increases in k^B. Also, we have $\lim_{k^B\to 0} \overline{c}_\omega = 0$. Thus, there exist $k^B < \underline{k}^B \in (0, \overline{\overline{k}}^B)$, such that $\overline{c}_\omega < c < \overline{c}^a_\eta$ and thus $\frac{da^*}{d\eta} > 0$, and otherwise $\frac{da^*}{d\eta} < 0$ in a lenient environment (see (ii)).

The effect of η on ρ^* is given by

$$\frac{d\rho^*}{d\eta} \propto \frac{\partial \Phi_a}{\partial a}\frac{\partial \Phi_\rho}{\partial \eta} - \frac{\partial \Phi_\rho}{\partial a}\frac{\partial \Phi_a}{\partial \eta} = T_H G\frac{(1-q^*)^2}{a^*}\Omega^\rho_{1,\eta} \propto \Omega^\rho_{1,\eta},$$

where

$$\Omega^{\rho}_{1,\eta} \equiv k^M f(\rho^* - \eta T_H) - \left[1 - (1 - F(\rho^* - \eta T_H))k^M\right](\rho^* - \eta T_H).$$

Observe that $\Omega^{\rho}_{1,\eta} > 0$ if $c \leq \overline{c}^{\#}$ (i.e., $\rho^* \leq \eta T_H$). Further, $\Omega^{\rho}_{1,\eta}$ has the following limits:

$$\lim_{c \to \overline{c}^{\#}} \Omega^{\rho}_{1,\eta} \widehat{=} \lim_{\rho^* \to \eta T_H} \Omega^{\rho}_{1,\eta} = \frac{k^M}{\sqrt{2\pi}} > 0 \text{ and } \lim_{c \to b} \Omega^{\rho}_{1,\eta} \widehat{=} \lim_{\rho^* \to \infty} \Omega^{\rho}_{1,\eta} = -\infty < 0.$$

Also, for $c > \overline{c}^{\#}$, $\Omega^{\rho}_{1,\eta}$ is decreasing in c, since

$$\frac{\partial \Omega^{\rho}_{1,\eta}}{\partial \rho^*} \frac{d\rho^*}{dc} = \left[-2k^M f(\rho^* - \eta T_H)(\rho^* - \eta T_H) - \gamma(\rho^*)\right] \frac{d\rho^*}{dc}\bigg|_{\rho^* > \eta T_H} < 0.$$

Taken together, the monotonicity for $c > \overline{c}^{\#}$ implies that there exists a unique threshold value $\overline{c}^{\rho}_{1,\eta} \in (\overline{c}^{\#}, b)$, such that if $c > \overline{c}^{\rho}_{1,\eta}$ ($c < \overline{c}^{\rho}_{1,\eta}$), it follows that $\frac{d\rho^*}{d\eta} < 0$ ($\frac{d\rho^*}{d\eta} > 0$). Note that $\overline{c}^{a}_{\eta} < \overline{c}^{\rho}_{1,\eta}$, which implies that $\overline{c}_{\omega} < c < \overline{c}^{\rho}_{1,\eta}$ exists if $0 < k^B < \overline{k}^B_1$. Then, we have $\frac{d\rho^*}{d\eta} > 0$, and otherwise $\frac{d\rho^*}{d\eta} < 0$ in a lenient environment (see (iii)). $\frac{dq^*}{d\eta} = 0$ follows immediately from $c > \overline{c}_{\omega}$ (see (i)). This shows Proposition 2 if $c > \overline{c}_{\omega}$.

Strict enforcement environment Now, I assume that $c < \overline{c}_{\omega}$. Using a three-variable version of the Implicit Function Theorem for an arbitrary parameter z, I solve the following system of equations for $\frac{d\Phi_a}{dz}$, $\frac{d\Phi_q}{dz}$ and $\frac{d\Phi_\rho}{dz}$, where the functions are defined in the Proof of Theorem 1:

$$J_2 \cdot \begin{pmatrix} \frac{da^*}{dz} \\ \frac{dq^*}{dz} \\ \frac{d\rho^*}{dz} \end{pmatrix} = - \begin{pmatrix} \frac{\partial \Phi_a}{\partial z} \\ \frac{\partial \Phi_q}{\partial z} \\ \frac{\partial \Phi_\rho}{\partial z} \end{pmatrix}.$$

This yields

$$\frac{da^*}{dz} = -\frac{1}{Det(J_2)} \left\{ \left[\frac{\partial \Phi_q}{\partial q^*}\frac{\partial \Phi_\rho}{\partial \rho^*} - \frac{\partial \Phi_q}{\partial \rho^*}\frac{\partial \Phi_\rho}{\partial q^*}\right]\frac{\partial \Phi_a}{\partial z} + \left[\frac{\partial \Phi_a}{\partial \rho^*}\frac{\partial \Phi_\rho}{\partial q^*} - \frac{\partial \Phi_a}{\partial q^*}\frac{\partial \Phi_\rho}{\partial \rho^*}\right]\frac{\partial \Phi_q}{\partial z} + \left[\frac{\partial \Phi_a}{\partial q^*}\frac{\partial \Phi_q}{\partial \rho^*} - \frac{\partial \Phi_a}{\partial \rho^*}\frac{\partial \Phi_q}{\partial q^*}\right]\frac{\partial \Phi_\rho}{\partial z} \right\}$$
$$\frac{dq^*}{dz} = -\frac{1}{Det(J_2)} \left\{ \left[\frac{\partial \Phi_q}{\partial \rho^*}\frac{\partial \Phi_\rho}{\partial a^*} - \frac{\partial \Phi_q}{\partial a^*}\frac{\partial \Phi_\rho}{\partial \rho^*}\right]\frac{\partial \Phi_a}{\partial z} + \left[\frac{\partial \Phi_a}{\partial a^*}\frac{\partial \Phi_\rho}{\partial \rho^*} - \frac{\partial \Phi_a}{\partial \rho^*}\frac{\partial \Phi_\rho}{\partial a^*}\right]\frac{\partial \Phi_q}{\partial z} + \left[\frac{\partial \Phi_a}{\partial \rho^*}\frac{\partial \Phi_q}{\partial a^*} - \frac{\partial \Phi_a}{\partial a^*}\frac{\partial \Phi_q}{\partial \rho^*}\right]\frac{\partial \Phi_\rho}{\partial z} \right\}$$

$$\frac{d\rho^*}{dz} = -\frac{1}{Det(J_2)} \left\{ \left[\frac{\partial \Phi_q}{\partial a^*} \frac{\partial \Phi_\rho}{\partial q^*} - \frac{\partial \Phi_q}{\partial q^*} \frac{\partial \Phi_\rho}{\partial a^*} \right] \frac{\partial \Phi_a}{\partial z} + \left[\frac{\partial \Phi_a}{\partial q^*} \frac{\partial \Phi_\rho}{\partial a^*} - \frac{\partial \Phi_a}{\partial a^*} \frac{\partial \Phi_\rho}{\partial q^*} \right] \frac{\partial \Phi_q}{\partial z} + \left[\frac{\partial \Phi_a}{\partial a^*} \frac{\partial \Phi_q}{\partial q^*} - \frac{\partial \Phi_a}{\partial q^*} \frac{\partial \Phi_q}{\partial a^*} \right] \frac{\partial \Phi_\rho}{\partial z} \right\}$$

Note from the Proof of Theorem 1 that $Det(J_2) > 0$. When $c < \bar{c}_\omega$, a change in c only affects Φ_ρ, as $\frac{\partial \Phi_\rho}{\partial c} = -\frac{1}{b} < 0$ and $\frac{\partial \Phi_a}{\partial c} = \frac{\partial \Phi_q}{\partial c} = 0$. This implies that $\frac{da^*}{dc} > 0$ due to $\left[\frac{\partial \Phi_a}{\partial q^*} \frac{\partial \Phi_q}{\partial \rho^*} - \frac{\partial \Phi_a}{\partial \rho^*} \frac{\partial \Phi_q}{\partial q^*} \right] > 0$ and $\frac{d\rho^*}{dc} > 0$ due to $\left[\frac{\partial \Phi_a}{\partial a^*} \frac{\partial \Phi_q}{\partial q^*} - \frac{\partial \Phi_a}{\partial q^*} \frac{\partial \Phi_q}{\partial a^*} \right] > 0$. This completes the proof of (ii) and (iii) of Proposition 1. In addition, observe that

$$\frac{dq^*}{dc} \propto \left[\frac{\partial \Phi_a}{\partial \rho^*} \frac{\partial \Phi_q}{\partial a^*} - \frac{\partial \Phi_a}{\partial a^*} \frac{\partial \Phi_q}{\partial \rho^*} \right] = \frac{(1-q^*)}{q^*} \frac{f(\rho^* - \eta T_H)}{a^*} \Omega_c^q,$$

where $\Omega_c^q \equiv k^M \left((1 - F(\rho^* - \eta T_H))(1 + k^B) - 1 \right) - \left[1 - (1 - F(\rho^* - \eta T_H)) k^M \right] \left(1 + k^B \right)$. Also, note that $\frac{dq^*}{dc} \propto \Omega_c^q$. The properties of Ω_c^q with respect to c are as follows:

$$\begin{aligned}
\frac{d\Omega_c^q}{dc} &= \frac{\partial \Omega_c^q}{\partial \rho^*} \frac{d\rho^*}{dc} \propto \frac{\partial \Omega_c^q}{\partial \rho^*} = -2f(\rho^* - \eta T_H) \left(1 + k^B \right) k^M < 0, \\
\lim_{c \to 0} \Omega_c^q &\widehat{=} \lim_{\rho^* \to -\infty} \Omega_c^q = k^M \left(1 + 2k^B \right) - \left(1 + k^B \right), \\
\lim_{c \uparrow \bar{c}_\omega} \Omega_c^q &\widehat{=} \lim_{\omega(\rho^*) \downarrow 0} \Omega_c^q = - \left[1 - (1 - F(\rho^* - \eta T_H)) k^M \right] \left(1 + k^B \right) < 0.
\end{aligned}$$

The effect of c thus depends on $\lim_{c \to 0} \Omega_c^q$, which is positive for $k^M > \frac{1+k^B}{1+2k^B} := \bar{k}^M \in (1/2, 1)$ and negative for $k^M \leq \bar{k}^M$. Thus, if $k^M > \bar{k}^M$, the monotonicity of Ω_c^q implies that there exists a threshold value $\bar{c}_c^q \in (0, \bar{c}_\omega)$, such that if $c > \bar{c}_c^q$ ($c < \bar{c}_c^q$), it follows that $\frac{dq^*}{dc} < 0$ ($\frac{dq^*}{dc} > 0$). For $k^M \leq \bar{k}^M$, $\frac{dq^*}{dc} < 0 \; \forall \; c \in (0, \bar{c}_\omega)$. This completes (i) of Proposition 1.

Now, I complete the proof of Proposition 2. η affects the equilibrium conditions as follows.

$$\begin{aligned}
\frac{\partial \Phi_a}{\partial \eta} &= -(1-q) \frac{k^M}{a} T_H f(\rho - \eta T_H) < 0, \\
\frac{\partial \Phi_q}{\partial \eta} &= \frac{a}{q} \left(1 + k^B \right) T_H f(\rho - \eta T_H) > 0, \\
\frac{\partial \Phi_\rho}{\partial \eta} &= \Pr(T_H | 0, \rho; a, q) (1 - \Pr(T_H | 0, \rho; a, q)) T_H (\rho - \eta T_H).
\end{aligned}$$

Considering that $\frac{\partial\Phi_a}{\partial\eta}\frac{\partial\Phi_q}{\partial\rho}\frac{\partial\Phi_\rho}{\partial q}-\frac{\partial\Phi_q}{\partial\eta}\frac{\partial\Phi_a}{\partial\rho}\frac{\partial\Phi_\rho}{\partial q}=0$, the equilibrium effect of η on a^* is given by

$$\begin{aligned}\frac{da^*}{d\eta} &\propto -\left\{\frac{\partial\Phi_q}{\partial q^*}\frac{\partial\Phi_\rho}{\partial\rho^*}\frac{\partial\Phi_a}{\partial\eta}-\frac{\partial\Phi_a}{\partial q^*}\frac{\partial\Phi_\rho}{\partial\rho^*}\frac{\partial\Phi_q}{\partial\eta}+\left[\frac{\partial\Phi_a}{\partial q^*}\frac{\partial\Phi_q}{\partial\rho^*}-\frac{\partial\Phi_a}{\partial\rho^*}\frac{\partial\Phi_q}{\partial q^*}\right]\frac{\partial\Phi_\rho}{\partial\eta}\right\}\\ &= -T_H\frac{1-q^*}{q^*}a^*Gf(\rho^*-\eta T_H)\left[k^M\frac{1-q^*}{q^*}\omega(\rho^*)+\gamma(\rho^*)\left(1+k^B\right)\right]\rho^*\propto-\rho^*.\end{aligned}$$

Thus, as already shown for $c>\overline{c}_\omega$, there exists a unique threshold value $\overline{c}^a_\eta$, such that if $c>\overline{c}^a_\eta$ ($c<\overline{c}^a_\eta$), it follows that $\frac{da^*}{d\eta}<0$ ($\frac{da^*}{d\eta}>0$), completing (ii) of Proposition 2.

Next, considering that $\frac{\partial\Phi_a}{\partial\eta}\frac{\partial\Phi_q}{\partial\rho}\frac{\partial\Phi_\rho}{\partial a}-\frac{\partial\Phi_q}{\partial\eta}\frac{\partial\Phi_a}{\partial\rho}\frac{\partial\Phi_\rho}{\partial a}=0$, the equilibrium effect of η on q^* is given by

$$\begin{aligned}\frac{dq^*}{d\eta} &\propto -\left\{-\frac{\partial\Phi_q}{\partial a^*}\frac{\partial\Phi_\rho}{\partial\rho^*}\frac{\partial\Phi_a}{\partial\eta}+\frac{\partial\Phi_a}{\partial a^*}\frac{\partial\Phi_\rho}{\partial\rho^*}\frac{\partial\Phi_q}{\partial\eta}+\left[\frac{\partial\Phi_a}{\partial\rho^*}\frac{\partial\Phi_q}{\partial a^*}-\frac{\partial\Phi_a}{\partial a^*}\frac{\partial\Phi_q}{\partial\rho^*}\right]\frac{\partial\Phi_\rho}{\partial\eta}\right\}\\ &= -T_H\frac{(1-q^*)^2}{q^*}a^*Gf(\rho^*-\eta T_H)\rho^*\Omega^q_c\propto-\rho^*\Omega^q_c\equiv\Omega^q_\eta.\end{aligned}$$

Observe that if $k^M\leq\overline{k}^M$, $\Omega^q_c<0\ \forall\ c\in(0,\overline{c}_\omega)$. This implies that $\Omega^q_\eta\propto\rho^*$ and thus there exists a threshold value $\overline{c}^a_\eta$, such that if $c>\overline{c}^a_\eta$ ($c<\overline{c}^a_\eta$), it follows that $\frac{dq^*}{d\eta}>0$ ($\frac{dq^*}{d\eta}<0$). For $k^M>\overline{k}^M$, $\overline{c}^a_\eta$ has similar implications as long as $\overline{c}^q_c<c$ additionally holds, but the implications of $\overline{c}^a_\eta$ flip if $c<\overline{c}^q_c$. This completes (i) of Proposition 2.

Lastly, the equilibrium effect of η on ρ^* is given by

$$\begin{aligned}\frac{d\rho^*}{d\eta} &\propto -\left[\frac{\partial\Phi_q}{\partial a^*}\frac{\partial\Phi_\rho}{\partial q^*}-\frac{\partial\Phi_q}{\partial q^*}\frac{\partial\Phi_\rho}{\partial a^*}\right]\frac{\partial\Phi_a}{\partial\eta}-\left[\frac{\partial\Phi_a}{\partial q^*}\frac{\partial\Phi_\rho}{\partial a^*}-\frac{\partial\Phi_a}{\partial a^*}\frac{\partial\Phi_\rho}{\partial q^*}\right]\frac{\partial\Phi_q}{\partial\eta}\\ &\quad-\left[\frac{\partial\Phi_a}{\partial a^*}\frac{\partial\Phi_q}{\partial q^*}-\frac{\partial\Phi_a}{\partial q^*}\frac{\partial\Phi_q}{\partial a^*}\right]\frac{\partial\Phi_\rho}{\partial\eta}\\ &\propto T_H\frac{1-q^*}{(q^*)^2}G\,\Omega^\rho_{2,\eta},\end{aligned}$$

where

$$\Omega^\rho_{2,\eta}\equiv f(\rho^*-\eta T_H)\left[k^M\omega(\rho^*)(1-2q^*)+2\gamma(\rho^*)(1+k^B)q^*\right]-\gamma(\rho^*)\,\omega(\rho^*)\,(\rho^*-\eta T_H).$$

Observe that $\Omega^{\rho}_{2,\eta} > 0$ if $\rho^* \leq \eta T_H$ (i.e., $c \leq \overline{c}^{\#}$). Further, we have $\lim_{c\uparrow\overline{c}_\omega} \Omega^{\rho}_{2,\eta} \widehat{=} \lim_{\omega(\rho^*)\downarrow 0} \Omega^{\rho}_{2,\eta} = 0$. Now, the equilibrium effects depend on the size of $\overline{c}_\omega$, which strictly increases in k^B (Lemma 2). There are two cases: First, consider $\overline{c}_\omega < \overline{c}^{\#}$, which occurs if $0 < k^B < \overline{k}^B_2$, where $\overline{k}^B_2$ is implicitly defined as $\overline{c}_\omega(\overline{k}^B_2) \stackrel{!}{=} \overline{c}^{\#}$. Then, the above characteristics imply $\Omega^{\rho}_{2,\eta} > 0 \Leftrightarrow \frac{d\rho^*}{d\eta} > 0 \; \forall \; c \in (0, \overline{c}_\omega)$. Second, consider $\overline{c}^{\#} < \overline{c}_\omega$, which requires $k^B > \overline{k}^B_2$. Feasibility requires $\overline{k}^B_2 < \overline{\overline{k}}^B$. It can be verified that $\overline{k}^B_2 < \overline{\overline{k}}^B$ can occur, as $\overline{c}_\omega > \overline{c}^{\#}$ is equivalent to $\lim_{c\to\overline{c}^{\#}} \omega(\rho^*) \widehat{=} \lim_{\rho^*\to\eta T_H} \omega(\rho^*) = \frac{1+k^B}{2} - 1 > 0$. For $k^M < \overline{k}^M$, we have $\overline{\overline{k}}^B = 1/\left[T_H(1-k^M)\right]$, such that if $1/\left[T_H(1-k^M)\right] > 1$, $\overline{c}_\omega > \overline{c}^{\#}$ is satisfied. Then, the sign of $\frac{d\rho^*}{d\eta}$ is indeterminate $\forall \; c \in \; (\overline{c}^{\#}, \overline{c}_\omega)$ but $\frac{d\rho^*}{d\eta} > 0 \; \forall \; c \in (0, \overline{c}^{\#})$.

Lastly, we can summarize the insights. If $k^B < \overline{k}^B_2$, there exists a unique threshold value $\overline{c}^{\rho}_{1,\eta} \in (\overline{c}^{\#}, b)$, such that if $c > \overline{c}^{\rho}_{1,\eta}$ ($c < \overline{c}^{\rho}_{1,\eta}$), we have $\frac{d\rho^*}{d\eta} < 0$ ($\frac{d\rho^*}{d\eta} > 0$). If $k^B > \overline{k}^B_2$ and $\overline{c}_\omega < \overline{c}^{\rho}_{1,\eta}$, we have $\frac{d\rho^*}{d\eta} > 0$ if $c < \underline{c}^{\rho}_{\eta} = \overline{c}^{\#}$ and $\frac{d\rho^*}{d\eta} < 0$ if $c > \overline{c}^{\rho}_{\eta} = \overline{c}^{\rho}_{1,\eta}$. If $k^B > \overline{k}^B_2$ and $\overline{c}_\omega > \overline{c}^{\rho}_{1,\eta}$, with existence following from $\lim_{k^M\to 0} \overline{c}^{\#} = \overline{c}^{\rho}_{1,\eta}$, we have $\frac{d\rho^*}{d\eta} > 0$ if $c < \underline{c}^{\rho}_{\eta} = \overline{c}^{\#}$ and $\frac{d\rho^*}{d\eta} < 0$ if $c > \overline{c}^{\rho}_{\eta} = \overline{c}_\omega$. This completes Proposition 2 (iii).

Corollary 1

As established in the proof of Proposition 2, $\overline{c}^{a}_{\eta} \in (0, \overline{c}^{\#})$ and $\underline{c}^{\rho}_{\eta} \in [\overline{c}^{\#}, b)$, implying $\overline{c}^{a}_{\eta} < \underline{c}^{\rho}_{\eta}$. Then, observe that since $\overline{c}^{a}_{\eta} < \underline{c}^{\rho}_{\eta}$, we also have $\frac{d\rho^*}{d\eta} > 0$ when $c < \overline{c}^{a}_{\eta}$. As $c < \overline{c}^{a}_{\eta}$ requires $\rho^*(\eta) < 0$ and $\overline{c}^{a}_{\eta}$ is defined at $\rho^*(\eta) = 0$, an increase of η decreases the range in which $\frac{da^*}{d\eta} > 0$ obtains. Thus, there is a threshold value $\overline{\eta}^a > 0$, such that only if $\eta < \overline{\eta}^a$, we have $\frac{da^*}{d\eta} > 0$. Lastly, observe that $\frac{d\rho^*}{dk^B} \propto \left[\frac{\partial\Phi_a}{\partial a^*}\frac{\partial\Phi_\rho}{\partial q^*} - \frac{\partial\Phi_a}{\partial q^*}\frac{\partial\Phi_\rho}{\partial a^*}\right] > 0$ and thus $\overline{\eta}^a$ increases in k^B.

Proposition 3

Lenient enforcement environment When $c > \overline{c}_\omega$, we have $CTP^* = \frac{1}{2}(1+a^*)$, implying $\frac{dCTP^*}{dz} \propto \frac{da^*}{dz}$ with $z \in \{c, \eta\}$. The tax audit efficiency measures are $AP^* = 1 - F(\rho^* - \eta T_H)$ and $LTR^* = a^* F(\rho^* - \eta T_H)$. As $a^* = \gamma(\rho^*) = 1 - k^M AP^*$ with $k^M \in (0,1)$, we know that $\frac{da^*}{dz} \propto -\frac{dAP^*}{dz} \propto \frac{dF(\rho^*-\eta T_H)}{dz}$. Taking Propositions 1 and 2 into account, the effect on the tax audit efficiency measures depends on the sign of $\frac{da^*}{dz}$ only, with the sign of $\frac{da^*}{d\eta}$ depending on the threshold value $\overline{c}^{a}_{\eta}$.

Strict enforcement environment When $c < \bar{c}_\omega$, we have $CTP^* = \frac{1}{2}(1+(1-q^*)a^*)$. The first-order condition of $z \in \{c, \eta\}$ with respect to CTP^* is $\frac{dCTP^*}{dz} = \frac{\partial CTP^*}{\partial q^*}\frac{dq^*}{dz} + \frac{\partial CTP^*}{\partial a^*}\frac{da^*}{dz} = \frac{1}{2}\left((1-q^*)\frac{da^*}{dz} - a^*\frac{dq^*}{dz}\right)$. This gives

$$\frac{dCTP^*}{dc} \propto 2\left(1+k^B\right)\gamma(\rho^*) + k^M f\left(\rho^* - \eta T_H\right)\omega\left(\rho^*\right)\frac{1-2q^*}{q^*} > 0,$$
$$\frac{dCTP^*}{d\eta} \propto -\rho^*\left[\left(1+a^*\right)\left(1+k^B\right)\gamma(\rho^*) + k^M\left(\frac{1-q^*}{q^*} - a^*\right)\right] \propto -\rho^*,$$

since $k^B \leq \overline{\overline{k}}^B$ implies $\frac{1-2q^*}{q^*} \geq 0$ and $\frac{1-q^*}{q^*} - a^* > 0$. Thus, for $\frac{dCTP^*}{d\eta}$, the same result as in a lenient enforcement environment applies.

Next, the behavior of z with respect to AP^* is $\frac{dAP^*}{dz} = -\left[\frac{\partial F(\rho^* - \eta T_H)}{\partial z} + \frac{\partial F(\rho^* - \eta T_H)}{\partial \rho^*}\frac{d\rho^*}{dz}\right]$. This yields $\frac{dAP^*}{dc} \propto -\frac{d\rho^*}{dc} < 0$. Further, observe that

$$\frac{dAP^*}{d\eta} = f\left(\rho^* - \eta T_H\right)\left(T_H - \frac{d\rho^*}{d\eta}\right) \propto 1 - \frac{\Omega_{2,\eta}^{\rho}}{\Omega_{2,\eta}^{\rho} + \gamma(\rho^*)\omega(\rho^*)\rho^*}.$$

Since $Det(J_2) > 0$ implies $\Omega_{2,\eta}^{\rho} + \gamma(\rho^*)\omega(\rho^*)\rho^* > 0$, it holds that $\frac{dAP^*}{d\eta} \propto \rho^*$, with the enforcement-strength dependent implications as already established.

Lastly, the effect on LTR^* is $\frac{dLTR^*}{dz} = \frac{1}{2}\left(\frac{d(1-q^*)a^*}{dz}F\left(\rho^* - \eta T_H\right) - \frac{dAP^*}{dz}(1-q^*)a^*\right)$. This yields $\frac{dLTR^*}{dc} > 0$ due to $\frac{d(1-q^*)a^*}{dc} > 0$ and $\frac{dAP^*}{dc} < 0$ as shown above, as well as $\frac{dLTR^*}{d\eta} \propto -\rho^*$ because $\frac{dCTP^*}{d\eta} \propto -\rho^*$ and $-\frac{dAP^*}{d\eta} \propto -\rho^*$, with the enforcement-strength dependent implications as already established.

An Economic Analysis of Joint Tax Audits*

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Abstract

We investigate how tax authorities use joint tax audits as a coordinated enforcement tool in cross-border transactions of a multinational firm. Joint tax audits aim to resolve potential tax disputes early, before such disputes escalate into costly and time-consuming resolution procedures that may not fully eliminate double taxation. Employing a game-theoretic model, we identify settings in which we expect joint audits to occur and investigate their effect on the firm's expected tax payments and tax audit efficiency. We find that the occurrence of joint audits critically depends on the double taxation risk in the absence of joint audits. Unless tax rules are consistently applied, joint audits can occur more often when this risk is higher. The reason is that the firm changes its income-shifting strategy to reduce its tax payments, and thereby also enables tax authorities to better target tax disputes via joint audits that would otherwise escalate. However, we identify conditions under which joint audits are then detrimental to tax audit efficiency, particularly when the firm prefers them most. Our results imply that cost-sharing arrangements for joint audits should be tailored to the level of double taxation risk, with firm involvement having the potential to improve efficiency when this risk is high.

Keywords: joint tax audits, double taxation, dispute prevention, income shifting
JEL classification: H26, H87, F23, M42, C72

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"TWO audit teams – ONE common solution – ZERO double or non-taxation.
That is what joint audits are about!"[1]

— Eva Oertel

1. Introduction

Joint tax audits have emerged as a critical tool in international tax enforcement. They involve two or more tax authorities collaboratively reviewing taxpayer records, thereby ensuring consistent tax assessments across jurisdictions and preventing double taxation (Burgers and Criclivaia 2016, Čičin-Šain and Englisch 2022). Double taxation arises when two or more tax authorities assert the right to tax the same income, and is a result of inconsistent applications of tax rules across jurisdictions. Anecdotal and empirical evidence suggests that inconsistent applications of tax rules, for example of transfer pricing rules, are widespread (Rathke et al. 2020, Diller et al. 2025). Theoretical models similarly predict inconsistent applications of tax rules as a result of tax competition (Mansori and Weichenrieder 2001, Raimondos-Møller and Scharf 2002), and this problem is further aggravated by the widespread fiscal constraints currently faced by many countries (e.g., PwC 2025). Due to the economic distortions for firms, instruments to prevent double taxation ex ante, such as Advance Pricing Agreements (APAs) or Advance Tax Rulings (De Waegenaere et al. 2007, Diller et al. 2017), and to resolve double taxation of escalated disputes ex post, such as Mutual Agreement Procedures (MAPs) or arbitration (Martini et al. 2025), exist. However, these instruments are costly and time-consuming for all stakeholders (OECD 2019).

Given this context, joint tax audits have been introduced as a policy response to reduce international tax disputes through coordinated enforcement. Joint audits can be conducted across various cross-border transactions, including transfer pricing cases, profit attribution to permanent establishments, and complex business restructurings. First pilot projects indicate that joint tax audits can be an efficient and timely alternative to traditional dispute prevention and resolution instruments (Braun et al. 2020). Most recently, the Directive on Administrative

[1]The quote is cited in OECD (2019, p. 13). At that time, Eva Oertel was a Legal Counsel for International Tax Policy at the Federal Ministry of Finance in Berlin.

Cooperation (DAC7) provides the first legally binding framework for conducting joint tax audits in the European Union (Form and Oestreicher 2021, Čičin-Šain and Englisch 2022). Despite the growing interest of policymakers and practitioners, we lack a theoretical understanding of when tax authorities are willing to engage in joint audits and what their economic implications are. This question is particularly pertinent because, although joint tax audits are expected to prevent disputes, they typically require greater administrative resources than national audits (Burgers and Criclivaia 2016, OECD 2019).

To address this gap, we develop a game-theoretic model that analyzes the strategic interactions between a multinational firm, two tax authorities, and their respective national tax auditors. In particular, we study the conditions under which we expect joint tax audits to arise and their effects on the firm's expected tax payments and tax audit efficiency.

The model features a multinational firm operating in a high-tax and a low-tax country. Part of the firm's income is disputed with regard to its allocation between the two countries. The true allocation is determined by the state of the world. In "consistent" states, tax rules are consistently applied across countries even in a national audit. In the "inconsistent" state, tax rules are inconsistently applied if no joint tax audit is established and a national audit is conducted, leading to double taxation. The firm privately observes the state and reports the disputed income to one of the tax authorities. Reporting disputed income to the low-tax authority can constitute income shifting. In particular, the firm can engage in "aggressive" income shifting when both countries would agree the income should be taxed in the high-tax country (consistent state), in "moderate" income shifting when both countries would disagree on the income allocation (inconsistent state), or abstain from income shifting altogether.[2] For example, the firm can shift income by varying a royalty payment from a subsidiary located in the low-tax country to the parent company located in the high-tax country. Following the firm's report, both tax authorities independently decide whether to opt for a joint tax audit, which is established only if both give their consent. If no joint audit occurs, the decisions to conduct (in-depth) national audits are

[2]We refer to income shifting in this consistent state as aggressive, since the firm deliberately misreports against a shared understanding of where income should be taxed. In the inconsistent state, shifting is termed moderate, as any interpretation is reasonable and both countries can plausibly claim taxing rights.

delegated to strategic tax auditors.[3] While joint audits involve additional coordination costs for both net-revenue maximizing authorities, joint audits prevent double taxation and avoid the costs associated with dispute resolution procedures (e.g., MAPs) when national audits would lead to double taxation. We label the latter as "inconsistency costs".

Three key institutional characteristics that depend on the specific country pair shape the players' behavior in the model. *Tax rule inconsistency* reflects how likely it is that diverging interpretations are practically applied under national audits, which varies even within OECD countries (Diller et al. 2025). This institutional friction directly affects the behavior of national tax auditors. These auditors typically have implicit incentives to increase revenues by uncovering income shifting (Blaufus et al. 2025), but also face personal audit costs. As tax rule inconsistency increases, so does the likelihood that (at least moderate) income shifting occurs, making their decisions to conduct national audits more attractive. The tax authorities base their preceding joint audit decisions on the anticipated behavior of the national auditors. While national audits increase revenues if they uncover income shifting, they may trigger *inconsistency costs* in the case of double taxation. These costs capture the administrative and procedural burden of resolving disputes through mechanisms such as MAPs. The costs can vary across countries, as, for example, reflected in different MAP durations (Martini et al. 2025). Higher inconsistency costs make joint audits more attractive to the tax authorities as a means to prevent disputes ex ante. A third institutional factor is the *residual risk of double taxation* for the firm, which captures the effectiveness of dispute resolution mechanisms in eliminating double taxation after national audits. The higher this risk, the less likely the firm is to engage in moderate income shifting, and the more likely conflicting preferences become between the firm and the authorities regarding joint versus national audits. This risk is low in country pairs with mandatory binding arbitration and can be high otherwise, particularly when the countries' tax rates are similar.

Our equilibrium analysis reveals how the firm's income shifting decisions, the tax authorities' decisions to opt for a joint audit, and the auditors' decisions to conduct national audits depend on these institutional characteristics. We find that the economic implications of joint tax audits

[3] We focus on permanently audited multinational firms, and thus the national audit decisions reflect auditors' decisions to conduct in-depth national audits of the underlying transaction.

critically depend on the firm's residual double taxation risk *absent* joint audits. When this risk is low, joint audits only occur when the tax authorities' expected inconsistency costs under national audits are higher than the additional coordination burdens under a joint tax audit. Therefore, a necessary condition for joint audits to occur is that the tax authorities' expected deadweight losses are lower than under national audits. Since these deadweight losses serve as our measure for tax audit efficiency, this reveals that when the residual risk is low, joint audits are always efficient if established. However, the converse is not true, as not all efficiency-enhancing joint audits are established. A joint audit requires mutual consent by both authorities, and the tax authority in the low-tax country blocks some efficiency-enhancing joint tax audits because the low-tax authority does not internalize the inconsistency cost savings that could be realized by the high-tax authority. This reveals a fundamental coordination problem in decentralized enforcement settings that efficiency can be necessary but not sufficient for implementation.

When tax rule inconsistency is sufficiently low but the risk of residual double taxation is high—that is, disputes are rare but in case of occurrence hard to resolve through traditional dispute resolution—we find that joint tax audits are unlikely to be initiated. However, as soon as tax rule inconsistency exceeds a threshold, we show that a national audit and a joint audit equilibrium may coexist. In the national audit equilibrium, the auditors of both countries conduct some national audits, and the firm engages in some moderate and aggressive income shifting. In the joint audit equilibrium, the firm engages in no moderate income shifting and more aggressive income shifting compared to the national audit equilibrium. On the one hand, the different income shifting behavior enables the tax authorities' to more effectively use joint audits to target genuine tax disputes that emerge in the inconsistent state, as the required inconsistency costs for joint audits decrease. On the other hand, the changed income shifting behavior triggers the possibility that joint audits get inefficient, because these can occur even for low levels of inconsistency costs. Summing up, we generally find that the existence of joint audits can decrease tax audit efficiency. This result is striking given that our tax audit efficiency definition incorporates both tax authorities' expected deadweight losses and their mutual consent is required for joint audits to occur. Further, we also show that efficient joint audits can be blocked by either tax authority, which contrast the findings from the low risk case.

We also examine how the presence of joint tax audits affects the firm's expected tax payments compared to a setting with only national audits. Across all equilibria, our findings suggest that the expected tax payments in the consistent states are identical, and hence any differences originate from the inconsistent state. When the residual double taxation risk is low, joint audits can increase expected tax payments because they can prevent the firm from fully leveraging the tax rate differential through moderate income shifting. Once the residual risk of double taxation is sufficiently high, joint tax audits always reduce the firm's expected tax payments. Because joint tax audits require both authorities to agree on a common report that eliminates double taxation, a high residual risk undermines the prospects of reaching such an agreement due to negative revenue implications for at least one authority. Notably, the cases where joint audits reduce expected tax payments coincide with those in which joint audits may be inefficient.

Concerning regulatory implications, our findings suggest that when the residual double taxation probability is low, a regulatory cost-sharing mechanism that reallocates coordination costs from the low-tax to the high-tax authority could enable more coordinated enforcement and efficient outcomes. By contrast, when the residual double taxation risk is high, a third-party cost-sharing approach involving the firm is more suitable. If the firm shares part of the coordination burden, such cost-sharing approach could better align the firm's preferences with overall efficiency goals.

We contribute to the literature in two ways. First, we contribute to the literature on strategic individual and corporate taxpayer audits (e.g., Graetz et al. 1986, Sansing 1993, Mills et al. 2010). Within this literature, De Waegenaere et al. (2006) employ an international tax compliance model with potential inconsistent applications of transfer prices and investigate the economic effects of harmonizing transfer pricing rules on income shifting and audit strategies. Diller et al. (2025) examine the effects of enhancing standards consistency on a firm's reporting and tax authorities' audit strategies, additionally including real effects. Unlike these studies, we analyze joint tax audits as an institutional mechanism that can be used by tax authorities to overcome inconsistency when harmonization is difficult or practically impossible.

Similarly, other studies consider institutional mechanisms to resolve or prevent inconsistencies and disputes. Kourouxous et al. (2024) study how the presence of a court of appeals affects taxpayer reporting and the tax authority's audit process. In an international setting, Martini et al. (2025) analyze how different arbitration mechanisms to resolve double taxation affect tax audit qualities. Unlike these resolution mechanisms, preventive mechanisms, such as joint tax audits, are voluntarily established by some of the players. De Simone et al. (2013) examine when firms and tax authorities voluntarily enter into Enhanced Relationship Programs and how the benefits of the program are shared. Diller et al. (2017) analyze the circumstances under which investors request Advance Tax Rulings. Unlike these studies, we focus on dispute prevention in an international setting. Similar to our international setting, De Waegenaere et al. (2007) examine when bilateral APAs arise and how they affect tax audit efficiency. They find that the absence of bilateral APAs can reveal private information which can decrease tax audit efficiency. Our study differs from De Waegenaere et al. (2007) because joint tax audits do not require the firm's consent and the authorities' joint audit decisions are based on the firm's report. We find that the existence of joint tax audits can decrease tax audit efficiency because the firm alters its income-shifting strategy, while the channel of De Waegenaere et al. (2007) is muted in our setting.

Second, we contribute to the literature on joint audits in non-tax settings. Deng et al. (2014) analyze joint audits in which two audit firms simultaneously but yet separately audit a firm's financial statement, considering two joint audit and one single audit regime. They find that joint audits can impair audit quality due to free-riding incentives. Biehl et al. (2022) propose an extension of this model and additionally consider joint audit synergies. Blaufus et al. (2024) examine whether tax audits become more efficient if tax auditors have access to information about statutory audit adjustments. Their setting can be interpreted as a sequential joint audit of two auditors with distinct but related audit fields. While these joint audit models also result in a common report, our tax setting differs because participation is voluntary and endogenous, the relationship absent a joint audit is more adversarial, and free-riding incentives are muted.

In sum, we are the first to theoretically examine the economic effects of joint tax audits and their distinct characteristics as compared to other dispute resolution mechanisms or joint audit arrangements. In particular, joint tax audits are a coordinated enforcement mechanism in an international tax setting and (only) require the tax authorities' consent.

The paper proceeds as follows. Section 2 describes the relevant elements of the institutional setting. Section 3 introduces the analytical model and its main assumptions. Section 4 presents the equilibria depending on the low or high residual double taxation risk. Section 5 identifies the economic effects of joint audits. Finally, section 6 concludes.

2. Institutional Framework

The OECD's Base Erosion and Profit Shifting project marked a turning point in international tax cooperation. In particular, action 14 of the project emphasized improving tax dispute resolution mechanisms between member states to address double taxation and income shifting by multinational firms (OECD 2015). Against this backdrop, joint tax audits emerged as a critical tool in international tax enforcement in a short period of time. In contrast to national or simultaneous audits, joint tax audits involve two or more tax authorities collaboratively reviewing taxpayer records, ensuring consistent tax assessments across jurisdictions and thereby avoiding double taxation (Burgers and Criclivaia 2016, Form and Oestreicher 2021). While information exchange is a key component of a joint tax audit, this exchange also exists outside joint tax audits. Thus, what sets the different audit types apart is the ability to reach a common assessment through mutual understanding (OECD 2019).

A joint tax audit typically replaces a national audit and renders subsequent MAPs, which are used to resolve double taxation arising from escalated disputes, unnecessary. An alternative for resolving double taxation issues related to transfer prices are APAs, which are based on the same legal provision as MAPs, namely Article 25 of the OECD Model Convention for Double Taxation Agreements. Even though both MAPs and APAs can provide solutions to double taxation issues, both exhibit similar weaknesses as they are time consuming and are mostly unable to resolve issues in advance of an audit (Zimmerl 2022).

Important milestones in institutionalizing joint tax audits within the European Union include the EU directive on Tax Dispute Resolution Mechanisms and DAC7. While the former introduced mandatory binding arbitration and encouraged member states to conduct joint audits (EU Council 2017), the latter establishes a legal and administrative framework by providing a structured approach to collaboration and information sharing mechanism aimed at standardizing joint audit procedures within the European Union (Form and Oestreicher 2021, Čičin-Šain and Englisch 2022). The 2008 revision of Article 26 of the UN Model Tax Convention also played a key role in facilitating joint tax audits. It influenced agreements at both the European and OECD levels and supported the establishment of joint audits through bilateral treaties by promoting information exchange between contracting states. Its provisions regarding the scope of information, confidentiality, and conditions for exchange were a contributing factor that led to the facilitation of joint audits globally. However, to this point, there is no institutional framework that mandates joint tax audits. In all cases, joint tax audits have to be initiated by one party and subsequently mutually agreed upon by the other participating parties (OECD 2019). In addition, under the current European and global provisions, taxpayers do not have a legally standardized right to request or reject a joint audit (Form and Oestreicher 2021, Čičin-Šain and Englisch 2022).

Globally, by 2020, we observe 232 joint audit cases (Braun et al. 2020). Although administrative barriers with regard to aligning the various tax audit procedures of participating jurisdictions were not yet fully resolved, first pilot projects between Germany, France, and the Netherlands in the early 2010s demonstrated that joint tax audits have the potential to prevent international tax disputes (OECD 2019, Criclivaia 2020). The majority of the pilot projects were initiated by member states of the European Union with Germany in the lead having initiated 113 of those 232 joint audits (Braun et al. 2020, Criclivaia 2020).[4] Recently, we also observe joint tax audits with a number of non-European countries. Initial reports indicate that joint tax audits can be a time-saving tool as compared to other traditional resolution procedures, as most cases have

[4]Joint tax audits exhibit a close resemblance to the interstate tax audits conducted by the Multistate Tax Commission in the United States (Burgers and Criclivaia 2016). Within the United States, first pilot projects regarding state-level sales and income tax were completed as early as 1969 (Multistate Tax Comission 1970).

been resolved and double taxation has been avoided. However, joint tax audits still lack mass suitability (Form and Oestreicher 2021). Also, joint audits are conducted by a limited pool of specialized auditors, and impose additional coordination burdens on tax authorities due to differences in procedures, legal frameworks, and audit standards, as well as practical challenges such as language barriers (Burgers and Criclivaia 2016). This calls for a theoretical foundation of joint tax audits.

3. Model

3.1. Model setup

Basic assumptions Subsequently, we introduce the setup of our model.[5] We assume that a firm with worldwide income W operates in two countries, a low-tax country L and a high-tax country H. The firm's income must be taxed in either of these countries. Income is subject to tax rate τ_L in the low-tax country or tax rate τ_H in the high-tax country with $\tau_H > \tau_L \geq 0$. Part of this income is disputed, where the disputed income is normalized to one. There are three possible states of nature: y_L, y_H and y_B. In state y_L (y_H), both tax authorities agree that the firm's disputed income should be taxed in country L (H). In state y_B, a tax dispute arises as both tax authorities claim the right to tax the firm's income following national audits, resulting in double taxation. The probabilities of the states are $\Pr(y_L) = \Pr(y_H) = (1-p)/2$ and $\Pr(y_B) = p$, where $p \in [0,1]$ reflects the probability that the tax rules are inconsistently applied by the tax authorities. For example, a high p may reflect transactions between countries with fundamentally different transfer pricing systems (Rathke et al. 2020). However, even among countries aligned with OECD guidelines, inconsistent applications of rules are prevalent, as shown by anecdotal evidence (Diller et al. 2021, Diller et al. 2025) and the high concentration of arbitration cases within this group (Martini et al. 2025).

The firm privately observes the state of nature, which captures the informational asymmetry typically assumed between the firm and the tax authorities or auditors before any audit. After

[5] Our model is a variation of the international tax compliance model of De Waegenaere et al. (2006).

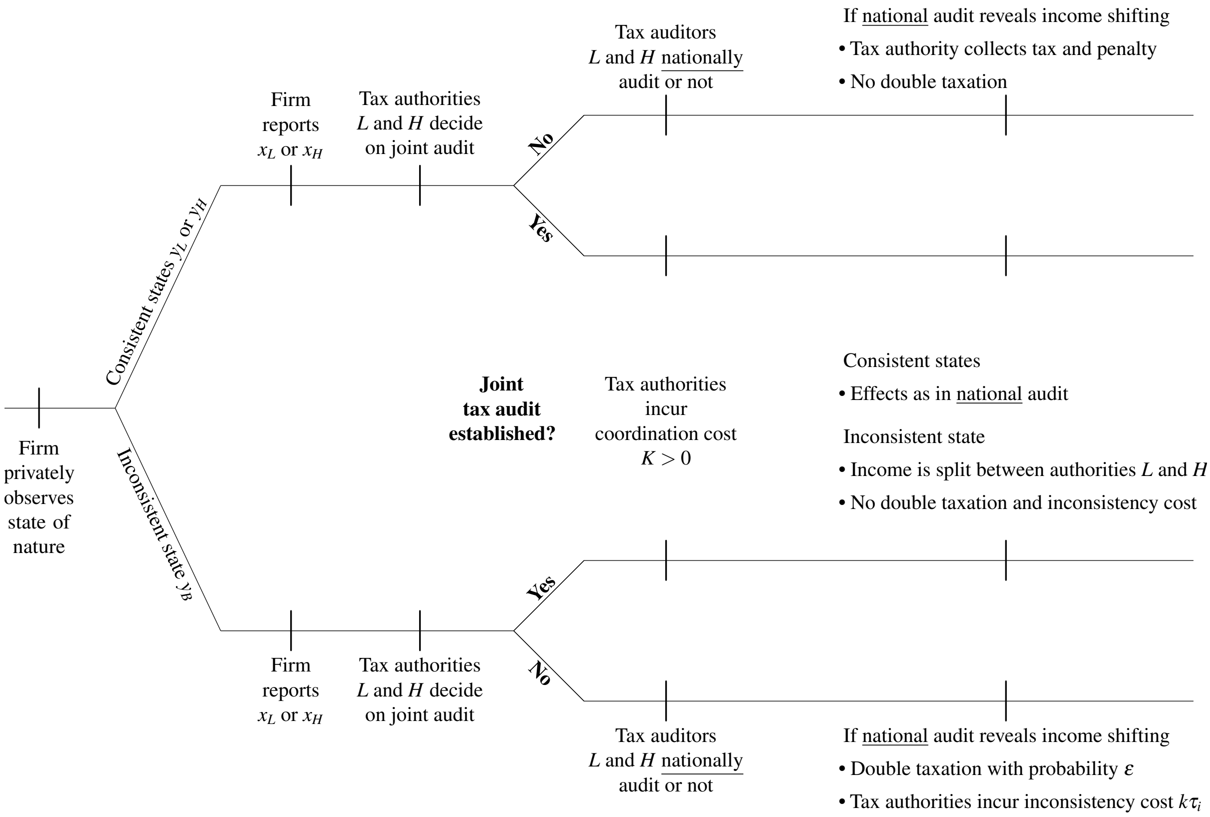
observing the state, the firm reports its aggregate taxable income W to country L and H. We restrict our focus to income shifting, which requires that aggregate income reported must equal W. For example, the firm can vary a royalty payment from a subsidiary located in L to the parent company located in H owning the intangible property. Therefore, we implicitly assume that cross-border information exchange, disclosure requirements, and substantial penalties for misreporting deter tax evasion (i.e., reported aggregate income smaller than W). The critical decision concerns the country to which the firm shifts the disputed income, either to L or H, as reflected in the respective reports x_L and x_H.

Next, both tax authorities observe the firm's report x_L or x_H and simultaneously decide whether they want to opt for a joint tax audit. Only when both tax authorities independently opt for the joint audit, it is established. Otherwise, the audit decision is delegated to strategic tax auditors who can audit nationally.[6] Joint tax audits involve additional coordination burdens relative to national audits (Burgers and Criclivaia 2016, OECD 2019). We model this by a cost $K > 0$ each tax authority incurs in case of a joint tax audit. Ultimately, the tax authorities' joint audit decisions are a trade-off between the additional coordination cost and the potential to avoid inconsistency costs associated with costly MAPs or arbitration, while accounting for the expected tax revenue consequences of the different types of audits. The payoffs are described in the following. Figure 1 depicts the game tree.

National tax audits If no joint tax audit is established, the tax authorities delegate the audit decisions to their respective national auditors, who also observe the report x_i with $i \in \{L,H\}$. If conducted, national audits reveal the state. The tax auditors in both countries receive a fixed benefit $b > 0$ if they uncover income shifting. For example, tax auditor H receives the benefit when x_L is reported and he uncovers state y_H ("aggressive" income shifting) or y_B ("moderate" income shifting). Conversely, auditor L receives the benefit when x_H is reported and states y_L or y_B are uncovered. However, auditing is personally costly to the auditors at cost $c_i > 0$ with

[6] The simultaneous joint audit decisions avoid introducing strategic timing frictions unrelated to the core question of coordinated enforcement and reflect the institutional reality that the momentum for coordination is typically lost once in-depth national audits have commenced (OECD 2019). In addition, the setup reflects that national audits are typically delegated to national tax auditors, whereas joint audits require higher-level coordination between authorities that are conducted by other auditors (Braun et al. 2020, Federal Central Tax Office 2025).

Figure 1. Game Tree



$c_i < b$. These assumptions reflect that tax auditors typically have implicit incentives to generate additional revenues through tax audits (Blaufus et al. 2024, Blaufus et al. 2025). The benefit in state y_B reflects the current environment of intensified competition for tax revenues across countries (e.g., Blaufus et al. 2023). In addition, we require that $b > 2c_H$, which guarantees that auditor H's audit threat is credible even if there is no inconsistency ($p = 0$).

The auditors' decisions affect the tax authorities' collected revenues. If the firm shifts income aggressively (report x_H in state y_H) and auditor H conducts an audit, the tax authority collects the tax and an additional penalty $\tau_H(1+\pi)$. This is similarly true in the opposite case when the state is y_L, the firm reports x_H, and auditor L audits, but this case never occurs in equilibrium. Thus, only the penalty π imposed by country H is relevant. In either case, the other authority collects no revenues because the allocation of income is undisputed in the consistent states.

If an audit is conducted in the inconsistent state y_B by auditor i after a report x_{-i}, both tax authorities claim the right to tax the disputed income, resulting in double taxation. Authority i, however, does not claim a penalty as any interpretation is reasonable in state y_B. To resolve double taxation, we assume that the firm initiates a MAP (potentially followed by arbitration) or litigates nationally.[7] The outcome of the dispute resolution procedure is that tax authority i (auditor i has audited x_{-i}) collects $\varepsilon\tau_i$ with $0 \leq \varepsilon \leq 1$, and tax authority $-i$ taxes the full income. In the following, we refer to ε as the residual double taxation risk, where "residual" refers to double taxation after the dispute resolution procedure. For example, if $\varepsilon = 0$, there would be mandatory binding arbitration in both countries, completely resolving double taxation. If $\varepsilon = 1$, both countries claim to tax the disputed income even after MAP. This modeling choice captures the assumption that the MAP procedure or arbitration panel favors the initial report x_i of the firm.[8]

Dispute resolution procedures aimed at eliminating double taxation have implications beyond the mere allocation of tax payments. These procedures are often lengthy and resource-intensive for tax authorities (Martini et al. 2025) and may erode taxpayers' trust in the fairness and efficiency of the system (Braun et al. 2020). Therefore, we additionally consider these *inconsistency costs*, and model them as an amount $k\tau_i$ with $k > 0$ incurred by each tax authority when national audits lead to double taxation. Countries with a higher tax rate thus have a larger share of revenue at stake, triggering more complex and costly resolution processes (Martini et al. 2025). High levels of k can occur when countries, such as the United States or India with a long average duration for arbitration cases, are part of the firm's business activity. Avoiding these inconsistency costs is among the determining factors for tax authorities to initiate joint tax audits.

Table 1 summarizes the players' payoffs for every possible state y_i and action choice in the national audit. Given that auditing x_i is a dominated strategy for tax auditor i, these choices are not included in the table.

[7] Our model captures both dispute resolution procedures. However, since national litigation is less common than resolution through MAP or arbitration, we concentrate on the international mechanisms in the main text.

[8] The assumption is consistent with our interpretation of state y_B, in which any outcome supported by robust documentation is considered reasonable. Given the cooperative nature of joint tax audits, we expect a more balanced allocation of income between countries compared to the typically adversarial nature of ex post dispute resolution procedures such as MAP or arbitration. We specify this balanced allocation below.

Table 1. Payoffs in a national tax audit

			Low-tax country		High-tax country	
		Firm	Auditor L	Tax authority	Auditor H	Tax authority
	x_L, H audit	$-\tau_L$	0	τ_L	$-c_H$	0
State	x_L, H no audit	$-\tau_L$	0	τ_L	0	0
y_L	x_H, L audit	$-\tau_L(1+\pi)$	$b-c_L$	$\tau_L(1+\pi)$	0	0
	x_H, L no audit	$-\tau_H$	0	0	0	τ_H
	x_L, H audit	$-\tau_H(1+\pi)$	0	0	$b-c_H$	$\tau_H(1+\pi)$
State	x_L, H no audit	$-\tau_L$	0	τ_L	0	0
y_H	x_H, L audit	$-\tau_H$	$-c_L$	0	0	τ_H
	x_H, L no audit	$-\tau_H$	0	0	0	τ_H
	x_L, H audit	$-\tau_L-\varepsilon\tau_H$	0	$\tau_L(1-k)$	$b-c_H$	$(\varepsilon-k)\tau_H$
State	x_L, H no audit	$-\tau_L$	0	τ_L	0	0
y_B	x_H, L audit	$-\tau_H-\varepsilon\tau_L$	$b-c_L$	$(\varepsilon-k)\tau_L$	0	$\tau_H(1-k)$
	x_H, L no audit	$-\tau_H$	0	0	0	τ_H

Joint tax audit Once both tax authorities opt for a joint tax audit, involving coordination cost $K>0$ for each authority, we assume that no further strategic decisions are made. National auditors no longer play an active role, and the authorities are assumed to reach a common agreement, as there is a strong commitment to reach an agreement once joint tax audits are in place.[9] As in national tax audits, we assume that joint tax audits reveal the state. In the consistent states, the revenue consequences are equivalent to those under national audits. In state y_B, however, the authorities agree on an income allocation that prevents double taxation. We model the joint audit outcome parsimoniously by assuming that, at the time of the joint audit decision, the share κ allocated to tax authority H is unknown. κ is drawn from a probability distribution with full support on [0,1], and independent of x_i. We consider symmetric distributions, for example, $\kappa \sim U(0,1)$, with all players anticipating the expected share $\mathbb{E}(\kappa)=\mathbb{E}(1-\kappa)=1/2$. Table 2 summarizes the players' payoffs for every possible state y_i and report x_i.

[9] As Braun et al. (2020, p. 24) note: "So far, almost all [joint tax audit] cases have been resolved and double taxation avoided". Also, the assumption aligns with those made for Bilateral Advance Pricing Agreements (De Waegenaere et al. 2007) and Cooperative Compliance Programs (De Simone et al. 2013).

Table 2. Payoffs in a joint tax audit

		Firm	Tax authority L	Tax authority H
State	x_L	$-\tau_L$	$\tau_L - K$	$-K$
y_L	x_H	$-\tau_L(1+\pi)$	$\tau_L(1+\pi) - K$	$-K$
State	x_L	$-\tau_H(1+\pi)$	$-K$	$\tau_H(1+\pi) - K$
y_H	x_H	$-\tau_H$	$-K$	$\tau_H - K$
State	x_L	$-\frac{\tau_L+\tau_H}{2}$	$\frac{\tau_L}{2} - K$	$\frac{\tau_H}{2} - K$
y_B	x_H	$-\frac{\tau_L+\tau_H}{2}$	$\frac{\tau_L}{2} - K$	$\frac{\tau_H}{2} - K$

3.2. Strategies and objective functions

We now turn to the players' strategies and their objective functions. Since the firm observes the state, it conditions its strategy on this private information. In state y_L, the firm has a dominant strategy of reporting x_L, as it can be sure that this report will be accepted regardless of the subsequent decisions by other players. In state y_H, the firm chooses a mixed strategy reporting x_H with probability α and x_L with probability $1-\alpha$, maximizing $\mathbb{E}\left[u_F\left(\alpha|y_H\right)\right]$. In state y_B, it chooses a mixed strategy reporting x_H with probability β and x_L with probability $1-\beta$, maximizing $\mathbb{E}\left[u_F\left(\beta|y_B\right)\right]$.

Both tax authorities observe the report x_i. Tax authority H chooses probability $\mu_H(x_i)$ to conduct a joint tax audit, considering expected payoffs in a joint audit $\mathbb{E}\left[v_H\left(JA|x_i\right)\right]$ and national audit $\mathbb{E}\left[v_H\left(NA|x_i\right)\right]$. Similarly, tax authority L chooses probability $\mu_L(x_i)$ considering $\mathbb{E}\left[v_L\left(JA|x_i\right)\right]$ and $\mathbb{E}\left[v_L\left(NA|x_i\right)\right]$. If no joint tax audit is established, the tax auditors come into play. Tax auditor H never audits x_H, since the auditor can only benefit from an audit of x_L. However, conditional on x_L, he chooses an audit probability γ by maximizing $\mathbb{E}\left[u_H\left(\gamma|x_L\right)\right]$. Analogously, tax auditor L never audits x_L and chooses an audit probability δ by maximizing $\mathbb{E}\left[u_L\left(\delta|x_H\right)\right]$. We next show the players' objective functions given their available information when making their strategic decisions. We start with the tax auditors' audit decisions.

Tax auditors' audit decisions Conjecturing the firm's strategies α and β, tax auditor H's expected utility given report x_L is

$$\mathbb{E}\left[u_H\left(\gamma|x_L\right)\right] = \gamma\left[\left(\Pr\left(y_H|x_L\right) + \Pr\left(y_B|x_L\right)\right)b - c_H\right], \tag{1}$$

with

$$\Pr\left(y_H|x_L\right) = \frac{\frac{1-p}{2}\left(1-\alpha\right)}{\frac{1-p}{2}\left(1-\alpha\right) + \frac{1-p}{2} + p\left(1-\beta\right)}, \tag{2}$$

$$\Pr\left(y_B|x_L\right) = \frac{p\left(1-\beta\right)}{\frac{1-p}{2}\left(1-\alpha\right) + \frac{1-p}{2} + p\left(1-\beta\right)}. \tag{3}$$

Thus, tax auditor H trades off the expected benefit of uncovering income shifting against the audit costs. Similarly, tax auditor L's expected utility given report x_H is given by

$$\mathbb{E}\left[u_L\left(\delta|x_H\right)\right] = \delta\left[\Pr\left(y_B|x_H\right)b - c_L\right] = \delta\left[\frac{p\beta}{p\beta + \frac{1-p}{2}\alpha}b - c_L\right]. \tag{4}$$

Notably, the expected benefit to conduct an audit increases for both tax auditors when tax rule inconsistency p is higher.

Tax authorities' joint audit decisions The tax authorities simultaneously decide on whether they opt for a joint audit. They conjecture the firm's reporting strategy, the other tax authority's joint audit strategy, and the auditors' audit strategies if no joint tax audit is established. Given a report x_L, tax authority H's expected payoff from a joint and national audit is

$$\mathbb{E}\left[v_H(JA|x_L)\right] = \Pr\left(y_H|x_L\right)\tau_H(1+\pi) + \Pr\left(y_B|x_L\right)\frac{\tau_H}{2} - K, \tag{5}$$

$$\mathbb{E}\left[v_H(NA|x_L)\right] = \gamma\left[\Pr\left(y_H|x_L\right)\tau_H\left(1+\pi\right) + \Pr\left(y_B|x_L\right)\left(\varepsilon - k\right)\tau_H\right]. \tag{6}$$

Thus, upon observing report x_L, tax authority H prefers a joint audit if

$$\tau_H\left[\Pr(y_H|x_L)(1-\gamma)(1+\pi) + \Pr(y_B|x_L)\left(\frac{1}{2} - \gamma(\varepsilon - k)\right)\right] \geq K. \tag{7}$$

Tax authority H's trade-off conditional on x_L is as follows. On the cost side, joint audits incur additional coordination costs and the authority loses expected tax revenues from double taxation. On the benefit side, it taxes the income and imposes an additional penalty if no national audit occurs in y_H, it taxes half of the income in y_B, and, most importantly, it saves the inconsistency costs when double taxation would occur in a national audit.

Conditional on x_L, tax authority L's expected payoffs from a joint and national audit is

$$\mathbb{E}\left[v_L(JA|x_L)\right] = \Pr\left(y_L|x_L\right)\tau_L + \Pr\left(y_B|x_L\right)\frac{\tau_L}{2} - K, \tag{8}$$

$$\mathbb{E}\left[v_L\left(NA|x_L\right)\right] = \tau_L - \gamma\left[\Pr\left(y_H|x_L\right)\tau_L + \Pr\left(y_B|x_L\right)\tau_L k\right]. \tag{9}$$

Thus, tax authority L prefers a joint audit if

$$\tau_L\left[\Pr\left(y_B|x_L\right)\left(\gamma k - \frac{1}{2}\right) - \Pr\left(y_H|x_L\right)(1-\gamma)\right] \geq K. \tag{10}$$

Intuitively, preventing the inconsistency costs arising from double taxation is the only advantage for authority L in this case. Other than that, a joint tax audit has negative revenue implications and induces the coordination cost K. Overall, tax authority L and H choose $\mu_i(x_L)$ so as to maximize

$$\mathbb{E}\left[v_i\left(\mu_i(x_L)\right)\right] = \mu_i(x_L)\mu_{-i}(x_L)\mathbb{E}\left[v_i\left(JA|x_L\right)\right] + \left(1-\mu_i(x_L)\mu_{-i}(x_L)\right)\mathbb{E}\left[v_i\left(NA|x_L\right)\right]. \tag{11}$$

The following lemma simplifies the equilibrium analysis. The proof is in the Appendix B.

Lemma 1. *If the firm reports x_L, the joint audit incentive for tax authority H is always higher than for tax authority L. Thus, the binding constraint to consider is* (10).

Lemma 1 establishes that in the equilibrium analysis, it suffices to focus on tax authority L's joint audit decision when the firm reports x_L. If (10) does not hold, no joint tax audit can occur.

Next, we turn to the decisions when the firm reports x_H. As this report cannot stem from state y_L, tax authority H's expected payoffs in a joint and national audit are

$$\mathbb{E}\left[v_H\left(JA|x_H\right)\right] = \Pr\left(y_H|x_H\right)\tau_H + \Pr\left(y_B|x_H\right)\frac{\tau_H}{2} - K, \tag{12}$$

$$\mathbb{E}\left[v_H\left(NA|x_H\right)\right] = \Pr\left(y_H|x_H\right)\tau_H + \Pr\left(y_B|x_H\right)\tau_H - \delta \Pr\left(y_B|x_H\right)k\tau_H. \tag{13}$$

Thus, tax authority H prefers a joint audit if

$$\tau_H \Pr(y_B|x_H)\left(\delta k - \frac{1}{2}\right) \geq K. \tag{14}$$

In this case, tax authority H trades-off the benefit of preventing inconsistency costs against the negative revenue effect of splitting the tax base and the coordination cost. Similarly, we obtain tax authority L's expected payoffs

$$\mathbb{E}\left[v_L\left(JA|x_H\right)\right] = \Pr\left(y_B|x_H\right)\frac{\tau_L}{2} - K, \tag{15}$$

$$\mathbb{E}\left[v_L\left(NA|x_H\right)\right] = \delta\left[\Pr\left(y_B|x_H\right)\left(\varepsilon - k\right)\tau_L\right]. \tag{16}$$

Thus, tax authority L prefers a joint audit if

$$\tau_L \Pr(y_B|x_H)\left(\delta(k-\varepsilon) + \frac{1}{2}\right) \geq K. \tag{17}$$

The trade-off resembles the one for tax authority H after a report x_L. Notably, we cannot establish a similar result as in Lemma 1 when the report is x_H. While the joint audit incentive for tax authority L is higher when $K = 0$ due to $\delta(k-\varepsilon) + \frac{1}{2} > \delta k - \frac{1}{2}$, this need not be the case when the coordination costs K are high.[10] Overall, tax authority L and H choose $\mu_i(x_H)$ so as to

[10]Lemma 1 is driven by our modeling choice for the inconsistency costs, that is, $k\tau_i$. If we model fixed inconsistency costs k independent of τ_i, Lemma 1 would not hold and the implications are similar to those in our setup when the report is x_H. By contrast, with fixed inconsistency costs, we could establish a similar lemma where (14) is the binding constraint when the report is x_H. Our results remain qualitatively unchanged for fixed inconsistency costs.

maximize

$$\mathbb{E}\left[v_i\left(\mu_i(x_H)\right)\right] = \mu_i(x_H)\mu_{-i}(x_H)\mathbb{E}\left[v_i\left(JA|x_H\right)\right] + \left(1-\mu_i(x_H)\mu_{-i}(x_H)\right)\mathbb{E}\left[v_i\left(NA|x_H\right)\right]. \quad (18)$$

Firm decisions The firm conjectures the auditors' audit decisions and the probabilities that a joint audit is established $\mu_L(x_i)\mu_H(x_i)$. As explained above, the firm always reports x_L in state y_L. In state y_H, the firm trades-off the costs and benefits of aggressive income shifting $1-\alpha$. Then, the firm's expected utility is given by

$$\begin{aligned}\mathbb{E}\left[u_F\left(\alpha|y_H\right)\right] =& -\alpha\tau_H - (1-\alpha)\left[\mu_H(x_L)\mu_L(x_L)\tau_H(1+\pi) + \right.\\ &\left.(1-\mu_H(x_L)\mu_L(x_L))\left(\gamma\tau_H(1+\pi)+(1-\gamma)\tau_L\right)\right]. \quad (19)\end{aligned}$$

From the perspective of the firm, joint tax audits and a national audit by auditor H are equally threatening, as both lead to a repayment of the tax and a penalty when it reports x_L in y_H.

In state y_B, the firm trades off the costs and benefits of moderate income shifting with probability $1-\beta$. The firm's expected utility is given by

$$\begin{aligned}\mathbb{E}\left[u_F\left(\beta|y_B\right)\right] =& -\left[\frac{\tau_L+\tau_H}{2}\right]\left[\beta\mu_H(x_H)\mu_L(x_H) + (1-\beta)\,\mu_H(x_L)\mu_L(x_L)\right]\\ &-\beta\left(1-\mu_H(x_H)\mu_L(x_H)\right)\left[\delta\left(\tau_H+\varepsilon\tau_L\right)+(1-\delta)\tau_H\right]\\ &-(1-\beta)\left(1-\mu_H(x_L)\mu_L(x_L)\right)\left[\gamma(\tau_L+\varepsilon\tau_H)+(1-\gamma)\tau_L\right]. \quad (20)\end{aligned}$$

When no joint audit is established, the firm's objective functions are fully in line with our benchmark model. Further, when tax authorities agree on a joint audit, for example after report x_L, the firm can prevent double taxation by choosing $\beta = 0$. Since the same outcome can also be achieved when joint audits are conducted after x_H and the firm chooses $\beta = 1$, this gives rise to multiple equilibria. We discuss this in more detail in the next section.

4. Equilibria

4.1. General remarks

In this section, we characterize the equilibria. Our equilibrium concept is Perfect Bayesian Equilibrium as defined in Gibbons (1992). When multiple equilibria arise for the same parameter values, we focus on those that are weakly payoff dominant (i.e., all players are weakly better off and at least one is strictly better off). For example, we exclude equilibria in which the firm's expected tax payments and the auditors' expected payoffs are identical to that in another equilibrium, but tax authorities incur higher deadweight losses (inconsistency and coordination costs).[11] We also rule out equilibria that rely on firm randomization in state y_B to induce a joint tax audit, as these only occur for extremely high inconsistency costs. Overall, we obtain equilibria that are institutionally plausible.[12]

The following observation underscores the role of De Waegenaere et al. (2006) as our benchmark model.

Observation. *Suppose there are no inconsistency costs ($k = 0$). Then, only national audits will be conducted, and we obtain equilibria I^{NA} to VI^{NA} with strategic tax auditors.*

The observation can be directly seen from the tax authorities' expected utilities. If we neglect inconsistency costs, tax authority L never prefers a joint audit when observing x_L (see equation 10) and tax authority H never prefers a joint audit when observing x_H (see equation 14). Since a joint audit requires consent of both authorities, this implies that only national audits are conducted. We postpone the proof that equilibria I^{NA} to $\mathrm{VI}^{\mathrm{NA}}$ exist to Proposition 1 to 5.

The various national audit equilibria crucially depend on the residual double taxation risk ε and the tax rule inconsistency p. The intuition behind the national audit equilibria is as follows. For a given level of ε, an increase in inconsistency generally induces auditors to adopt more rigorous audit strategies. This, in turn, reduces aggressive income shifting by the firm, but may

[11] Harsanyi and Selten (1988) develop strict payoff dominance as a criterion for equilibrium selection, noting that weak payoff dominance is a possible refinement.

[12] As Korn and Schiller (2003) point out, equilibrium refinements should identify those equilibria that are (likely to be) observed in reality.

generally increase or decrease moderate income shifting. The increase in audit aggressiveness also increases tax authorities' expected inconsistency costs. If the authorities want to conduct a joint tax audit, a sufficiently high inconsistency p ensures credible off the equilibrium path (national audit) threats. Moreover, for a given level of p, an increase in ε generally discourages moderate income shifting. While this does not discourage joint tax audits per sé, it increases the range where national audit equilibria are feasible.

More specifically, the national audit equilibria depend on threshold values for the probability of double taxation, namely $\varepsilon_1^* = (\tau_H - \tau_L)/\tau_H$ and $\varepsilon_2^* = \pi + (\tau_H - \tau_L)/\tau_H$, as well as threshold values for tax rule inconsistency, namely p_1^*, p_2^* and p_3^*.[13] We will show that the thresholds are defined as

$$p_1^* = \frac{c_H}{2(b-c_H)+c_H}, \quad p_2^* = \frac{(b-c_H)c_L + (b-c_L)c_H}{(b-c_H)c_L + (b-c_L)c_H + 2(b-c_H)(b-c_L)}, \text{ and}$$
$$p_3^* = \frac{(b-2c_H)c_L}{(b-2c_H)c_L + 2(b-c_L)(b-c_H)}.$$

The value p_1^* reflects the value of p for which auditor H would be indifferent between auditing and not auditing reports x_L if the firm would never engage in aggressive income shifting but always engages in moderate income shifting. The value p_2^* (p_3^*) is the value of p for which auditor H would always audit (auditor L audits with positive probability) when the residual double taxation risk is high, that is, $\varepsilon > \varepsilon_2^*$. Similar to the benchmark model, our assumptions guarantee that $0 \leq p_1^* \leq p_2^* \leq 1$ and $0 \leq p_3^* \leq p_2^* \leq 1$.

Tax authorities' joint tax audit decisions will also depend on threshold values for inconsistency costs. Therefore, we will only discuss two ε-cases, namely $\varepsilon < \underline{\varepsilon}$ and $\varepsilon > \overline{\varepsilon}$, where

$$\underline{\varepsilon} = \min\left\{\frac{\tau_H - \tau_L}{\tau_H}, \frac{\tau_H(1+\pi) - \tau_L}{2\tau_H}\right\} \quad \text{and} \quad \overline{\varepsilon} = \varepsilon_2^* = \frac{\tau_H(1+\pi) - \tau_L}{\tau_H}.$$

[13] Compared to our model, De Waegenaere et al. (2006) differ on one key dimension. In our model, tax auditors conduct national audits, while in their model, these are conducted by the tax authorities themselves. Tax authorities directly consider the revenue implications of the audit, particularly $\varepsilon\tau_i$ in state y_B, while auditors receive a fixed benefit b. Therefore, while ε_1^* and ε_2^* remain identical, the threshold values for tax rule inconsistency become independent of ε in our model.

Intuitively, the case when the residual double taxation risk is low ($\varepsilon < \underline{\varepsilon}$) occurs when the countries participate in mandatory binding arbitration or when their tax rate differential is high. By contrast, the case when this double taxation risk is high ($\varepsilon > \overline{\varepsilon}$) occurs if the tax rate differential is low and no binding arbitration exists.

To keep the following Propositions concise, we report only the outcomes of the joint audit decisions $\mu_L^*(x_L)\mu_H^*(x_L)$ and $\mu_L^*(x_H)\mu_H^*(x_H)$ in the main text. The individual decisions $\mu_i^*(x_L)$ and $\mu_i^*(x_H)$, as well as the specific values of mixed strategies (where applicable) and the proofs, are provided in the Appendix B.

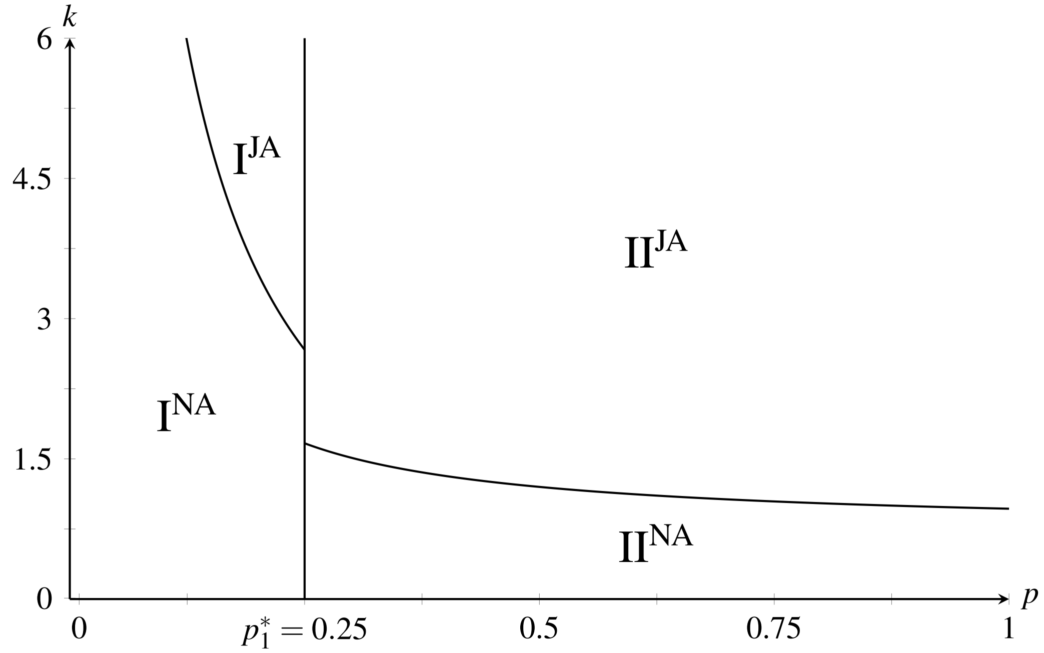
4.2. Low residual double taxation risk

To begin, let us preview the different equilibria regions when the residual double taxation risk is low $\varepsilon < \underline{\varepsilon}$ in Figure 2, depending on the probability of tax rule inconsistency p and inconsistency cost k. Importantly, the equilibrium that is played crucially depends on the specific country-pair combination in which the firm's business activity takes place. The intuition for all equilibria regions is illustrated in Figure 4 in the Appendix A. There, we provide a parsimonious classification for potentially observed equilibria, taking Germany as a fixed part of the country-pair combination.[14]

When the residual double taxation risk is low, the following equilibria arise when p is smaller than p_1^*.

[14]Germany is a global pioneer with regard to joint tax audits (Braun et al. 2020, Criclivaia 2020), making it a particularly fitting example.

Figure 2. Equilibria regions when residual double taxation risk is low



Notes: Parameters are $\tau_H = 30\%$, $\tau_L = 15\%$, $\pi = 30\%$, $b = 0.1$, $c_H = 0.04$, $c_L = 0.06$ and $K = 0.07$, requiring $\varepsilon < \underline{\varepsilon} = 0.4$.

Proposition 1. *If $p < p_1^*$ and*

(i) if $k < k_I^*$, we obtain equilibrium I^{NA}.

The firm chooses a mixed reporting strategy α^* in y_H and always reports x_L in y_B ($\beta^* = 0$). The tax authorities do not conduct joint tax audits. Auditor H chooses a mixed auditing strategy γ^* of reports x_L, and auditor L never audits reports x_H ($\delta^* = 0$).

(ii) if $k > k_I^*$, we obtain equilibrium I^{JA}.

The firm chooses a mixed reporting strategy α^* in y_H and always reports x_L in y_B ($\beta^* = 0$). The tax authorities conduct joint tax audits of reports x_L with probability $\mu_L^*(x_L)$, and no joint tax audits of reports x_H. Auditor H chooses a mixed auditing strategy γ^* of reports x_L, and auditor L never audits reports x_H ($\delta^* = 0$).

In equilibrium I^{NA}, no joint tax audits are established because the (expected) inconsistency costs are too low ($k < k_I^*$), particularly for tax authority L. Further, there is no pure strategy with regard to auditor H's national audit strategy γ^* and aggressive income shifting α^*. Intuitively, when auditor H always audits ($\gamma = 1$), the firm will never engage in aggressive income shifting ($\alpha = 1$); but then the relatively low inconsistency $p < p_1^*$ implies that auditor H would not audit anymore ($\gamma = 0$). However, if auditor H does not audit, the firm would prefer to always engage in aggressive income shifting ($\alpha = 0$), which incentivizes auditor H to always audit. Thus, the only equilibrium is in mixed strategies γ^* and α^*. Also, as the residual double taxation risk is low, the firm prefers to always engage in moderate income shifting $\beta^* = 0$. Consequently, auditor L never audits $\delta^* = 0$.

In equilibrium I^{JA}, some joint tax audits of reports x_L are conducted when the (expected) inconsistency costs are sufficiently high ($k > k_I^*$). In addition, the same notion for auditor H's audit strategy and aggressive income shifting as in equilibrium I^{NA} applies, requiring randomization γ^* and α^*. The reason that only *some* reports x_L are jointly audited is as follows. If tax authority L always opted for a joint audit ($\mu_L(x_L) = 1$), the joint audit would always be established (see Lemma 1). Then, aggressive income shifting would be deterred ($\alpha = 1$), and the relatively low inconsistency $p < p_1^*$ implies that auditor H would not audit ($\gamma = 0$). This, however, mutes the off the equilibrium path audit threat of auditor H, leading to expected inconsistency costs of zero. Then, tax authority L would prefer a national audit $(\mu_L(x_L) = 0)$ to avoid the joint audit coordination cost $K > 0$. By contrast, due to $k > k_I^*$, the (expected) inconsistency costs in the national audit equilibrium I^{NA} are so high that tax authority L wants to conduct some joint tax audits. Thus, the equilibrium requires mixed strategy $\mu_L^*(x_L)$.

Equilibria I^{NA} and I^{JA} correspond to settings with limited disputes over the application of tax rules and country pairs with binding arbitration or sufficiently different tax rates. Equilibrium I^{NA} is likely when both countries consistently apply the OECD Transfer Pricing Guidelines and exhibit relatively moderate MAP durations. Many transaction within the European Union, for example, among Germany (high-tax) and Ireland (low-tax) could fall into this category. By contrast, equilibrium I^{JA} would require a country pair characterized by significantly prolonged MAP or arbitration procedures.

Next, we turn to the equilibria that arise when p is larger than p_1^*.

Proposition 2. *If $p > p_1^*$ and*

(i) *if $k < k_{II}^*$, we obtain equilibrium II^{NA}.*

The firm always reports x_H in y_H ($\alpha^* = 1$) and x_L in y_B ($\beta^* = 0$). The tax authorities do not conduct joint tax audits. Auditor H always audits reports x_L ($\gamma^* = 1$), and auditor L never audits reports x_H ($\delta^* = 0$).

(ii) *if $k > k_{II}^*$, we obtain equilibrium II^{JA}.*

The firm always reports x_H in y_H ($\alpha^* = 1$) and x_L in y_B ($\beta^* = 0$). The tax authorities always conduct joint tax audits of reports x_L, and never of reports x_H. Auditor H would always audit reports x_L ($\gamma^* = 1$), and auditor L never audits reports x_H ($\delta^* = 0$).

In equilibrium II^{NA}, no joint tax audit is established because the (expected) inconsistency costs are too low for tax authority L to initiate one ($k < k_{II}^*$). Compared to equilibrium I^{NA}, auditor H has now sufficient incentives to always audit report x_L due to $p > p_1^*$, although the report solely stems from moderate income shifting. Thus, $\alpha^* = \gamma^* = 1$ arise simultaneously, and, together with $\beta^* = \delta^* = 0$, constitute this pure strategy equilibrium.

In equilibrium II^{JA}, the inconsistency costs are sufficiently high ($k > k_{II}^*$) that both tax authorities always initiate joint tax audits after a report x_L. Compared to equilibrium II^{NA}, the authorities' joint audit decision neither changes the firm's income shifting decisions nor the auditors' audit strategies. The reason is that, from the firm's perspective, both the joint and national audit are qualitatively identical in uncovering aggressive income shifting. Also, the firm still prefers to always engage in moderate income shifting, as the resulting joint audit eliminates double taxation and yields a higher payoff than the otherwise certain tax payment of τ_H. Importantly, our equilibrium concept requires auditor H to act optimally off the equilibrium path. The resulting audit threat ($\gamma^* = 1$) ensures that authority L opts for the joint audit to avoid the inconsistency costs that would otherwise arise in a national audit.

Equilibria II^{NA} and II^{JA} reflect situations with substantial disputes over the application of tax rules, but where dispute resolution mechanisms to eliminate double taxation are in place.

Transactions involving many European countries and Italy are likely to fall under equilibrium II^{JA}, as Italy is known for unilateral transfer pricing adjustments (Diller et al. 2021).

Corollary 1 emphasizes two additional implications of the equilibria.

Corollary 1. *The required inconsistency costs for joint tax audits approach to infinity when* $\tau_L = 0$*, and are (significantly) higher when tax rules are consistently applied (*$p < p_1^*$*).*

First, we find that joint tax audits do not occur with tax haven countries ($\tau_L = 0$), as the required inconsistency costs k_I^* and k_{II}^* get extremely high. Second, we find that when tax rule inconsistency is low, joint tax audits require significantly higher inconsistency costs ($k_I^* \gg k_{II}^*$) to be worthwhile for the authorities. Put differently, joint audits are less likely in low-p environments unless the (expected) inconsistency costs stemming from MAPs or arbitration are very high. The requirement $k > k_I^*$ could reflect extremely long and resource-intensive MAPs, as, on average, in cases involving the United States (Martini et al. 2025). By contrast, if $k > k_{II}^*$, joint audits may become attractive even under average MAP or arbitration durations. Notably, marginal increases in p, especially around the threshold p_1^*, can substantially expand the joint audit equilibrium range, as auditor H's strategy changes discontinuously.

The strategies of the players are summarized in Table 3 when the residual double taxation risk is low.

Table 3. Equilibria strategies (low residual double taxation risk)

Strategy	Equil. I^{NA}	Equil. II^{NA}	Equil. I^{JA}	Equil. II^{JA}
$\mu_L(x_L)\mu_H(x_L)$	0	0	$\mu_L^*(x_L)$	1
$\mu_L(x_H)\mu_H(x_H)$	0	0	0	0
α	α^*	1	α^*	1
β	0	0	0	0
γ	γ^*	1	γ^*	1
δ	0	0	0	0

4.3. High residual double taxation risk

Now, we turn to the different equilibria regions when the residual double taxation risk is high ($\varepsilon > \overline{\varepsilon}$). The following equilibria arise when p is smaller than p_3^*. We preview the different equilibria in Figure 3.

Proposition 3. *If $p < p_3^*$,*

(i) we obtain equilibrium V^{NA}.
The firm chooses a mixed reporting strategy α^* in y_H and always reports x_H in y_B ($\beta^* = 1$). The tax authorities do not conduct joint tax audits. Auditor H chooses a mixed auditing strategy γ^* of reports x_L, and auditor L never audits reports x_H ($\delta^* = 0$).

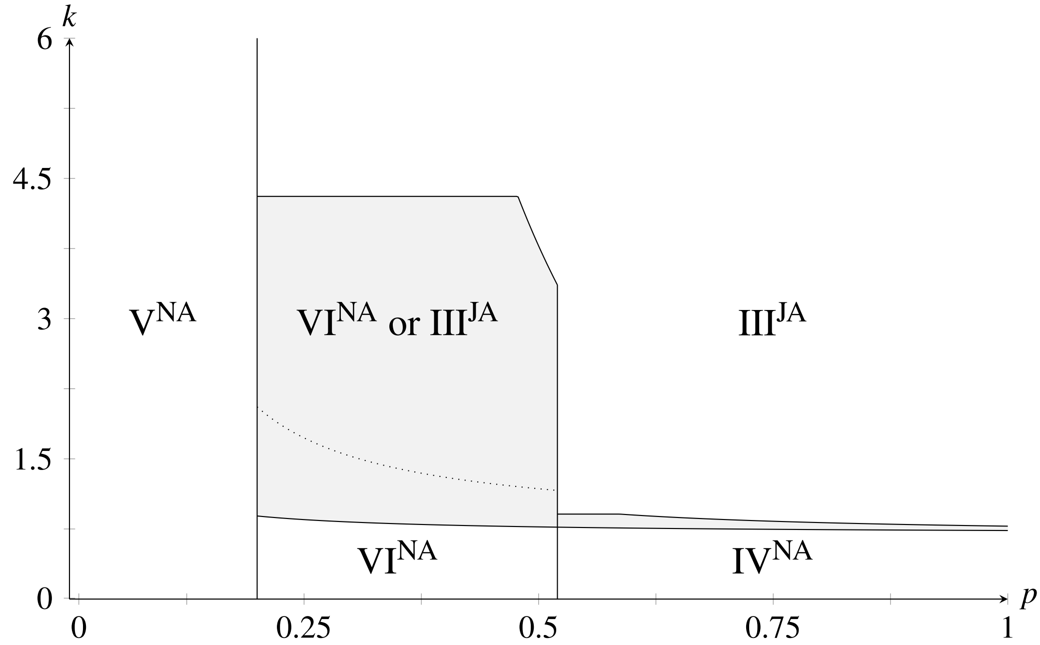
(ii) $p_1^* < p < p_3^*$ and $k > k_{II}^*$, we obtain equilibrium II^{JA} (see Proposition 2 (ii)).

(iii) $p_3^* < p_1^*$ and $k > k_V^*$, we obtain equilibrium I^{JA} (see Proposition 1 (ii)).

In equilibrium V^{NA}, the tax authorities prefer national audits over joint audits. Further, the firm engages in some aggressive income shifting α^* but no moderate income shifting ($\beta^* = 1$). The relatively low inconsistency implies that auditor H does not want to always audit. However, the national audit probability γ^* together with the high double taxation probability ε deter moderate income shifting. Although $\beta^* = 1$ creates audit incentives for auditor L, the level of inconsistency is yet too low for auditing reports x_H ($\delta^* = 0$). Interestingly, this national audit equilibrium exists independent of the size of inconsistency costs k. The reason is that in this national audit equilibrium, the tax authorities do not incur any inconsistency costs in expectation. Hence, they have no incentive to conduct joint audits. Notably, this is the *only* national audit equilibrium with this characteristic.

The mere fact that tax authorities would always prefer a national tax audit when $p < p_3^*$ does not imply that this equilibrium is actually played. As we show in Proposition 3 (ii) and (iii), joint audit equilibria do exist when $p < p_3^*$. First, consider the case $p_3^* < p_1^*$ depicted in Figure 3, which occurs if auditor L's audit cost c_L is not too high. Then, for very high inconsistency costs $k > k_V^*$, the firm prefers to play equilibrium I^{JA}, as the prevalence of some joint tax audits

Figure 3. Equilibria regions when the residual double taxation risk is high



Notes: Parameters are $\tau_H = 30\%$, $\tau_L = 25\%$, $\pi = 30\%$, $b = 0.1$, $c_H = 0.04$, $c_L = 0.06$, $K = 0.07$ and $\varepsilon = 0.9 > 0.47 \approx \overline{\varepsilon}$, implying $p_3^* = 0.2 < p_1^* = 0.25 < p_2^* = 0.52$. The gray area indicates regions where multiple equilibria exist. For example, within the gray area when $p > p_2^*$, equilibria IV^{NA} and III^{JA} cannot be ranked according to weak payoff dominance. Equilibrium I^{JA} lies out of the plot range and starts to exist for $k > k_V^*|_{p=p_3^*} \approx 8.2$, with k_V^* reaching its minimum value at p_3^*. The dotted line indicates the value of k above which equilibrium III^{JA} would be ex ante efficient when $p_3^* < p < p_2^*$ (see Proposition 7 below).

($\mu_L^*(x_L) > 0$) would reduce the firm's expected tax payments compared to equilibrium V^{NA} (see Proposition 6 below). In the figure, k_V^* is, however, outside the plot range, suggesting that this equilibrium is unlikely to occur when tax rate differences are low compared to when the differences are high. Second, consider the case $p_1^* < p < p_3^*$, which requires that c_L is higher than c_H. For example, in Figure 3, $p_1^* < p_3^*$ would require $c_L > 0.0\overline{6}$, all else equal. When tax rule inconsistency takes these weakly intermediate values, the firm always prefers to play equilibrium II^{JA} as its resulting expected tax payments in state y_B are lower. Taken together, we cannot rank these potential national and joint audit equilibria according to weak payoff dominance and thus cannot make a prediction on which equilibrium will arise. However, we expect that firms will try to persuade tax authorities to conduct joint tax audits if they report the disputed income in the low-tax country.

The presented equilibria correspond to settings in which the difference in tax rates between the countries is similar and the residual risk of double taxation is substantial, but there are limited disputes on the application of tax rules. We expect that national tax audits are the likely outcome in these scenarios.

The following equilibria arise when p is larger than p_3^* but smaller than p_2^*.

Proposition 4. *If $p_3^* < p < p_2^*$ and*

(i) if $k < k_{VI}^*$, we obtain equilibrium VI^{NA}.
The firm chooses a mixed reporting strategy α^* in y_H and β^* in y_B. The tax authorities do not conduct joint tax audits. Auditor H chooses a mixed auditing strategy γ^* of reports x_L, and auditor L chooses a mixed auditing strategy δ^* of reports x_H.

(ii) if $k > k_{III}^*$, we obtain equilibrium III^{JA}.
The firm chooses a mixed reporting strategy α^* in y_H and always reports x_H in y_B ($\beta^* = 1$). The tax authorities always conduct joint tax audits of reports x_H, and never of reports x_L. Auditor H chooses a mixed auditing strategy γ^* of reports x_L, and auditor L would always audit reports x_H ($\delta^* = 1$).

In equilibrium VI^{NA}, the inconsistency costs are too low ($k < k_{VI}^*$) for joint tax audits to be strictly preferred by the authorities despite the intermediate tax rule inconsistency p. Compared to equilibrium V^{NA}, auditor L now audits with positive probability $\delta^* > 0$, because state y_B is sufficiently likely when $p > p_3^*$. As a response, the firm engages in some moderate income shifting to balance the double taxation arising from the national audits by both auditors.

In equilibrium III^{JA}, the tax authorities always initiate joint tax audits after a report x_H when the inconsistency costs are sufficiently high ($k > k_{III}^*$).[15] The other strategies on the equilibrium path are mostly in line with equilibrium V^{NA}. The firm engages in some aggressive income shifting α^* and auditor H audits reports x_L with probability γ^*. A pure strategy by either of the two players cannot be sustained in equilibrium. Further, the firm chooses report x_H in state

[15] Our equilibrium refinement to focus on weakly payoff dominant equilibria excludes equilibrium II^{JA} in this parameter range. As we show in section 5, the expected tax payments in II^{JA} are identical but the tax authorities' deadweight losses are higher.

y_B ($\beta^* = 1$), because auditor H's audit threat and the relatively high double taxation amount deter moderate income shifting. Auditor L acts optimally off the equilibrium path and creates a credible threat that inconsistency costs after a report x_H occur ($\delta^* = 1$), inducing the tax authorities to coordinate on a joint tax audit.

Our results imply that when the inconsistency costs take intermediate values ($k^*_{III} < k < k^*_{VI}$), both equilibria coexist and no prediction can be made concerning the equilibrium that will be played. Again, the firm will promote the use of joint tax audits as the expected tax payments are lower in expectation, while at least one tax authority is better off in the national audit equilibrium. Intuitively, the firm acknowledges that a certain minimum level of inconsistency costs k^*_{III} is necessary for an equilibrium, although it unambiguously prefers a joint tax audit independent of this minimum level. By contrast, one tax authority is only willing to give up the higher expected tax payments in the purely national audit equilibrium when the inconsistency costs exceed k^*_{VI}. In Figure 3, tax authority L is reluctant to give up the purely national audit for $p^*_3 < p < 0.48$, while authority H is reluctant for $0.48 < p < p^*_2$. To sum up, only if the inconsistency costs are low (high), we can conclude that the pure national (partial joint) audit equilibrium will be played.

The presented equilibria correspond to settings in which the (in-)consistency in the application of tax rules takes intermediate values. Also, the equilibria require that the residual risk that double taxation prevails is high or that the tax rate differential between the countries is low. The former describes many transactions between European countries and non-European countries such as China and India, as the latter two reject mandatory binding arbitration in their tax treaties. The latter can occur even between European countries if the characteristics of the transaction favor national litigation over dispute resolution via MAP or arbitration.[16]

Lastly, we present the equilibria that arise when p is larger than p^*_2.

[16]The threshold values for the required inconsistency costs can, for example, correspond to the three tertiles of average MAP duration of countries as reported in Appendix A.

Proposition 5. *If* $p > p_2^*$ *and*

(i) *if* $k < k_{IV}^*$*, we obtain equilibrium* IV^{NA}*.*
The firm always reports x_H *in* y_H *(*$\alpha^* = 1$*) and chooses a mixed reporting strategy* β^* *in* y_B*. The tax authorities do not conduct joint tax audits. Auditor H always audits reports* x_L *(*$\gamma^* = 1$*), and auditor L chooses a mixed auditing strategy* δ^* *of reports* x_H*.*

(ii) *if* $k > k_{III}^*$*, we obtain equilibrium* III^{JA} *(see Proposition 4 (ii)).*

Equilibrium IV^{NA} constitutes an aggressive national audit equilibrium when the inconsistency costs are sufficiently low ($k < k_{IV}^*$). Here, compared to VI^{NA}, the even higher level of inconsistency induces auditor H to adopt a pure audit strategy of always auditing x_L. Consequently, the firm does not engage in aggressive income shifting ($\alpha^* = 1$). In addition, the firm engages in some moderate income shifting and auditor L audits some reports x_H with probability δ^* that is higher than under VI^{NA}.

Since the national audit probabilities are higher in equilibrium IV^{NA} than in VI^{NA}, the required inconsistency costs for a joint tax audit decrease: $k_{IV}^* < k_{VI}^*$. Notably, Figure 3 shows that a range with coexistence of equilibria IV^{NA} and III^{JA} exists, but is negligible in terms of its expected occurrence. The reason is that both auditors' audit probabilities discontinuously increase, sharply increasing the authorities' expected inconsistency costs in IV^{NA}. When the inconsistency costs are sufficiently high ($k > k_{III}^*$), we obtain III^{JA} in which joint tax audits are initiated after reports x_H. Interestingly, this joint audit equilibrium involves more aggressive income shifting as compared to the respective national audit counterparts IV^{NA} and VI^{NA}. As this result becomes more likely when the countries' tax rates are similar, we find that joint tax audits can lead to more aggressive income shifting to (non-traditional) low-tax countries.

Equilibrium III^{JA} typically arises when the residual double taxation probability is high and the countries disagree on the application of tax rules. The range in which this equilibrium is the unique outcome expands significantly when tax rules are inconsistently applied. We expect that joint tax audits are most commonly initiated by the respective authorities in such cases, even when inconsistency costs are moderate.

Table 4 shows the equilibria illustrated in Figure 3. We omit equilibria I^{JA} and II^{JA}, as these equilibria have already been depicted in Table 3.[17]

Table 4. Equilibria strategies (high residual double taxation risk)

Strategy	Equil. IV^{NA}	Equil. V^{NA}	Equil. VI^{NA}	Equil. III^{JA}
$\mu_L(x_L)\mu_H(x_L)$	0	0	0	0
$\mu_L(x_H)\mu_H(x_H)$	0	0	0	1
α	1	α^*	α^*	α^*
β	β^*	1	β^*	1
γ	1	γ^*	γ^*	γ^*
δ	δ^*	0	δ^*	1

5. Economic effects of joint tax audits

5.1. Firm's expected tax payments

In this section, we examine how joint tax audits affect the firm's expected tax payments. Proposition 6 summarizes the result.

Proposition 6. *The existence of joint tax audits*

(i) increases the firm's expected tax payments when $\varepsilon < \frac{\tau_H - \tau_L}{2\tau_H}$ *and decreases them when* $\frac{\tau_H - \tau_L}{2\tau_H} < \varepsilon < \underline{\varepsilon}$ *in equilibria* I^{JA} *and* II^{JA} *(low residual double taxation risk case);*

(ii) decreases the firm's expected tax payments in equilibria I^{JA}*,* II^{JA} *and* III^{JA} *when* $\varepsilon > \overline{\varepsilon}$ *(high residual double taxation risk case).*

The effect of joint tax audits on expected tax payments is evaluated relative to the national audit benchmark that would prevail in their absence. Across all equilibria, the expected tax payments

[17] The case $\underline{\varepsilon} < \varepsilon < \overline{\varepsilon}$ does not lead to additional qualitative insights beyond the high residual double taxation risk case. While there is an additional national audit equilibrium when $p_1^* < p < p_2^*$ and inconsistency costs are sufficiently low (equilibrium III^{NA}), no additional joint tax audit equilibrium emerges. Further, we also have a considerable range where the purely national audit and partial joint audit equilibrium coexist when inconsistency costs take intermediate values. Depending on parameters, both joint audits after reports x_L and x_H can occur, with joint audits conditional on x_L (on x_H) becoming more likely when ε is lower (higher).

in the consistent states y_L and y_H remain unchanged. In state y_L, the firm always reports x_L, a dominant strategy that leads to a tax payment of τ_L, irrespective of subsequent audit decisions. Similarly, in state y_H, the expected tax payment equals τ_H in all equilibria. To illustrate, consider equilibria III$^{\text{JA}}$ and IV$^{\text{NA}}$. In IV$^{\text{NA}}$, the firm adopts a pure strategy $\alpha^*_{IV^{NA}} = 1$, reporting x_H in y_H and thereby paying τ_H with certainty, since double taxation is not possible in the consistent state. By contrast, in III$^{\text{JA}}$, the firm randomizes in y_H with probability $\alpha^*_{III^{JA}} = (b-2c_H)/(b-c_H) > 0$. However, the mere fact that it randomizes implies that the firm's expected tax payment from reporting x_L or x_H must be equal, that is, τ_H. These observations suggest that any differences in tax payments induced by the presence of joint tax audits originate from the inconsistent state y_B.

We show that when the residual risk of double taxation is sufficiently low ($\varepsilon < \frac{\tau_H - \tau_L}{2\tau_H}$), joint tax audits increase expected tax payments. This is because, in the corresponding national audit equilibria I$^{\text{NA}}$ and II$^{\text{NA}}$, the firm engages in moderate income shifting ($\beta^* = 0$), reporting disputed income in the low-tax country. Given the low residual risk of double taxation, the firm anticipates paying close to τ_L on the disputed income in state y_B. By contrast, in a joint tax audit, the two authorities coordinate and agree to split the income, with tax authority H receiving a substantial share. As a result, expected tax payments rise to $\frac{\tau_L + \tau_H}{2}$. Thus, while joint audits eliminate double taxation, they also prevent the firm from fully leveraging the tax rate differential, thereby increasing its overall tax payments.

Further, we demonstrate that once the residual risk of double taxation becomes sufficiently high, joint tax audits reduce the firm's expected tax payments. Notably, this result holds irrespective of the residual double taxation risk case or the degree of tax rule inconsistency between the countries. The underlying mechanism is straightforward. Because joint tax audits require both authorities to agree on a common report (e.g., a common transfer price), a high residual risk of double taxation ε undermines the prospects of reaching such an agreement. This reflects a general coordination friction that mirrors findings on Bilateral Advance Pricing Agreements (De Waegenaere et al. 2007), and we also find this for joint tax audits when tax rule inconsistency is low ($p < p_3^*$). When inconsistency is high ($p > p_3^*$), however, the impact of ε becomes more complex. On the one hand, ε increases the thresholds k^*_{IV} and k^*_{VI}, thereby narrowing the parameter regions where the equilibrium with joint audit is unique. On the other hand, it also expands the conditions under which equilibrium III^{JA} emerges, allowing joint audits to become viable over a wider range of inconsistency costs. Hence, the overall effect of ε on the occurrence of joint audits is ambiguous. While it raises coordination barriers from the authorities' perspective, it can simultaneously promote joint audits by making them more attractive to the firm due to lower expected tax payments.

5.2. Tax audit efficiency

In this section, we examine how joint tax audits affect tax audit efficiency. Since the firm's tax payments correspond to tax revenues for the authorities, they represent zero-sum transfers and do not affect efficiency. We define tax audit efficiency as the inverse of the tax authorities' expected deadweight losses, which arise from inconsistency and coordination costs. In other words, the lower these audit-related losses, the higher the tax audit efficiency.[18]

The following observation has already been used for equilibrium selection, but we highlight it explicitly due to its counterintuitive nature and conceptual significance.

Corollary 2. *Due to aggressive income shifting ($1-\alpha^* > 0$), tax audit efficiency in equilibrium III^{JA} is higher than in equilibrium II^{JA}.*

In particular, we apply Corollary 2 in the high residual double taxation risk case, selecting equilibrium III^{JA} over II^{JA} whenever both exist within the same parameter range. Given that the expected tax payments are identical, the lower deadweight losses in III^{JA} render it the weakly payoff-dominant outcome. A particularly striking implication of this result is that tax audit efficiency improves not *despite* but *because* of aggressive income shifting. While such behavior might initially appear to undermine enforcement objectives, it can in fact enhance efficiency in our setting. Specifically, the firm's willingness to shift income in the consistent state y_H

[18] We exclude the tax auditors' payoffs from our definition of tax audit efficiency. This omission is without loss of generality in equilibria where auditor H plays a mixed strategy or is off the equilibrium path; auditor L always has an expected payoff of zero. In these cases, our efficiency concept effectively coincides with social welfare. Only in equilibria II^{NA} and IV^{NA} does it slightly understate overall welfare. However, under the plausible assumption that auditor H's net benefit of uncovering income shifting $b-c_H$ is negligible relative to tax revenues, inconsistency costs, and coordination costs, our efficiency measure remains a valid proxy for welfare.

allows joint audits to be more effectively directed toward genuine disputes, without distorting tax payments. Thus, aggressive income shifting, typically viewed as a concern, can serve a beneficial role in improving the allocation of audit resources between national and joint procedures.

Next, Proposition 7 summarizes how the existence of joint tax audits affects tax audit efficiency.

Proposition 7. *The existence of joint tax audits*

(i) increases tax audit efficiency in case the residual double taxation risk is low;

(ii) can increase or decrease efficiency in case the residual double taxation risk is high.

When the residual double taxation risk is low (part (i)), joint audits are efficient if implemented. However, they may not be established even when they would improve overall efficiency. Mutual consent ensures that both authorities benefit, yet also creates a coordination barrier. Tax authority L blocks cooperation, as it only considers its own avoided inconsistency costs and ignores potentially greater costs faced by tax authority H. This leads to coordination failures rooted in decentralized decision-making despite potential efficiency gains.

When the residual double taxation risk is high (part (ii)), joint tax audits can be inefficient. Consider equilibrium V^{NA} under low inconsistency ($p < p_3^*$). This equilibrium is efficient because national audits only occur in consistent states, avoiding any deadweight losses in the inconsistent state. However, equilibria I^{JA} and II^{JA} may coexist, since the firm seeks to avoid high tax payments in the inconsistent state under national audits. Coordination on a joint audit equilibrium, even if inefficient, can still emerge, as all players' strategies are mutual best responses in these equilibria. This highlights a tension between individual rationality and collective efficiency. Joint audits, while desirable from the firm's perspective, generate higher coordination burdens for the tax authorities.

These inefficiencies also arise at intermediate levels of tax rule inconsistency ($p_3^* < p < p_2^*$). The dotted line in Figure 3 indicates the threshold above which equilibrium III^{JA} is efficient. Below this line, joint audits may still emerge as equilibrium outcomes, but they are inefficient due to high coordination costs relative to expected inconsistency costs. This type of inefficiency is specific to joint tax audits and contrasts with other dispute prevention tools such as bilateral

APAs (De Waegenaere et al. 2007) or cooperative compliance programs (De Simone et al. 2013). The result arises because of the different firm behavior in equilibrium III^{JA} as compared to VI^{NA}. By never engaging in moderate income shifting when joint audits as an instrument exist, the firm facilitates these audits even for lower levels of inconsistency costs ($k^*_{III} < k^*_{VI}$). This mechanism is in contrast to the low residual double taxation risk case, where the firm always engages in moderate income shifting *independent* of the respective joint or national audit equilibrium.

Overall, our analysis reveals two interesting results. First, joint tax audits tend to be least efficient precisely when firms are most likely to promote them. Second, we find that marginal increases in tax rule consistency at $p = p^*_2$ can be detrimental to tax audit efficiency, as they may trigger premature coordination. However, marginal increases in consistency at $p = p^*_3$ always increase tax audit efficiency, highlighting the non-trivial role of harmonizing tax rules.

6. Conclusions

We investigate tax authorities' use of joint tax audits in cross-border tax cases of a multinational firm. Joint tax audits have emerged as a coordinated enforcement tool, aimed at resolving potential tax disputes early before cases escalate into costly resolution procedures. Our model features a firm's income shifting decisions, tax authorities' joint audit decisions, and, when these are not established, tax auditors' national audit decisions. We pose two interrelated research questions. First, under what circumstances do joint tax audits arise? Second, how do joint audits affect the firm's expected tax payments and tax audit efficiency, measured by the tax authorities' expected deadweight losses from auditing?

We find that whether joint tax audits arise depends on the firm's residual double taxation risk *absent* joint tax audits. When this risk is low (e.g., due to mandatory binding arbitration), joint audits only occur if they reduce tax authorities' expected deadweight losses, comprising coordination and inconsistency costs, relative to national audits. However, not all efficiency-enhancing joint audits are established, as mutual consent by all authorities is required. When the double taxation risk is high and tax rule inconsistency is not too low, joint audits can occur more often, as the required inconsistency costs are lower than under low double taxation risk.

The result that more joint audits *can* occur does not imply that these *must* occur. Unless the required inconsistency costs are sufficiently high, the tax authorities favor national audits, while the firm prefers (some) joint audits due to lower expected tax payments. If joint audits occur when the residual double taxation risk is high, their occurrence does not guarantee improvements in tax audit efficiency although both authorities give their consent. The reason is that the firm alters its income shifting behavior, which can trigger inefficient joint audits. In particular, joint audits tend to be most inefficient when firms are most likely to promote them.

Our findings have regulatory implications. When the residual double taxation risk is low, a regulatory cost-sharing mechanism that reallocates coordination costs from the low-tax to the high-tax authority could enable more coordinated enforcement and efficient outcomes. This is because the low-tax authority blocks some efficient joint audits in these cases. For example, the Fiscalis Programme within the European Union can fulfill this objective if specifically designed for that purpose. By contrast, when the residual double taxation risk is high, a third-party cost-sharing approach involving the firm is more suitable, as either tax authority may block the joint audit. If the firm shares part of the coordination burden, such mechanisms could better align the firm's preferences with overall efficiency goals.

This study offers guidance for future empirical research. In particular, the introduction of DAC7 provides a valuable opportunity to examine changes in tax audit efficiency, as it establishes a legally binding framework for joint tax audits within Europe and encourages their broader use. Empirical analyses could focus on the effect of joint audits on audit completion times in cross-border settings. Such analyses would require detailed cross-country data on audit outcomes and durations, as well as proxies—potentially survey-based—for tax rule inconsistency. Key control variables include country-pair MAP durations and tax rate differentials. Alternatively, researchers could investigate whether and to what extent the broader use of joint tax audits affects the number of APAs or MAPs initiated. Since these procedures are generally considered costly and time-consuming, a reduction in their use may indirectly signal greater tax audit efficiency.

References

Biehl, H., Bleibtreu, C., & Stefani, U. (2022). Effects of Joint Audits on Audit Quality and Audit Costs: A Game-Theoretical Explanation for Contradictory Empirical Results. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.3816011

Blaufus, K., Bock, J., Peuthert, B., & Schwäbe, A. N. (2025). The Effect of Individual Tax Auditor Characteristics on Tax Audit Efficiency – Implications for Auditor Training and Allocation. *Journal of the American Taxation Association, forthcoming*, 1–26. https://doi.org/10.2308/JATA-2023-010

Blaufus, K., Reineke, J., & Trenn, I. (2023). Perceived Tax Audit Aggressiveness, Tax Control Frameworks and Tax Planning: An Empirical Analysis. *Journal of Business Economics*, *93*(3), 509–557.

Blaufus, K., Schöndube, J. R., & Wielenberg, S. (2024). Information Sharing between Tax and Statutory Auditors: Implications for Tax Audit Efficiency. *European Accounting Review*, *33*(2), 545–568.

Braun, M., Eisgruber, T., Greil, S., & Schmitz, S. (2020). Joint Audits: The German Experience. *International Tax Review*, *31*, 23–25.

Burgers, I. J., & Criclivaia, D. (2016). Joint Tax Audits: Which Countries May Benefit Most? *World Tax Journal*, *8*(3), 306–355.

Čičin-Šain, N., & Englisch, J. (2022). DAC 7: An Entire New Framework for Joint Audits in the EU: How Do the Taxpayers Fare? *Intertax*, *50*(1), 7–27.

Criclivaia, D. (2020). Joint Audits–Ten Years of Experience: A Literature Review. *World Tax Journal*, *12*(3), 663–708.

De Simone, L., Sansing, R. C., & Seidman, J. K. (2013). When are Enhanced Relationship Tax Compliance Programs Mutually Beneficial? *The Accounting Review*, *88*(6), 1971–1991.

De Waegenaere, A., Sansing, R. C., & Wielhouwer, J. L. (2006). Who Benefits from Inconsistent Multinational Tax Transfer-Pricing Rules? *Contemporary Accounting Research*, *23*(1), 103–131.

De Waegenaere, A., Sansing, R. C., & Wielhouwer, J. L. (2007). Using Bilateral Advance Pricing Agreements to Resolve Tax Transfer Pricing Disputes. *National Tax Journal*, *60*(2), 173–191.

Deng, M., Lu, T., Simunic, D. A., & Ye, M. (2014). Do Joint Audits Improve or Impair Audit Quality? *Journal of Accounting Research*, *52*(5), 1029–1060.

Diller, M., Kortebusch, P., Schneider, G., & Sureth-Sloane, C. (2017). Boon or Bane? Advance Tax Rulings as a Measure to Mitigate Tax Uncertainty and Foster Investment. *European Accounting Review*, *26*(3), 441–468.

Diller, M., Lorenz, J., Schneider, G., & Sureth-Sloane, C. (2025). Is Tax Transfer Pricing Harmonization a Panacea? Real Effects of Global Tax Transparency and Standards Consistency. *The Accounting Review*, *100*(2), 71–102.

Diller, M., Lorenz, J., & Sureth-Sloane, C. (2021). Inconsistent Tax Transfer Prices: Tax Filings, Audits, and Double Taxation. *TRR 266 Accounting for Transparency*. https://doi.org/10.52569/ACPJ5634

EU Council. (2017). Council Directive (EU) 2017/1852, 1–14. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017L1852

Federal Central Tax Office. (2025). Cross-border Audit Cooperation in Joint Audits and Simultaneous Controls in Direct Tax Matters. https://www.bzst.de/EN/Businesses/Joint_Audit/joint_audit_node.html

Form, A., & Oestreicher, A. (2021). Possibilities for Improving Transfer Pricing Procedures. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.4862817

Gibbons, R. (1992). *A Primer in Game Theory*. FT Prentice Hall.

Graetz, M. J., Reinganum, J. F., & Wilde, L. L. (1986). The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement. *Journal of Law, Economics, & Organization*, *2*(1), 1–32.

Harsanyi, J. C., & Selten, R. (1988). *A General Theory of Equilibrium Selection in Games*. The MIT Press.

Korn, E., & Schiller, U. (2003). Voluntary Disclosure of Nonproprietary Information: A Complete Equilibrium Characterization. *Journal of Business Finance & Accounting*, *30*(9-10), 1327–1339.

Kourouxous, T., Krenn, P., & Niemann, R. (2024). How do Tax Courts Affect Tax Compliance and Tax Audits? A Game-theoretic Analysis. *SSRN Electronic Journal*. https://ssrn.com/abstract=4995621

Mansori, K. S., & Weichenrieder, A. J. (2001). Tax Competition and Transfer Pricing Disputes. *FinanzArchiv/Public Finance Analysis*, *58*(1), 1–11.

Martini, J. T., Niemann, R., Simons, D., & Voeller, D. (2025). Incentive Effects of Tax Transparency: Does Country-by-Country Reporting Call for Arbitration? *Journal of Accounting and Public Policy*, *49*, 107278.

Mills, L. F., Robinson, L. A., & Sansing, R. C. (2010). FIN 48 and Tax Compliance. *The Accounting Review*, *85*(5), 1721–1742.

Multistate Tax Comission. (1970). Third Annual Report Multistate Tax Commission, 1–27. https://www.mtc.gov/wp-content/uploads/2023/11/FY69-70.pdf

OECD. (2015). Making Dispute Resolution Mechanisms More Effective, Action 14 - 2015 Final Report, 1–50. https://www.oecd.org/en/publications/making-dispute-resolution-mechanisms-more-effective-action-14-2015-final-report_9789264241633-en.html

OECD. (2019). Joint Audit 2019 – Enhancing Tax Co-operation and Improving Tax Certainty, 1–75. https://www.oecd.org/en/publications/joint-audit-2019-enhancing-tax-co-operation-and-improving-tax-certainty_17bfa30d-en.html

PwC. (2025). Global Tax Controversy and Dispute Resolution Survey. https://www.pwc.com/gx/en/services/tax/tax-controversy-dispute-resolution-survey.html

Raimondos-Møller, P., & Scharf, K. (2002). Transfer Pricing Rules and Competing Governments. *Oxford Economic Papers*, *54*(2), 230–246.

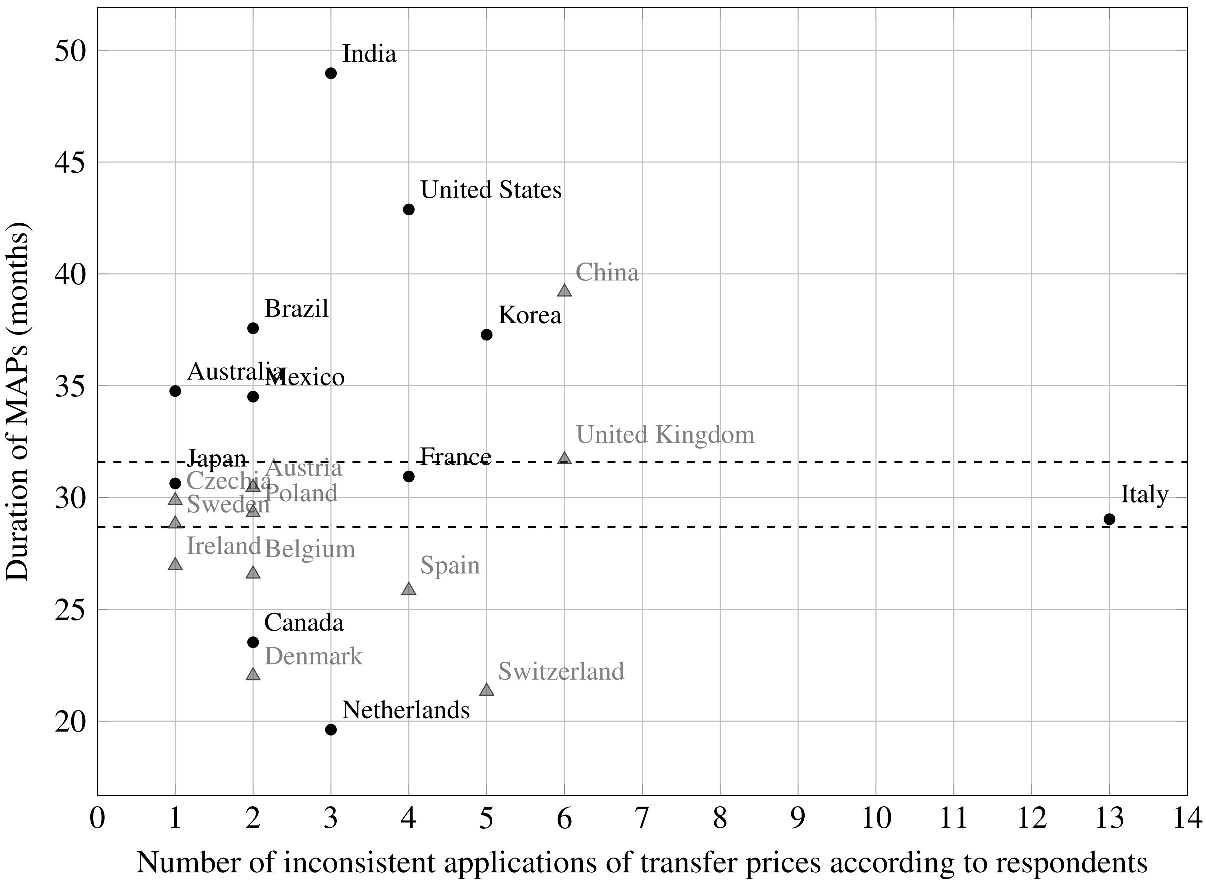
Rathke, A. A., Rezende, A. J., & Watrin, C. (2020). Classification of Transfer Pricing Systems Across Countries. *International Economics*, *164*, 151–167.

Sansing, R. C. (1993). Information Acquisition in a Tax Compliance Game. *The Accounting Review*, *68*(4), 874–884.

Zimmerl, I. (2022). Reaching Cross-Border Tax Certainty With Joint Audits. *EC Tax Review*, *31*(6), 300–311.

Appendix A

Figure 4. Duration of MAPs and transfer pricing inconsistencies from a German perspective



Notes: The figure ranks countries by the average duration of MAPs in months (based on Martini et al. (2025)), which we use as a proxy for k, and by the number of transfer pricing inconsistencies identified after tax audits from a German perspective (data based on a survey of German transfer pricing practitioners (Diller et al. 2021), as reported in Diller et al. (2025)), which serves as a proxy for p. We caution that the survey is not necessarily representative for the German firm population but nevertheless gives an indication of how inconsistent applications of transfer prices p can be approximated. Countries are color-coded based on their corporate tax rate differential relative to Germany (data from Martini et al. (2025)): black circles indicate a low differential ($<$ 4.8 percentage points), gray triangles a high differential ($>$ 4.8 percentage points), with the threshold corresponding to the median. Dashed horizontal lines indicate the 33rd and 66th percentiles of MAP duration (28.7 and 31.6 months, respectively); these thresholds are also used to classify countries into low, medium, and high values of k.

Appendix B

For the equilibrium proofs, let us define the following functions

$$\begin{aligned}
\Phi_H^{x_L} &= \tau_H \left[\frac{\frac{1-p}{2}(1-\alpha)(1-\gamma)(1+\pi)}{\frac{1-p}{2}(2-\alpha)+p(1-\beta)} + \frac{p(1-\beta)}{\frac{1-p}{2}(2-\alpha)+p(1-\beta)} \left(\frac{1}{2} - \gamma(\varepsilon - k) \right) \right], \\
\Phi_L^{x_L} &= \tau_L \left[\frac{p(1-\beta)}{\frac{1-p}{2}(2-\alpha)+p(1-\beta)} \left(\gamma k - \frac{1}{2} \right) - \frac{\frac{1-p}{2}(1-\alpha)}{\frac{1-p}{2}(2-\alpha)+p(1-\beta)} (1-\gamma) \right], \\
\Phi_H^{x_H} &= \tau_H \frac{p\beta}{p\beta + \frac{1-p}{2}\alpha} \left(\delta k - \frac{1}{2} \right), \\
\Phi_L^{x_H} &= \tau_L \frac{p\beta}{p\beta + \frac{1-p}{2}\alpha} \left(\delta (k-\varepsilon) + \frac{1}{2} \right).
\end{aligned}$$

In addition, let us introduce the following notation.

Definition. *For a given equilibrium $\omega \in \Omega$, where Ω is the set of all equilibria identified in this paper, we define $k_i^x = (\Phi_i^x)^{-1}(K|\omega)$ as the unique value of k that solves $\Phi_i^x = K$ with $x \in \{x_L, x_H\}$, given that all strategies are at their equilibrium values under equilibrium ω.*

Lemma 1

We have to show that $\mathbb{E}[v_H(JA|x_L)] - \mathbb{E}[v_H(NA|x_L)] \geq \mathbb{E}[v_L(JA|x_L)] - \mathbb{E}[v_L(NA|x_L)]$, which simplifies to $\Phi_H^{x_L} \geq \Phi_L^{x_L}$. Consider $\gamma = 1$, which is sufficient to show the result, as $\gamma = 1$ decreases $\Phi_H^{x_L}$ and increases $\Phi_L^{x_L}$. Simplifying yields $\tau_H(k - \varepsilon + \frac{1}{2}) \geq \tau_L(k - \frac{1}{2})$. With $\varepsilon \leq 1$ and $\tau_H \geq \tau_L$, Lemma 1 is shown.

Low residual double taxation risk equilibria

Let us note that the requirement $\varepsilon < \varepsilon_2^*/2$ guarantees that equilibrium III^{JA} does not exist in the low residual double taxation risk case (see proof of Proposition 4 and 5 (ii)). III^{JA} weakly payoff dominates all other equilibria in which joint tax audits occur (see also Proposition 6 and 7).

Proposition 1 (i)

We show that $\mu_H^*(x_H) = \mu_L^*(x_H) = \mu_L^*(x_L) = 0$, $\mu_H^*(x_L) \geq 0$, and

$$\alpha^* = \frac{(1-p)(b-2c_H)+2p(b-c_H)}{(1-p)(b-c_H)}, \beta^* = 0, \gamma^* = \frac{\tau_H - \tau_L}{\tau_H(1+\pi)-\tau_L}, \delta^* = 0,$$

constitutes equilibrium I^{NA} when $\varepsilon < \underline{\varepsilon} = \min\left\{\frac{\tau_H-\tau_L}{\tau_H}, \frac{\tau_H(1+\pi)-\tau_L}{2\tau_H}\right\} = \min\{\varepsilon_1^*, \varepsilon_2^*/2\}$, $p < p_1^* = \frac{c_H}{2(b-c_H)+c_H}$ and $k < k_I^*$, where $k_I^* = (\Phi_L^{x_L})^{-1}\left(K|I^{NA}\right)$.

The firm is willing to randomize in y_H, because a report x_L yields payoff $\gamma^*(-\tau_H(1+\pi) - \tau_L(1-\gamma^*)) = -\tau_H$, which equals the payoff from reporting x_H. α^* is feasible because $p < p_1^*$ ensures $\alpha^* < 1$. In state y_B, the firm chooses $\beta^* = 0$, as reporting x_H yields a payoff of $-\tau_H$ and reporting x_L a payoff of $-\tau_L - \varepsilon\tau_H\gamma^* > -\tau_H$ due to $\varepsilon < \varepsilon_2^*$. Auditor H is willing to randomize because not auditing yields a payoff of zero and auditing x_L yields a payoff of $\frac{(1-p)(1-\alpha^*)+2p}{(1-p)(1-\alpha^*)+(1+p)}b - c_H = 0$. Auditor L chooses $\delta^* = 0$ since $\beta^* = 0$.

The tax authorities choose $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$ due to $\delta^* = \beta^* = 0$. Tax authority L chooses $\mu_L^*(x_L) = 0$, because under this equilibrium, $\Phi_L^{x_L} < K$ as long as $k < k_I^*$. From Lemma 1, we know that $\Phi_L^{x_L} < \Phi_H^{x_L}$. Thus, we have $\mu_H^*(x_L) \geq 0$.

Proposition 1 (ii)

We show that $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$, $\mu_H^*(x_L) = 1$, $\beta^* = 0$, $\delta^* = 0$, and

$$\alpha^* = \frac{(1-p)(b-2c_H)+2p(b-c_H)}{(1-p)(b-c_H)}, \gamma^* = \frac{((1-p)(2-\alpha^*)+2p)\frac{K}{\tau_L}+(1-p)(1-\alpha^*)+p}{2pk+(1-p)(1-\alpha^*)},$$
$$\mu_L^*(x_L) = \frac{\tau_H - (\gamma^*\tau_H(1+\pi)+(1-\gamma^*)\tau_L)}{\tau_H(1+\pi)-(\gamma^*\tau_H(1+\pi)+(1-\gamma^*)\tau_L)},$$

constitutes equilibrium I^{JA} when $\varepsilon < \underline{\varepsilon} = \min\{\varepsilon_1^*, \varepsilon_2^*/2\}$, $p < p_1^* = \frac{c_H}{2(b-c_H)+c_H}$ and $k > k_I^*$, where $k_I^* = (\Phi_L^{x_L})^{-1}\left(K|I^{NA}\right)$.

The firm is willing to randomize in y_H, because a report x_L yields payoff

$$-\tau_H(1+\pi)\left[\mu_L^*(x_L)+(1-\mu_L^*(x_L))\gamma^*\right] - \tau_L(1-\mu_L^*(x_L))(1-\gamma^*) = -\tau_H,$$

which equals the payoff from reporting x_H. α^* is feasible because $p < p_1^*$ ensures $\alpha^* < 1$. In state y_B, the firm chooses $\beta^* = 0$, as reporting x_H yields a payoff of $-\tau_H$ and reporting x_L a payoff of $-\mu_L^*(x_L)\frac{\tau_L+\tau_H}{2} - (1-\mu_L^*(x_L))(\tau_L + \gamma^*\varepsilon\tau_H) > -\tau_H$, as with $\mu_L^*(x_L) = 0$ and $\gamma^* = 1$, a sufficient condition for the inequality is found to be $\varepsilon < \varepsilon_1^*$. Auditor H is willing to randomize because not auditing yields a payoff of zero and auditing x_L yields a payoff of $\frac{(1-p)(1-\alpha^*)+2p}{(1-p)(1-\alpha^*)+(1+p)}b - c_H = 0$. γ^* is feasible because $\gamma^* < 1$ requires $k > \left[((1-p)(1-\alpha^*)+(1+p))\frac{K}{\tau_L} + p\right]/2p$, which is guaranteed when $k > k_I^*$. Auditor L chooses $\delta^* = 0$ since $\beta^* = 0$.

The tax authorities choose $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$ due to $\delta^* = \beta^* = 0$. Tax authority L is willing to randomize, because under this equilibrium, $\Phi_L^{x_L}(\alpha^*, \beta^*, \gamma^*) = K$. $\mu_L^*(x_L)$ is feasible because $\mu_L^*(x_L) > 0$ requires $k > k_I^*$. From Lemma 1, we know that $\Phi_L^{x_L} < \Phi_H^{x_L}$. Thus, we have $\mu_H^*(x_L) = 1$.

Proposition 2 (i)

We show that $\mu_H^*(x_H) = \mu_L^*(x_H) = \mu_L^*(x_L) = 0$, $\mu_H^*(x_L) \geq 0$, and

$$\alpha^* = 1, \beta^* = 0, \gamma^* = 1, \delta^* = 0,$$

constitutes equilibrium II^{NA} when $\varepsilon < \underline{\varepsilon} = \min\{\varepsilon_1^*, \varepsilon_2^*/2\}$, $p > p_1^* = \frac{c_H}{2(b-c_H)+c_H}$ and $k < k_{II}^*$, where $k_{II}^* = (\Phi_L^{x_L})^{-1}(K|II^{NA})$.

In state y_H, the firm chooses $\alpha^* = 1$ because when $\gamma^* = 1$, a report x_L yields payoff $-\tau_H(1+\pi) < -\tau_H$, where the latter equals the payoff from reporting x_H. In state y_B, the firm chooses $\beta^* = 0$, as reporting x_H yields a payoff of $-\tau_H$ and reporting x_L a payoff of $-\tau_L - \varepsilon\tau_H > -\tau_H$ due to $\varepsilon < \varepsilon_1^*$. Auditor H chooses $\gamma^* = 1$, since $\frac{2p}{(1+p)}b - c_H > 0$ when $p > p_1^*$. Auditor L chooses $\delta^* = 0$ since $\beta^* = 0$.

The tax authorities choose $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$ due to $\delta^* = \beta^* = 0$. Tax authority L chooses $\mu_L^*(x_L) = 0$, because under this equilibrium, $\Phi_L^{x_L} < K$ as long as $k < k_{II}^*$. From Lemma 1, we know that $\Phi_L^{x_L} < \Phi_H^{x_L}$. Thus, we have $\mu_H^*(x_L) \geq 0$.

Proposition 2 (ii)

We show that $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$, $\mu_L^*(x_L) = \mu_H^*(x_L) = 1$, and

$$\alpha^* = 1, \beta^* = 0, \gamma^* = 1, \delta^* = 0,$$

constitutes equilibrium II$^{\text{JA}}$ when $\varepsilon < \underline{\varepsilon} = \min\{\varepsilon_1^*, \varepsilon_2^*/2\}$, $p > p_1^* = \frac{c_H}{2(b-c_H)+c_H}$ and $k > k_{II}^*$, where $k_{II}^* = (\Phi_L^{x_L})^{-1}\left(K|II^{NA}\right)$.

In state y_H, the firm chooses $\alpha^* = 1$ because when $\mu_L^*(x_L)\mu_H^*(x_L) = 1$, a report x_L yields payoff $-\tau_H(1+\pi) < -\tau_H$, where the latter equals the payoff from reporting x_H. In state y_B, the firm chooses $\beta^* = 0$, as reporting x_H yields a payoff of $-\tau_H$ and reporting x_L a payoff of $-(\tau_L + \tau_H)/2 > -\tau_H$. Auditor H chooses $\gamma^* = 1$ off the equilibrium path, since $\frac{2p}{(1+p)}b - c_H > 0$ when $p > p_1^*$. Auditor L chooses $\delta^* = 0$ since $\beta^* = 0$.

The tax authorities choose $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$ due to $\delta^* = \beta^* = 0$. Tax authority L chooses $\mu_L^*(x_L) = 1$, because under this equilibrium, $\Phi_L^{x_L}(\alpha^*, \beta^*, \gamma^*) > K$ if $k > k_{II}^*$. From Lemma 1, we know that $\Phi_L^{x_L} < \Phi_H^{x_L}$. Thus, we also have $\mu_H^*(x_L) = 1$.

Corollary 1

First, let us make the required inconsistency costs for joint audit equilibria explicit. These are

$$k_I^* = \frac{\left[(1+p+(1-p)(1-\alpha^*))\frac{K}{\tau_L} + (1-p)(1-\alpha^*) + p\right]\frac{\tau_H(1+\pi)-\tau_L}{\tau_H-\tau_L} - (1-p)(1-\alpha^*)}{2p},$$

$$k_{II}^* = \frac{(1+p)\frac{K}{\tau_L} + p}{2p}.$$

It is straightforward to see that $\lim_{\tau_L \to 0} k_I^* = \infty$ and $\lim_{\tau_L \to 0} k_{II}^* = \infty$, as α^* is independent of τ_L.

Second, observe that $k_{II}^* < k_I^*$, because $\Phi_L^{x_L}$ increases in α and increases in γ. As γ and α are higher under equilibrium II$^{\text{NA}}$ than under I$^{\text{NA}}$, $k_{II}^* < k_I^*$ is shown.

High residual double taxation risk equilibria

Proposition 3 (i)

We show that $\mu_H^*(x_H) = \mu_L^*(x_L) = 0$, $\mu_H^*(x_L) \geq 0$, $\mu_L^*(x_H) \geq 0$ and

$$\alpha^* = \frac{b-2c_H}{b-c_H}, \beta^* = 1, \gamma^* = \frac{\tau_H - \tau_L}{\tau_H(1+\pi) - \tau_L}, \delta^* = 0,$$

constitutes equilibrium V^{NA} when $\varepsilon > \overline{\varepsilon} = \frac{\tau_H(1+\pi)-\tau_L}{\tau_H}$ and $p < p_3^* = \frac{(b-2c_H)c_L}{(b-2c_H)c_L+2(b-c_H)(b-c_L)}$.

The firm is willing to randomize in y_H, because a report x_L yields payoff $\gamma^*(-\tau_H(1+\pi) - \tau_L(1-\gamma^*)) = -\tau_H$, which equals the payoff from reporting x_H. In state y_B, the firm chooses $\beta^* = 1$, as reporting x_H yields a payoff of $-\tau_H$ and reporting x_L a payoff of $-\tau_L - \varepsilon\tau_H\gamma^* < -\tau_H$ due to $\varepsilon > \overline{\varepsilon}$. Auditor H is willing to randomize because not auditing yields a payoff of zero and auditing x_L yields a payoff of $\frac{1-\alpha^*}{2-\alpha^*}b - c_H = 0$. Auditor L chooses $\delta^* = 0$ since auditing report x_H would yield $\frac{2p}{2p+(1-p)\alpha^*}b - c_L < 0$, which is due to $p < p_3^*$.

The tax authorities choose $\mu_H^*(x_H) = \mu_L^*(x_L) = 0$ due to $\delta^* = 0$ and $\beta^* = 1$, and $\mu_L^*(x_H) \geq 0$ as well as $\mu_H^*(x_L) \geq 0$.

Proposition 3 (ii)

See proof of Proposition 2 (ii), which is independent of ε when $p_1^* < p < p_3^*$.

Proposition 3 (iii)

We show that $\mu_H^*(x_H) = \mu_L^*(x_H) = 0$, $\mu_H^*(x_L) = 1$, $\beta^* = 0$, $\delta^* = 0$, and

$$\alpha^* = \frac{(1-p)(b-2c_H)+2p(b-c_H)}{(1-p)(b-c_H)}, \gamma^* = \frac{((1-p)(2-\alpha^*)+2p)\frac{K}{\tau_L} + (1-p)(1-\alpha^*)+p}{2pk+(1-p)(1-\alpha^*)},$$

$$\mu_L^*(x_L) = \frac{\tau_H - (\gamma^*\tau_H(1+\pi)+(1-\gamma^*)\tau_L)}{\tau_H(1+\pi) - (\gamma^*\tau_H(1+\pi)+(1-\gamma^*)\tau_L)},$$

constitutes equilibrium I^{JA} when $\varepsilon > \overline{\varepsilon} = \frac{\tau_H(1+\pi)-\tau_L}{\tau_H}$, $p < p_1^* = \frac{c_H}{2(b-c_H)+c_H}$ and $k > k_V^*$, where $k_V^* > k_I^* = (\Phi_L^{x_L})^{-1}\left(K|I^{NA}\right)$.

The proof follows the similar logic as the one for Proposition 1 (ii). The key difference is that, in state y_B, the firm is willing to choose $\beta^* = 0$ less often, as reporting x_L yields a payoff of $-\mu_L^*(x_L)\frac{\tau_L+\tau_H}{2} - (1-\mu_L^*(x_L))(\tau_L + \gamma^*\varepsilon\tau_H)$, which strictly decreases in ε (γ^* and $\mu_L^*(x_L)$ are independent of ε). Also, observe that $\lim_{\varepsilon\to\overline{\varepsilon},\, k\to k_I^*} -\mu_L^*(x_L)\frac{\tau_L+\tau_H}{2} - (1-\mu_L^*(x_L))(\tau_L+\gamma^*\varepsilon\tau_H) = -\tau_H$, which equals the payoff of reporting x_H. Thus, for $\varepsilon > \overline{\varepsilon}$, $\beta^* = 0$ additionally requires that γ^* is sufficiently low, since γ^* strictly decreases in k. With $\lim_{k\to\infty} -\mu_L^*(x_L)\frac{\tau_L+\tau_H}{2} - (1-\mu_L^*(x_L))(\tau_L+\gamma^*\varepsilon\tau_H) > -\tau_H$, there exists a threshold value $k_V^* > k_I^*$, such that $\beta^* = 0$ is the firm's best response and equilibrium I^{JA} obtains.

Proposition 4 (i)

We show that $\mu_L^*(x_L) = 0$, $\mu_H^*(x_L) \geq 0$, $\mu_L^*(x_H) = 0$ or $\mu_H^*(x_H) = 0$, and

$$\alpha^* = \frac{(b-c_L)(b(1+p)-2c_H)}{(b-c_H)b(1-p)},\ \beta^* = \frac{(b(1+p)-2c_H)c_L}{(b-c_H)2bp},$$
$$\gamma^* = \frac{\tau_H-\tau_L}{\tau_H(1+\pi)-\tau_L}, \qquad \delta^* = \gamma^*\frac{\tau_L-\tau_H(1+\pi-\varepsilon)}{\varepsilon\tau_L},$$

constitutes equilibrium VI^{NA} when $\varepsilon > \overline{\varepsilon} = \frac{\tau_H(1+\pi)-\tau_L}{\tau_H}$, $p_3^* = \frac{(b-2c_H)c_L}{(b-2c_H)c_L+2(b-c_H)(b-c_L)} < p < p_2^* = \frac{(b-c_H)c_L+(b-c_L)c_H}{(b-c_H)c_L+(b-c_L)c_H+2(b-c_H)(b-c_L)}$ and $k < k_{VI}^*$, where $k_{VI}^* = \min\left\{k_L^{x_L}, \max\{k_L^{x_H}, k_H^{x_H}\}\right\}$ and $k_i^x = (\Phi_i^x)^{-1}\left(K|VI^{NA}\right)$.

The firm is willing to randomize in y_H, because a report x_L yields payoff $\gamma^*(-\tau_H(1+\pi) - \tau_L(1-\gamma^*)) = -\tau_H$, which equals the payoff from reporting x_H. α^* is feasible because $p < p_2^*$ ensures $\alpha^* < 1$. The firm is willing to randomize in state y_B, as reporting x_L and x_H yield a payoff of $-\tau_H - \varepsilon\tau_L\delta^* = -\tau_L - \varepsilon\tau_H\gamma^*$. β^* is feasible because $p > p_3^*$ ensures $\beta^* > 0$. Auditor H is willing to randomize because not auditing yields a payoff of zero and auditing x_L yields a payoff of $\frac{(1-p)(1-\alpha^*)+2p(1-\beta^*)}{(1-p)(2-\alpha^*)+2p(1-\beta^*)}b - c_H = 0$. Auditor L is willing to randomize because not auditing yields a payoff of zero and auditing x_H yields a payoff of $\frac{2p\beta^*}{2p\beta^*+(1-p)\alpha^*}b - c_L = 0$. δ^* is feasible because $\varepsilon > \overline{\varepsilon}$ ensures $\delta^* > 0$.

Tax authority L chooses $\mu_L^*(x_L) = 0$ due to $k < k_L^{x_L}$, and tax authority H $\mu_H^*(x_L) \geq 0$. Further, either tax authority L or H choose $\mu_i(x_H) = 0$ due to $k < \max\{k_L^{x_H}, k_H^{x_H}\}$. Concretely, if $k_L^{x_H} < k_H^{x_H}$, we have $\mu_H(x_H) = 0$ and $\mu_L(x_H) \geq 0$; otherwise we have $\mu_L(x_H) = 0$ and $\mu_H(x_H) \geq 0$.

Proposition 4 (ii)

We show that $\mu_H^*(x_H) = \mu_L^*(x_H) = 1$, $\mu_L^*(x_L) = 0$, $\mu_H^*(x_L) \geq 0$ and

$$\alpha^* = \frac{b - 2c_H}{b - c_H}, \beta^* = 1, \gamma^* = \frac{\tau_H - \tau_L}{\tau_H(1+\pi) - \tau_L}, \delta^* = 1,$$

constitutes equilibrium III$^{\text{JA}}$ when $\varepsilon > \overline{\varepsilon} = \frac{\tau_H(1+\pi)-\tau_L}{\tau_H}$, $p > p_3^* = \frac{(b-2c_H)c_L}{(b-2c_H)c_L + 2(b-c_H)(b-c_L)}$ and $k > k_{III}^*$, where $k_{III}^* = \max\{k_L^{x_H}, k_H^{x_H}\}$ and $k_i^{x_H} = \left(\Phi_i^{x_H}\right)^{-1}\left(K|III^{JA}\right)$.

The firm is willing to randomize in y_H, because a report x_L yields payoff $\gamma^*(-\tau_H(1+\pi)$ $-\tau_L(1-\gamma^*)) = -\tau_H$, which equals the payoff from reporting x_H. In state y_B, the firm chooses $\beta^* = 1$, as reporting x_L yields a payoff of $-\tau_L - \varepsilon\tau_H\gamma^*$ and reporting x_H a payoff of $-(\tau_L + \tau_H)/2$ $> -\tau_L - \varepsilon\tau_H\gamma^*$ due to $\varepsilon > \frac{\tau_H(1+\pi)-\tau_L}{2\tau_H}$. Auditor H is willing to randomize because not auditing yields a payoff of zero and auditing x_L yields a payoff of $\frac{(1-p)(1-\alpha^*)}{(1-p)(2-\alpha^*)}b - c_H = 0$. Auditor L chooses $\delta^* = 1$ off the equilibrium path since $\frac{2p}{2p+(1-p)\alpha^*} - c_L > 0$ when $p > p_3^*$.

The tax authorities choose $\mu_H^*(x_H) = \mu_L^*(x_H) = 1$ due to $k > k_{III}^*$. Tax authority L chooses $\mu_L^*(x_L) = 0$ due to $\beta^* = 1$, and tax authority H chooses $\mu_H^*(x_L) \geq 0$. In addition, equilibrium III$^{\text{JA}}$ weakly payoff dominates II$^{\text{JA}}$ whenever II$^{\text{JA}}$ is feasible.

Proposition 5 (i)

We show that $\mu_L^*(x_L) = 0$, $\mu_H^*(x_L) \geq 0$, $\mu_L^*(x_H) = 0$ or $\mu_H^*(x_H) = 0$, and

$$\alpha^* = 1, \beta^* = \frac{(1-p)c_L}{2p(b-c_L)}, \gamma^* = 1, \delta^* = \frac{\tau_L - \tau_H(1-\varepsilon)}{\varepsilon\tau_L},$$

constitutes equilibrium IV$^{\text{NA}}$ when $\varepsilon > \frac{\tau_H(1+\pi)-\tau_L}{\tau_H}$, $p > p_2^* = \frac{(b-c_H)c_L + (b-c_L)c_H}{(b-c_H)c_L + (b-c_L)c_H + 2(b-c_H)(b-c_L)}$ and $k < k_{IV}^*$, where $k_{IV}^* = \min\left\{k_L^{x_L}, \max\{k_L^{x_H}, k_H^{x_H}\}\right\}$ and $k_i^x = (\Phi_i^x)^{-1}\left(K|IV^{NA}\right)$.

In state y_H, the firm chooses $\alpha^* = 1$ due to $\gamma^* = 1$. The firm is willing to randomize in state y_B, as reporting x_L and x_H yield a payoff of $-\tau_H - \varepsilon\tau_L\delta^* = -\tau_L - \varepsilon\tau_H$. δ^* is feasible because $p > p_2^*$ implies $\beta^* < 1$. Auditor H chooses $\gamma^* = 1$, since $\frac{2p(1-\beta^*)}{2p(1-\beta^*)+1-p}b - c_H > 0$ when $p > p_2^*$. Auditor L is willing to randomize because not auditing yields a payoff of zero and auditing x_H yields a payoff of $\frac{2p\beta^*}{2p\beta^*+1-p}b - c_L = 0$. δ^* is feasible because $\varepsilon > \varepsilon_1^*$ ensures $\delta^* > 0$.

Tax authority L chooses $\mu_L^*(x_L) = 0$ due to $k < k_L^{x_L}$, and tax authority H $\mu_H^*(x_L) \geq 0$. Further, either tax authority L or H choose $\mu_i^*(x_H) = 0$ due to $k < \max\{k_L^{x_H}, k_H^{x_H}\}$. Concretely, if $k_L^{x_H} < k_H^{x_H}$, we have $\mu_H^*(x_H) = 0$ and $\mu_L^*(x_H) \geq 0$; otherwise we have $\mu_L^*(x_H) = 0$ and $\mu_H^*(x_H) \geq 0$.

Proposition 5 (ii)

See proof of Proposition 4 (ii).

Proposition 6

The firm's expected tax liabilities in the equilibria with joint tax audits are given by

$$T_{I^{JA}} = \frac{1-p}{2}(\tau_L + \tau_H) + p\left[\mu_L^*(x_L)\frac{\tau_L + \tau_H}{2} + (1 - \mu_L^*(x_L))\left(\tau_L + \varepsilon\gamma_{I^{JA}}^*\tau_H\right)\right],$$
$$T_{II^{JA}} = \frac{1-p}{2}(\tau_L + \tau_H) + p\left[\frac{\tau_L + \tau_H}{2}\right] = T_{III^{JA}}.$$

The change in expected tax liabilities induced by the existence of joint tax audits requires comparing the above expected tax liabilities and the liabilities in the respective national audit benchmark that would be played if joint tax audits did not exist. These benchmark equilibria depend on the low or high residual double taxation risk case.

First, consider the low residual double taxation risk case. The expected tax liabilities in the national audit equilibria are

$$T_{I^{NA}} = \frac{1-p}{2}(\tau_L + \tau_H) + p\left[\tau_L + \varepsilon\tau_H\gamma_{I^{NA}}^*\right],$$
$$T_{II^{NA}} = \frac{1-p}{2}(\tau_L + \tau_H) + p\left[\tau_L + \varepsilon\tau_H\right].$$

When $p > p_1^*$, the change in expected tax liabilities is given by

$$T_{II^{JA}} - T_{II^{NA}} = p\left[\frac{\tau_L + \tau_H}{2} - \tau_L - \varepsilon\tau_H\right] = p\left[\frac{\tau_H - \tau_L}{2} - \varepsilon\tau_H\right].$$

Thus, we can see that increasing tax liabilities $T_{II^{JA}} - T_{II^{NA}} > 0$ require $\varepsilon < \frac{\tau_H - \tau_L}{2\tau_H}$. Also, observe that $\frac{\tau_H - \tau_L}{2\tau_H} < \min\left\{\frac{\tau_H - \tau_L}{\tau_H}, \frac{\tau_H(1+\pi) - \tau_L}{2\tau_H}\right\} = \underline{\varepsilon}$, such that the threshold for increasing and decreasing tax liabilities is unique in the low residual double taxation risk case.

When $p < p_1^*$, the change in expected tax liabilities is given by

$$\begin{aligned} T_{I^{JA}} - T_{I^{NA}} &= p\left[\mu_L^*(x_L)\frac{\tau_L + \tau_H}{2} + (1 - \mu_L^*(x_L))\left(\tau_L + \varepsilon\gamma_{I^{JA}}^*\tau_H\right) - \tau_L - \varepsilon\tau_H\gamma_{I^{NA}}^*\right] \\ &= p\left[\mu_L^*(x_L)\frac{\tau_H - \tau_L}{2} + \varepsilon\tau_H\left[(1 - \mu_L^*(x_L))\gamma_{I^{JA}}^* - \gamma_{I^{NA}}^*\right]\right]. \end{aligned}$$

Since the firm is indifferent in state y_H in both equilibrium I^{NA} and I^{JA}, this necessarily implies that $\mu_L^*(x_L) + (1 - \mu_L^*(x_L))\gamma_{I^{JA}}^* = \gamma_{I^{NA}}^*$. Inserting and simplifying yields

$$T_{I^{JA}} - T_{I^{NA}} = p\mu_L^*(x_L)\left[\frac{\tau_H - \tau_L}{2} - \varepsilon\tau_H\right],$$

with the identical implications as for $T_{II^{JA}} - T_{II^{NA}}$. This shows part (i).

Concerning part (ii), let us note the expected tax liabilities in the national audit benchmarks

$$\begin{aligned} T_{V^{NA}} &= \frac{1-p}{2}(\tau_L + \tau_H) + p\tau_H, \\ T_{VI^{NA}} &= \frac{1-p}{2}(\tau_L + \tau_H) + p\left[\tau_L + \varepsilon\tau_H\frac{\tau_H - \tau_L}{\tau_H(1+\pi) - \tau_L}\right], \\ T_{IV^{NA}} &= \frac{1-p}{2}(\tau_L + \tau_H) + p\left[\tau_L + \varepsilon\tau_H\right]. \end{aligned}$$

When $p < p_3^*$, $T_{II^{JA}} - T_{V^{NA}} < 0$ can be observed straightforwardly. Further, the *existence* of equilibrium I^{JA} in the high residual double taxation risk case requires $T_{I^{JA}} - T_{V^{NA}} < 0$. In the proof of Proposition 3 (iii), we show that these situations exist when $k > k_V^*$. Lastly, we show that $T_{III^{JA}} - T_{VI^{NA}} < 0$, which also implies $T_{III^{JA}} - T_{IV^{NA}} < 0$:

$$T_{III^{JA}} - T_{VI^{NA}} = p\left[\frac{\tau_H - \tau_L}{2} - \varepsilon \tau_H \frac{\tau_H - \tau_L}{\tau_H(1+\pi) - \tau_L}\right].$$

Since $T_{III^{JA}} - T_{VI^{NA}}$ decreases in ε, it is sufficient to show that $T_{III^{JA}} - T_{VI^{NA}} < 0$ when $\varepsilon = \overline{\varepsilon} = \frac{\tau_H(1+\pi)-\tau_L}{\tau_H - \tau_L}$. Inserting $\overline{\varepsilon}$ and simplifying yields $T_{III^{JA}} - T_{VI^{NA}} = -p(\tau_H - \tau_L)/2 < 0$. This completes the proof of part (ii).

Corollary 2 and Proposition 7

Let us make the authorities' deadweight losses in all equilibria explicit. In the equilibria with joint tax audits, these are given by

$$L_{I^{JA}} = \mu_L^*(x_L)K(2-(1-p)\alpha^*) + p(1-\mu_L^*(x_L))\gamma_{I^{JA}}^* k(\tau_L + \tau_H),$$
$$L_{II^{JA}} = (1+p)K, \qquad L_{III^{JA}} = \left(2p + (1-p)\,\alpha_{III^{JA}}^*\right)K.$$

In the purely national audit equilibria, we have

$$L_{I^{NA}} = pk(\tau_L + \tau_H)\,\gamma_{I^{NA}}^*, \quad L_{II^{NA}} = pk(\tau_L + \tau_H), \quad L_{V^{NA}} = 0,$$
$$L_{IV^{NA}} = pk(\tau_L + \tau_H)\left[\beta_{IV^{NA}}^* \delta_{IV^{NA}}^* + \left(1 - \beta_{IV^{NA}}^*\right)\right],$$
$$L_{VI^{NA}} = pk(\tau_L + \tau_H)\left[\beta_{VI^{NA}}^* \delta_{VI^{NA}}^* + \left(1 - \beta_{VI^{NA}}^*\right)\gamma_{VI^{NA}}^*\right].$$

To begin, we show that equilibrium III$^{\mathrm{JA}}$ weakly payoff dominates II$^{\mathrm{JA}}$. Considering $T_{III^{JA}} = T_{II^{JA}}$, this requires $L_{II^{JA}} > L_{III^{JA}}$, which holds because $\alpha_{III^{JA}}^* < 1$.[19] This proves Corollary 2.

Next, we show that the existence of joint tax audits increases tax audit efficiency when the residual double taxation risk is low. We show the underlying mechanics of the proof only for $L_{II^{NA}} > L_{II^{JA}}$; the proof for $L_{I^{NA}} > L_{I^{JA}}$ works similarly. Considering that equilibrium II$^{\mathrm{JA}}$ only

[19] Here, we exemplify that the auditors' ex ante expected payoffs can be frequently neglected from an efficiency perspective. In equilibrium II$^{\mathrm{JA}}$, the auditors' expected payoffs are zero, as they are off the equilibrium path. In III$^{\mathrm{JA}}$, auditor L's expected payoff is zero for the same reason. For auditor H, the ex ante expected payoff is $\frac{1-p}{2}\gamma_{III^{JA}}^*\left[-c_H + (1-\alpha_{III^{JA}}^*)(b - c_H)\right]$. With $\alpha_{III^{JA}}^* = \frac{b-2c_H}{b-c_H}$ and further simplification, we see that auditor H's expected payoff is also zero.

exists for $k > k^*_{II} = \frac{(1+p)\frac{K}{\tau_L}+p}{2p}$,[20] we get

$$L_{II^{NA}} - L_{II^{JA}}\big|_{k=k^*_{II}} = p\frac{(1+p)\frac{K}{\tau_L}+p}{2p}(\tau_L+\tau_H) - (1+p)K$$
$$= \frac{p(\tau_L+\tau_H)}{2} + (1+p)\left(\frac{\tau_L+\tau_H}{2\tau_L} - 1\right)K > 0,$$

due to $\frac{\tau_L+\tau_H}{2\tau_L} > 1$. This shows Proposition 7 (i).

When $p < p^*_3$ in the high residual double taxation risk case, we can have equilibrium I^{JA} and II^{JA}. Observe that the national benchmark V^{NA} implies $L_{V^{NA}} = 0$. Thus, $L_{I^{JA}} > 0$ and $L_{II^{JA}} > 0$ imply that when $p < p^*_3$ and the equilibria with joint tax audits would be played, the existence of joint tax audits decreases tax audit efficiency. For $p^*_2 < p < p^*_3$, consider the limiting case $\tau_L = \tau_H$. Then, because both $\gamma^*_{VI^{NA}}$ and $\delta^*_{VI^{NA}}$ converge to zero, we have $\lim_{\tau_L\to\tau_H} L_{VI^{NA}} = 0 < L_{III^{JA}} = \left(2p + (1-p)\,\alpha^*_{III^{JA}}\right)K$, as $\alpha^*_{III^{JA}}$ is independent of τ_i. Similarly, joint tax audits can also be efficient in the high residual double taxation risk case, because $\lim_{k\to\infty} L_{VI^{NA}} = \infty > L_{III^{JA}}$ and $\lim_{k\to\infty} L_{IV^{NA}} = \infty > L_{III^{JA}}$. This shows Proposition 7 (ii).

Also, observe that for $p > p^*_3$, the range in which a joint tax audit equilibrium exists increases, that is, $k^*_{III} = \max\left\{\left(\frac{K}{\tau_H}(2p+(1-p)\alpha^*)+p\right)/2p, \left(\frac{K}{\tau_L}(2p+(1-p)\alpha^*)+p(2\varepsilon-1)\right)/2p\right\}$ $< k^*_{II} = \left((1+p)\frac{K}{\tau_L}+p\right)/2p$. This can be be observed straightforwardly for the limiting case $\alpha^* = 1$, which strictly increases k^*_{III}.

[20]Note that the efficient threshold is $k^{eff}_{II} = \frac{K(1+p)}{\tau_L+\tau_H} < k^*_{II}$.

Tax Disputes – The Role of Technology and Controversy Expertise*

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Abstract

This study investigates how two practices to manage tax risk in firms, namely the use of tax technology for internal information provision and the use of a controversy manager who offers specific expertise in tax disputes, affect two key tax metrics for firms: the probability of unfavorable dispute outcomes and low final tax payments. Building on a Bayesian persuasion model, we find that the controversy manager has a tax reassurance and a tax planning effect. In a given dispute with a strategic tax authority, she directly decreases unfavorable dispute outcomes, which shields the tax manager from the costs of unfavorable outcomes. In equilibrium, the tax manager thus increases his tax planning effort, indirectly increasing the tax dispute probability and making the net effect on unfavorable outcomes ambiguous. Although we show that the controversy manager consistently enhances the probability for low final tax payments, the same is not true for tax technology quality. Taken together, our results indicate that using a controversy manager combined with an intermediate-quality tax technology is often beneficial for firms. Ultimately, the preferred quality depends on the firm's favored metric, tax manager characteristics, and the litigation environment.

Keywords: tax disputes, tax risk management, tax technology, controversy experts, Bayesian persuasion
JEL classification: H25, H26, C72, K34

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1. Introduction

We study how using tax technology and a controversy expert affect a firm's tax planning and reporting, and the resolution of disputes with a tax authority. As tax authorities might disagree with reported tax positions, tax disputes with potentially unfavorable outcomes may emerge. Drawing upon a game-theoretic model with a tax manager engaging in risky tax planning, a controversy manager developing a tax opinion to persuade the tax authority in a tax dispute, and a strategically enforcing tax authority, we investigate how improving a firm's tax technology and employing the controversy manager interact and affect firms' tax outcomes.

This study is important and timely because the number and magnitude of corporate tax disputes have increased considerably in recent years (EY 2023, KPMG 2023, Lindsey et al. 2023), and so have resulting tax risks. Tax disputes entail significant tax risks, due to the unpredictability of their outcomes (Blaufus et al. 2016), their financial uncertainties (Nessa et al. 2020, Lindsey et al. 2023), and potential reputational and compliance costs (Graham et al. 2014, Neuman et al. 2020, Brühne and Schanz 2022, Li and Okafor 2024). At the same time, tax risks also involve upside potential (Brühne and Schanz 2022). Thus, tax disputes are partly attributable to firms' attempts to enhance tax performance (e.g., Armstrong et al. 2012, Klassen et al. 2017), as the consistent avoidance of disputes can result in unexploited tax planning opportunities. Consistently, anecdotal and survey evidence highlight the necessity of "building [the] tax controversy department of the future" (EY 2021, p. 4).

Corporate tax disputes and their resolution have gained increased attention in recent years. Mandated tax-related disclosures (Mills et al. 2010, Bozanic et al. 2017, Joshi 2020) and more intensive, targeted risk-based tax audits (Eberhartinger et al. 2022, OECD 2023) have increased the salience of risky tax positions and, in turn, tax authorities' concerns. Alternative instruments to prevent disputes before they emerge, such as "enhanced relationship programs" (e.g., De Simone et al. 2013) or advance pricing agreements (e.g., De Waegenaere et al. 2007), often do not fully shield against tax risk. In addition, tight fiscal and tax authority budgets have put more pressure on tax collection (Nessa et al. 2020, Blaufus et al. 2023) and have increased the probability of (unilateral) corrections of firms' tax positions (Diller et al. 2025, Martini et al. 2025).

Compared with civil disputes, tax disputes tend to be more complex, and the burden of proof lies more heavily on the (corporate) taxpayer (Spier 2007, Tran-Nam and Walpole 2012, Tran-Nam and Walpole 2016). Therefore, practices to manage tax risk and improve tax dispute outcomes matter to firms (Brühne and Schanz 2022, Blaufus et al. 2023). We follow Dyreng and Maydew's (2018) call to look inside the black box of firms' tax strategies. Within tax risk management, two practices have received considerable attention.[1]

As a first practice, firms implement and improve tax technologies generating information about tax positions. We focus on the information provided about *risky* (i.e., uncertain or ambiguous) tax positions that are likely to result in a tax dispute. Consider, for example, a typical risky tax position concerning the deductibility of specific expenses (Mills et al. 2010) and the tax technology encompassing (generative) artificial intelligence (Krupa and Mullaney 2025) or a digitized process support (Brühne and Schanz 2022). The tax technology aggregates information and provides a tax manager with a red flag (nondeductible) or a green flag (deductible). The technology could be designed to always indicate a red flag if the slightest tax risk arises, which reduces the likelihood of tax disputes. However, this would also inhibit tax saving opportunities if the tax conditions favor the deductibility. Therefore, in our setting, a low-quality tax technology conservatively indicates unfavorable conditions, while a high-quality tax technology can indicate favorable conditions.

As a second practice, firms can consult external controversy managers such as attorneys or tax advisors, which constitutes a key element of their tax controversy strategies (Acito and Nessa 2022, Niemann and Sailer 2023). Reflecting the growing importance of this practice, our textual analysis of tax-related job postings from the LinkUp database shows a steady rise in the demand

[1] Brühne and Schanz (2022, p. 35) define tax risk management as the "entirety of corporate practices implemented by a firm to identify, evaluate, manage, mitigate, monitor, and control corporate tax risk and to establish a beneficial internal information environment," including "specific tools, steps, and sub-processes." We focus on two common and recently promoted tax risk management practices that are particularly relevant in tax disputes.

for these positions, increasing from 38 postings in 2016 to 343 in 2023.[2] Controversy managers provide expertise beyond that of common tax managers (KPMG 2016, 2019). In disputes, they conduct in-depth investigations to identify favorable or unfavorable tax conditions underlying risky tax positions, structuring arguments to resolve disputes favorably with tax authorities (Blaufus et al. 2016), which is in line with our anecdotal evidence:

> ... my job is to evaluate ... how could a court decide this at the end of the day? How strong are our positions? How strong are the objections that are raised? How certain is the law? How certain is the legal basis?
> —Head of Controversy and Litigation, Partner, Tax, Big4

Unlike other tax professionals, controversy managers are strongly committed to disclosing both favorable and unfavorable conditions to maintain their reputation and credibility as mediators between firms and tax authorities.

> ... I am and remain an organ of the administration of law and justice and for me, the administration of law and justice is also about representing the interests of my clients ... and that includes having to say no and ... being able to catch a client and saying, '... we can't continue to take this position, ... the position is a false position.'
> —Head of Controversy and Litigation, Partner, Tax, Big4

We develop a model incorporating both practices. It involves three strategic players: a tax manager (he), a tax authority (it), and a potentially present controversy manager (she). The tax technology provides the tax manager with private information about the underlying tax condition of a risky tax position. The tax manager has an incentive to decrease the reported tax but also suffers disutility if the tax authority later overturns his reported tax. He can exert tax planning effort, facilitating a low tax report even when the technology indicates a high tax. The tax authority always accepts a high report but challenges a low report, which culminates in a tax dispute.[3] When a tax dispute emerges, the controversy manager can investigate and develop a substantiated tax opinion so as to persuade the tax authority to agree with the tax manager's initial low report. She can choose the properties of the investigation, which we model

[2]From 2016 to 2023, we find 1354 job postings with "tax" and "controversy" in the job title, primarily in the U.S. and Canada. The LinkUp database provides daily job posting data scraped directly from firms' websites. For more details, see Giese et al. (2025).

[3]We could easily extend our model by allowing the tax authority to challenge only a fraction of low reports. Our results would not change qualitatively.

as the distribution of a tax opinion over the underlying tax condition. For example, a completely informative investigation would correspond to a tax opinion that always reveals the underlying tax conditions.[4] Based on the controversy manager's tax opinion, which either supports or refutes the low report, or the absence of a tax opinion, the net revenue-maximizing tax authority strategically decides to accept a low tax or enforce a high one (i.e., enforce aggressively).

To begin, we illuminate the effect of improving the tax technology on the equilibrium strategies. We find that, *without a controversy manager*, improvements decrease the tax authority's enforcement aggressiveness, and, in turn, increase the tax manager's tax planning effort only if a critical technology quality level is exceeded and the tax authority's litigation exposure is high.[5] Otherwise, improving the tax technology has no impact on equilibrium strategies. *With a controversy manager*, improving the technology similarly decreases the tax authority's incentives to enforce aggressively. Thus, the controversy manager can design her investigation so that her tax opinion more often supports a low tax, increasing the tax manager's tax planning incentives. However, improving technology increases the tax manager's expected enforcement-related costs after a high technology signal, reducing his planning incentive. We show that this second effect dominates, leading, in equilibrium, to a decrease in tax planning effort.

In subsequent analyses, we show how the quality of the tax technology and the presence of a controversy manager affect three corporate tax metrics: tax dispute probability, the probability of unfavorable dispute outcomes, and the probability of low final tax payments. We find that controversy managers tend to "create their own demand": their presence increases the probability of tax disputes by incentivizing the tax manager to engage in more tax planning. This occurs because the probability of losing a tax dispute decreases with a controversy manager, reducing the tax manager's marginal costs of tax planning and increasing his effort. From the firm's perspective, this increase in tax manager effort can be beneficial, as the low tax report—despite triggering tax disputes—is key to ultimately achieving a low final tax payment.

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[4]This aligns with other Bayesian persuasion models (e.g., Kamenica and Gentzkow 2011, Michaeli 2017).

[5]Generally, the tax authority's litigation exposure is high when the tax system provides easy access to the legal system, effective arbitration procedures (Markham 2018, Martini et al. 2025), and a reasonable burden of proof for taxpayers (Rhoades 1997, LeBlanc 1998). In our model, this is parsimoniously represented by the tax authority suffering high costs after falsely enforcing a high tax liability.

Next, we demonstrate that the controversy manager generally reduces the probability of unfavorable dispute outcomes. She has a twofold effect driven by her investigation's underlying properties and their influence on the tax manager's effort. First, she produces a *tax reassurance* effect, which hinders the tax authority from falsely enforcing a high tax liability. Second, she yields a *tax planning* effect, which can persuade the tax authority to accept a low tax liability more often than would align with the ex ante tax condition. Surprisingly, we also identify conditions under which the controversy manager increases unfavorable dispute outcomes. This result arises because the tax dispute (i.e., the persuasion stage) is endogenously determined through the tax manager's effort. While reducing unfavorable dispute outcomes for a given dispute, the controversy manager's presence can increase the tax dispute probability to an extent that overall unfavorable dispute outcomes occur more often. Conditions with low-quality tax technology and high enforcement-related tax manager costs ultimately result in a negative tax planning effect, which outweighs the still positive tax reassurance effect.

In addition, we find that the controversy manager consistently increases the probability of low final tax payments. Intuitively, the higher tax dispute probability (upside potential) outweighs the risk of unfavorable dispute outcomes (downside potential). Due to complex strategic interactions, tax technology quality can increase or decrease all tax metrics, depending on the presence of the controversy manager, tax manager's planning and enforcement-related costs, and the authority's litigation exposure. Our key takeaway is that a firm's preferred tax department design is often characterized by an *imperfect* tax technology and a controversy manager.

Lastly, we extend our analyses to allow for private tax authority information in the tax dispute. This is particularly relevant given recent efforts by tax authorities to collect information from sources beyond tax returns (e.g., OECD 2023). Appending our model in the spirit of Alonso and Câmara (2016), we show that the controversy manager adjusts her investigation in response to private tax authority information. For a given dispute, if the tax authority holds low-quality private information, the investigation still provides reassurance and avoids voluntary tax overpayment, but its tax planning property is diluted. For high-quality private information, the investigation additionally involves some voluntary tax overpayment. Thus, private tax authority information tends to increase the tax manager's expected enforcement-related costs, thereby reducing both the tax planning effort and dispute probability. From a policymaker perspective, this suggests that private tax authority information can be an effective instrument to deal with sophisticated controversy experts. In general, our findings without private information should be viewed as an upper bound of the controversy manager's value to a firm.

Our contribution is threefold. First, we contribute to the literature on strategic tax audits (e.g., Graetz et al. 1986, De Simone et al. 2013). Two extensions of this literature relate particularly to our study. First, some studies include (potentially strategic) tax advisors who are *assumed* to resolve taxpayer uncertainty (Melumad et al. 1994, Beck et al. 1996, Phillips and Sansing 1998, Kaçamak 2022) or facilitate (aggressive) tax planning (Lipatov 2012, Elitzur and Yaari 2024). Second, few studies explicitly consider tax disputes after a strategic tax reporting stage (Jung 1995, Franzoni 2004, Martini et al. 2025).[6] Following the call for further research on the role of tax advisors (Niemann and Sailer 2023), we add to this literature by examining the role of controversy experts in corporate tax enforcement and provide an *endogenous* explanation for advisors' tax reassurance and tax planning roles.

Second, we contribute to examining the black box of firms' tax departments (Feller and Schanz 2017, Dyreng and Maydew 2018). In our model, we recognize the upcoming role of tax technologies (Hamilton and Stekelberg 2017, Brühne and Schanz 2022, Krupa and Mullaney 2025) and emphasize that tax planning and tax risk management are intertwined through the interaction of strategic tax and controversy managers. Our work thus relates to empirical studies on tax managers' (Armstrong et al. 2012, Feller and Schanz 2017, Li and Okafor 2024) and tax advisors' (Blaufus et al. 2016, Kubick et al. 2020, Acito and Nessa 2022, Belnap et al. 2023) crucial role for firms' tax performance. To the best of our knowledge, we are the first to analytically investigate how tax risk management practices interdependently impact firms' tax outcomes.

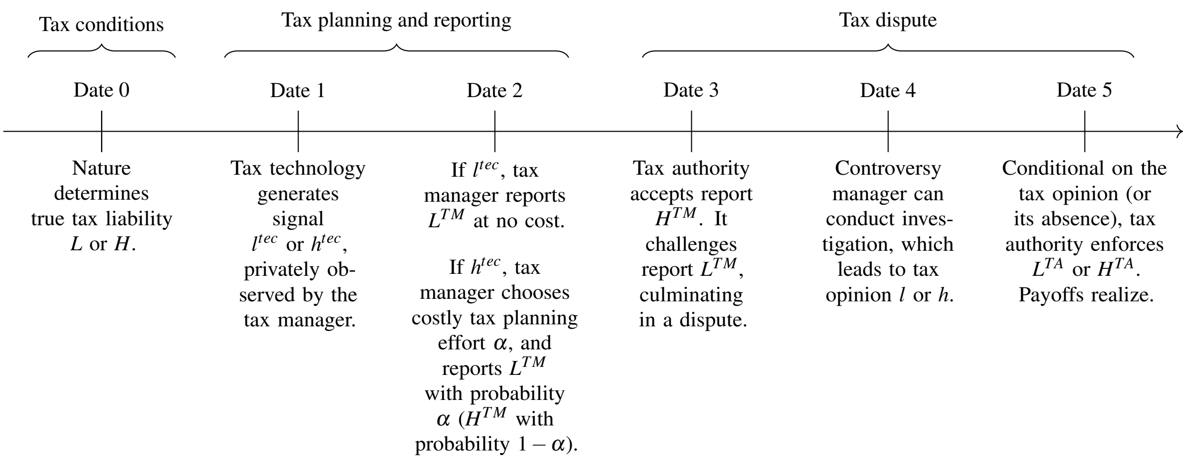
[6] Tax disputes are also related to auditor-manager disputes (Kronenberger et al. 2023) and civil disputes (Bebchuk 1984, Reinganum and Wilde 1986, Hay 1995). Unlike these dispute studies, we focus on how controversy experts persuade other dispute parties by providing additional information, and consider litigation parsimoniously in the tax authority's payoffs. For a Bayesian persuasion model in a nontax dispute setting, see Hennigs (2021).

Third, we contribute to the Bayesian persuasion literature by being the first to apply the seminal model of Kamenica and Gentzkow (2011) in a corporate tax setting. Like Alonso and Câmara (2016), we also extend our basic setting to allow for private receiver (i.e., tax authority) information in the persuasion stage. Other model applications in corporate contexts deal with agency problems (Jehiel 2015, Göx and Michaeli 2019), selective disclosure of information to multiple parties (Michaeli 2017), voluntary disclosure (Friedman et al. 2020, Friedman et al. 2022), and corporate governance (Gregor and Michaeli 2025). Unlike these applications, we consider that strategic decisions (i.e., risky tax planning effort) can precede the persuasion stage and influence the (potentially heterogeneous) prior at the persuasion stage.

2. Model

We consider three risk-neutral players: a tax manager (he), a controversy manager (she) and a tax authority (it).[7] The tax manager is responsible for tax planning and reports the firm's tax position to the tax authority. The controversy manager gets involved if a material tax dispute emerges (KPMG 2016, 2019). Then she becomes responsible for resolving the dispute with a strategic tax authority. Figure 1 shows the sequence of events.

Figure 1. Timeline



[7] Risk neutrality is a common assumption in studies involving three players (Lipatov 2012, Schantl and Wagenhofer 2020, Blaufus et al. 2024). It allows us to keep the model tractable and to focus on strategic interactions between the players.

Tax conditions At date 0, there is a significant (and representative) tax position, which is characterized by complexity, uncertainty, or ambiguity.[8] A tax position can exhibit these characteristics because tax law and regulations are often unclear and open to interpretation, yielding different tax liabilities (e.g., De Simone et al. 2013). We restrict the true tax liability of this tax position to be low with probability $\Pr(L) = p \in (0,1)$ or high with $\Pr(H) = 1 - p$. The true tax liability would only be revealed upon (perfect) adjudication, and is ex ante unknown by all players. The binary representation of the tax position illustrates, for example, uncertainty about whether R&D expenses qualify for a tax credit, a tax expense is tax-deductible (Beck and Jung 1989, Mills et al. 2010) or about the application of a specific transfer pricing method in an income shifting context (Reineke et al. 2023).

Tax planning and reporting At date 1, the tax manager obtains a private, imperfect signal from the firm's tax technology. The tax technology aggregates information about the risky tax position, and we make three key assumptions related to this technology. First, the tax manager receives the signal at no cost, implying that the costs of generating information are negligible, once the technology is implemented. Second, the quality of the tax technology is observable to all players. This might be a result of experiences from past interactions in tax audits and disputes or the quality may be inferred from a certified tax risk management system (Blaufus et al. 2023). Third, the technology is conservative: it never indicates a high tax liability as low, $\Pr(l^{tec}|H) = 0$, but it can indicate a low tax liability as high, $\Pr(h^{tec}|L) = 1 - q$. Thus, the conservative default signal is h^{tec}. The quality of the technology q reflects its ability to indicate favorable tax conditions $\Pr(l^{tec}|L) = q \in (0,1)$. This quality definition is consistent with empirical evidence suggesting that internal information quality increases tax avoidance, especially in uncertain environments (Gallemore and Labro 2015), and that firms aim to lower their tax payments. We show in Section 4 that—somewhat surprisingly—setting $q = 1$ is not necessarily preferred by firms even though we assume that improving quality q is costless.

[8] The assumption of a representative tax position is made for ease of exposition. Typically, there are several (uncertain) tax positions that have to be filed via the tax return (Rhoades 1999, De Simone et al. 2013).

The tax manager must submit a report to the tax authority (date 2). He benefits from reporting the low tax L^{TM}. Reasons for this may include a preference for meeting a targeted low effective tax rate (e.g., Armstrong et al. 2012) or reputational concerns arising from the labor market (e.g., Li and Okafor 2024). For ease of exposition, we normalize the tax manager's utility benefit from reporting L^{TM} to one. By contrast, if a tax dispute emerges and the tax authority ultimately enforces the high tax liability (date 5), the tax manager incurs enforcement-related costs $\lambda \in (0,1)$. Two interpretations of these costs are possible. First, the tax manager loses his utility benefit, and λ represents a discount factor, due to time gaps between tax reporting and enforcement (Nessa et al. 2020, Lindsey et al. 2023). Second, λ can include costs from correcting the tax return or unfavorable career outcomes for the tax manager, such as turnover while working in the firm or longer employment gaps after exiting it (Li and Okafor 2024).

Given signal l^{tec}, we assume that the cost of reporting L^{TM} is zero. Thus, independent of the tax authority's subsequent enforcement decision, the tax manager's best choice is to always report L^{TM}. However, upon observing h^{tec}, reporting L^{TM} is privately costly for him and requires a tax planning effort $\alpha \in (0,1)$, which translates into a low report with probability $\Pr(L^{TM}|h^{tec}) = \alpha$. The effort is unobservable to the other players and involves convex tax planning costs of $c\alpha^2/2$ with $c > 0$, as commonly assumed in the literature (e.g., Koethenbuerger et al. 2019, Reineke et al. 2025). These costs include preparing documentation, organizing majorities, and persuading stakeholders (Feller and Schanz 2017). Summing up, our assumptions reflect the tax manager's objective to utilize tax saving opportunities but to avoid surprises and disputes (Armstrong et al. 2012, Klassen et al. 2017).[9]

Tax dispute At date 3, the tax authority observes the reported tax. The tax authority accepts all high reports H^{TM}, because there is nothing to win in a tax dispute. However, the tax authority (exogenously) challenges all low reports L^{TM}. This reflects recent environments with substantial

[9]We treat the tax manager's objective as given. This comports with studies highlighting tax actors' personal incentives beyond performance-based contracts (Kohlhase and Wielhouwer 2023, Li and Okafor 2024) and the resulting obstacles of these contracts (Li and Okafor 2024, Gregor and Michaeli 2025). Studies that explicitly analyze the role of incentive contracts in tax planning or minimization include Chen and Chu (2005), Crocker and Slemrod (2005), and Jacob et al. (2019). Further, a manager's given compensation is also an assumption used in other accounting contexts (Schantl and Wagenhofer 2020, Gregor and Michaeli 2025).

(perceived) audit aggressiveness and scrutiny (Blaufus et al. 2023, Brühne and Schanz 2022) as well as that the costs of challenging a tax position's assessment are negligible, because in tax disputes, the onus predominantly falls on the taxpayer (Spier 2007, Tran-Nam and Walpole 2016, Lindsey et al. 2023).[10]

At date 4, the controversy manager steps in to resolve the tax dispute. The controversy manager's aims at persuading the tax authority to agree with the tax manager's report. She can do so by performing an investigation, which provides additional information to the tax authority that either supports l or refutes h the tax manager's report. The choice of the investigation can comprise what tax evaluation methods to choose, which comparable court rulings and precedents to check, or which questions to ask the experts in the R&D or accounting departments. Most importantly, we assume that the controversy manager commits to communicate the outcome of her investigation truthfully to the tax authority. In line with other Bayesian persuasion models (e.g., Michaeli 2017, Kamenica 2019), this commitment to the investigation design enables us to focus on the endogenous choice of information quality and provides an upper bound for the effect of a controversy manager. This commitment assumption is consistent with our anecdotal evidence and particularly descriptive of tax dispute settings for at least two reasons. First, controversy managers are typically lawyers, and their professional ethics or bar rules require them to disclose both favorable and unfavorable information. Second, their commitment can come from reputational concerns. As controversy managers frequently interact with the courts, they are keen to avoid any actions that might be viewed as potentially illegal or unethical.

We formalize the controversy manager's dispute resolution decisions as follows. She chooses the probability Δ of conducting an investigation and the investigation's properties. We formalize these properties as distributions $\delta(\cdot|L)$ and $\delta(\cdot|H)$ that generate a tax opinion l or h. Like most Bayesian persuasion models (e.g., Kamenica 2019, Friedman et al. 2020, Gregor and Michaeli 2025), we assume that the investigation is costless.[11]

[10]We could allow the tax authority to challenge only a fraction of reports L^{TM}. Since the controversy manager's and the tax authority's strategic decisions occur after L^{TM}, a lower probability only affects the tax manager's effort decision, which is similarly reflected in a decrease in his enforcement-related cost λ.

[11]Introducing fixed investigation costs leaves the optimal investigation properties and the underlying economics unaffected (Alonso and Câmara 2016). However, if different investigations or messages impose different costs,

Both the controversy manager and the tax authority cannot observe the tax manager's effort α but are informed about the tax manager's preferences and the quality of the tax technology. Therefore, both share a common prior at the dispute stage $\mu_P(\alpha)$ that a low tax manager report originates from a low true tax. This prior depends on their conjecture about the tax manager's effort. In section 5, we acknowledge that the tax authority might receive additional information and account for heterogeneous priors. The common prior at the dispute stage is

$$\mu_P(\alpha) \equiv \Pr\left(L|L^{TM}\right) = \frac{pq + p(1-q)\alpha}{(1-p)\alpha + pq + p(1-q)\alpha}. \tag{1}$$

The controversy manager obtains a utility $u^{CM}\left(L^{TA}\right) > u^{CM}\left(H^{TA}\right) = 0$ if her tax opinion (or its absence) persuades the tax authority to choose L^{TA} instead of enforcing H^{TA}.[12] As we will show later, it then suffices to focus on the controversy manager's investigation property choice $\delta(l|H)$, as she is always better off to choose $\delta(l|L) = 1$ (and respectively, $\delta(h|L) = 0$).

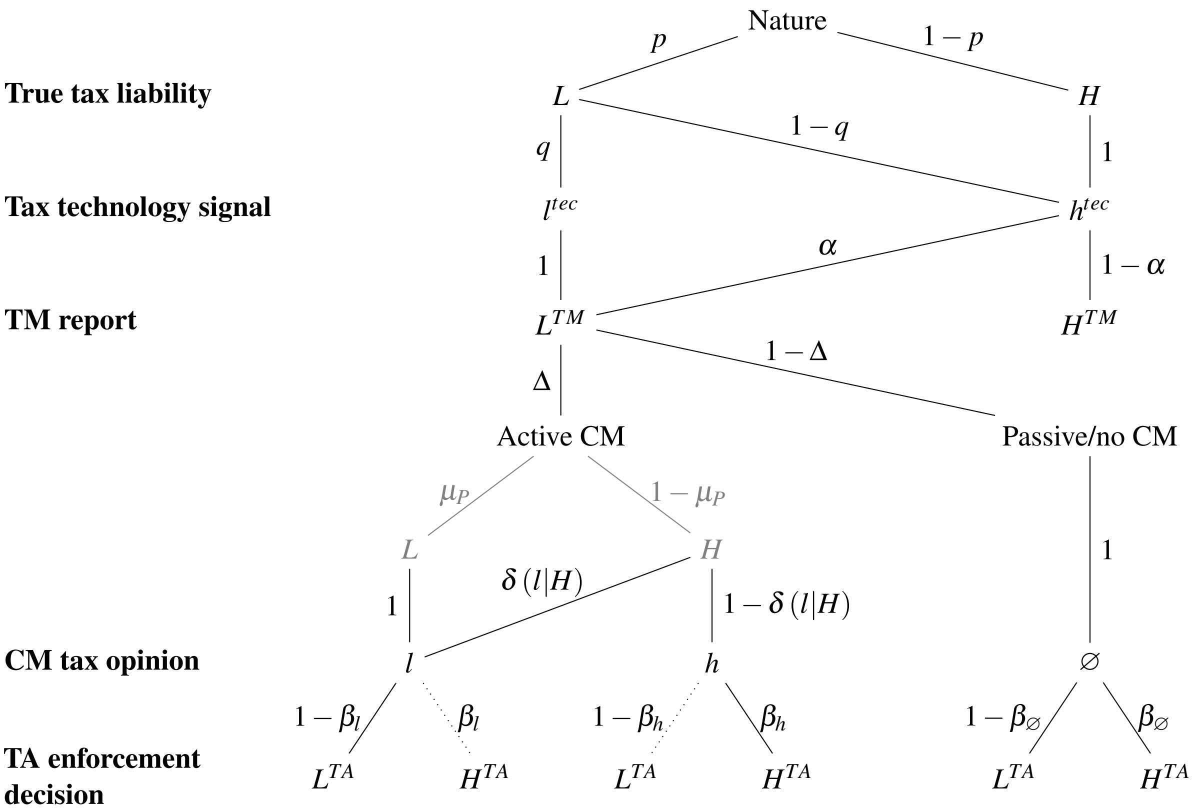
Finally, at date 5, the tax authority observes the controversy manager's tax opinion (or its absence) and ultimately decides on whether to accept the low or enforce the high tax liability. Formally, it chooses a probability $\beta_j \equiv \Pr\left(H^{TA}|j;L^{TM}\right) = \Pr\left(H^{TA}|j\right)$ with $j \in \{l,h,\varnothing\}$, where we drop L^{TM} for ease of notation wherever possible. If the tax authority chooses L^{TA}, it obtains a utility $u^{TA}(L^{TA}) = 0$, irrespective of the true tax liability. If the tax authority chooses H^{TA} and the true tax liability is high, it obtains the disputed value $u^{TA}(H^{TA}|H) = z > 0$, which comprises the difference in tax liabilities and a penalty proportional to the size of under-reporting. However, if the true tax liability is low, the tax authority incurs a disutility $u^{TA}(H^{TA}|L) = -\theta z$. $\theta > 0$ represents the tax authority's litigation exposure. For example, high litigation exposure (i.e., high θ) characterizes cross-border tax disputes within Europe, where a tax authority's false enforcement decision may result in double taxation, thereby allowing the firm to request mandatory binding arbitration (Martini et al. 2025). The tax authority's payoff structure acknowledges the common assumption of a net revenue maximizing tax authority when analyzing

the properties of the investigation may change (Gentzkow and Kamenica 2014, Michaeli 2017, Nguyen and Tan 2021).

[12]This simple payoff structure characterizes the "conventional view" (Phillips and Sansing 1998, p. 4) that the advisor's (i.e., controversy manager's) and taxpayer's (here the tax manager's) incentives are aligned.

strategic interactions in tax audits and disputes (Graetz et al. 1986, Franzoni 2004, Diller et al. 2025).[13] Figure 2 shows the game tree.

Figure 2. Game Tree



Notes: Nature and tax technology are exogenous; tax manager (TM), controversy manager (CM), and tax authority (TA) are players. TM chooses α, CM chooses Δ and $\delta(l|H)$, and TA chooses β_j with $j \in \{l, h, \varnothing\}$. In addition, for $\Delta = 0$, the game tree depicts the game without a CM. The gray lines indicate that the CM's investigation provides a signal about the true tax liability, which is truthfully submitted. The dotted lines are off the equilibrium path.

3. Equilibrium

In this section, we characterize the equilibrium strategies of the tax manager, the potentially involved controversy manager, and the tax authority. We solve the game by backward induction, starting with the tax authority's enforcement decision, then determining the controversy man-

[13] Our results also extend to a setting in which the tax authority only cares about fair taxation, that is, $u^{TA}(L^{TA}|L) = u^{TA}(H^{TA}|H) > u^{TA}(L^{TA}|H) = u^{TA}(H^{TA}|L) = 0$, or combinations of net revenue maximization and fair taxation.

ager's dispute resolution decisions, and finally the tax manager's tax planning effort. All formal proofs are given in the Appendix A.

3.1. Tax authority's enforcement decision

On date 5 the tax authority observes the controversy manager's tax opinion or its absence, $j \in \{l, h, \varnothing\}$. Conditional on this information, the tax authority chooses the probability of enforcing a high tax liability $\beta_j \equiv \Pr\left(H^{TA}|j\right) \in [0,1]$. It solves

$$\max_{\beta_j} \beta_j \left[\Pr(H|j)\, z - (1 - \Pr(H|j))\, \theta z\right]. \tag{2}$$

Absent a tax opinion ($j = \varnothing$), enforcing the high tax is beneficial with conditional probability

$$\Pr(H|\varnothing) \equiv 1 - \mu_P(\alpha) = \frac{(1-p)\alpha}{(1-p)\alpha + pq + p(1-q)\alpha}. \tag{3}$$

Thus, when $j = \varnothing$, the tax authority's prospects of choosing H^{TA} increase in the tax planning effort α and decrease in the tax technology quality q.

Note that, if the enforcement decision absent a tax opinion is $\beta_\varnothing = 0$, independent of the level of tax planning effort, there is no room for the controversy manager to improve the dispute's outcome. In that case, the tax authority already chooses the controversy (and tax) manager's preferred enforcement decision. To rule out this uninteresting case, we make the following assumption.

Assumption 1. *The tax authority's litigation exposure is not too high; that is,* $\theta < \frac{1-p}{p}\frac{1}{c} \equiv \overline{\overline{\theta}}$.

If the tax authority receives a tax opinion l or h, it considers how the controversy manager designs the properties of her investigation $\delta(\cdot|L)$ and $\delta(\cdot|H)$. Then enforcing the high tax is beneficial with conditional probability

$$\Pr(H|j) = \frac{(1-\mu_P(\alpha))\,\delta(j|H)}{(1-\mu_P(\alpha))\,\delta(j|H) + \mu_P(\alpha)\,\delta(j|L)} \text{ with } j \in \{l, h\}. \tag{4}$$

Intuitively, the higher the conditional probability $1-\mu_P(\alpha)$ that enforcing H^{TA} is beneficial *before* receiving a tax opinion, the higher is the conditional probability $\Pr(H|j)$ that enforcing H^{TA} is beneficial *after* tax opinion l or h. As tax planning effort α increases and tax technology quality q decreases $1-\mu_P(\alpha)$, the probability $\Pr(H|j)$ also (weakly) increases in α and decreases in q with a tax opinion. The direct effect of tax technology quality q comports with regulatory proposals encouraging firms to improve their information generation processes as part of their internal controls (De Simone et al. 2013, Blaufus et al. 2023), which might result in less enforcement scrutiny. However, in this study, we additionally scrutinize the indirect effect of q on the controversy manager's dispute resolution decisions and, in turn, the tax authority's enforcement decision.

3.2. Controversy manager's dispute resolution decisions

The controversy manager's dispute resolution decisions consist of the probability of conducting an investigation and the properties of the investigation. As highlighted above, each tax opinion leads to a posterior belief (equation 4), and thus the properties of the investigation create a distribution over posterior beliefs. The controversy manager designs the properties of the investigation such that it is Bayes-plausible; that is, the expected posterior distribution equals the prior (e.g., Kamenica and Gentzkow 2011, Michaeli 2017).

It is always optimal for the controversy manager to choose the property $\delta(h|L)=0$ when investigation precision is costless. Then the tax authority can be sure that the tax opinion h stems from a high true tax liability, implying $\beta_h=1$. Thus, we can restrict our focus to the controversy manager's choice of the property $\delta(l|H)$. Her objective function is given by

$$\max_{\Delta,\delta(l|H)} u^{CM}(L^{TA})\cdot\left[\Delta\left(\left(\mu_P(\alpha)+(1-\mu_P(\alpha))\,\delta(l|H)\right)(1-\beta_l)\right)+(1-\Delta)(1-\beta_\varnothing)\right]. \quad (5)$$

Then the properties of the optimal investigation can be shown to be as follows.

Lemma 1. *The controversy manager chooses* $\delta(l|L)=1$ *and* $\delta(l|H)=\theta\frac{\mu_P(\alpha)}{1-\mu_P(\alpha)}$.

The investigation properties in Lemma 1 structurally resemble those obtained in other persuasion models with a binary state (e.g., Friedman et al. 2022). However, in contrast to most other applications, $\delta(l|H)$ depends on the prior $\mu_P(\alpha)$, which endogenously arises in the tax planning and reporting stage. If the tax planning effort and thus $1-\mu_P(\alpha)$ is very high ($\mu_P(\alpha) \to 0$), the investigation becomes perfectly informative ($\delta(l|H) \to 0$).[14] By contrast, if $1-\mu_P(\alpha)$ is sufficiently low ($\mu_P(\alpha) \to \frac{1}{1+\theta}$), the investigation almost always leads to tax opinion l ($\delta(l|H) \to 1$). The controversy manager chooses $\delta(l|H)$ such that the tax authority is just willing to choose L^{TA} when observing l (i.e., $\beta_l = 0$).[15] Note that, if $\delta(l|H) = 1$, the investigation is completely uninformative for the tax authority. Then the controversy manager is indifferent between conducting an investigation or not, and we follow the convention to focus on pure strategies $\Delta \in \{0,1\}$, with $\delta(l|H) = 1$ implying $\Delta = 0$.[16] Considering Lemma 1, the controversy manager's optimization problem simplifies to

$$\max_{\Delta} \; u^{CM}(L^{TA}) \cdot \left[\Delta \mu_P(\alpha)(1+\theta)(1-\beta_l) + (1-\Delta)(1-\beta_\varnothing)\right]. \tag{6}$$

3.3. Tax manager's tax planning effort

The tax manager's best choice is to always report L^{TM} if the tax technology generates a low signal l^{tec}, independent of the tax authority's enforcement decision. If the tax technology generates a high signal h^{tec}, he has an incentive to engage in tax planning, which succeeds with probability $\Pr\left(L^{TM}|h^{tec}\right) = \alpha$ and involves tax planning costs $c\alpha^2/2$. However, if the tax manager reports L^{TM} and the tax authority ultimately enforces the high tax H^{TA}, the tax manager incurs enforcement-related costs $\lambda \in (0,1)$. Without a controversy manager's investigation, the tax manager incurs these costs with probability $\beta_\varnothing$. With an investigation, the tax manager

[14]The Bayesian persuasion framework implies that a fully informative investigation about the true tax liability is feasible. However, one can reinterpret this liability to be the best estimate *any* expert could generate without requiring the feasibility of an arbitrarily precise investigation (Kamenica and Gentzkow 2011, Kamenica 2019).

[15]Formally, $\beta_l = 0$ would require that the controversy manager chooses $\delta(l|H) = \theta \frac{\mu_P}{1-\mu_P} - \varepsilon$, with $\varepsilon > 0$ being arbitrarily small. We drop $\varepsilon > 0$, which corresponds to the approach of Kamenica and Gentzkow (2011).

[16]Focusing on "informative signal[s]" (Kamenica and Gentzkow 2011, p. 2591) is common in Bayesian persuasion settings. We thus exclude mixed strategies where the controversy manager arbitrarily conducts uninformative investigations $\Delta \in (0,1]$ and $\delta(l|H) = 1$, which do not change equilibrium outcomes compared to pure strategy $\Delta = 0$.

considers the investigation's properties (see Lemma 1), and the tax authority's resulting responses $\beta_l = 0$ and $\beta_h = 1$. Then the tax manager only needs to worry about situations that occur with probability $\Pr\left(h^{tec}|H\right)\left(1-\delta\left(l|H\right)\right)$.

Overall, after observing h^{tec}, the tax manager chooses the tax planning effort solving

$$\max_{\alpha}\ \alpha - \alpha\lambda\left[\Delta\frac{1-p}{1-pq}\left(1-\delta\left(l|H\right)\right)+\left(1-\Delta\right)\beta_{\varnothing}\right]-c\alpha^2/2. \tag{7}$$

His optimal tax planning effort is thus

$$\alpha = \frac{1-\lambda\left[\Delta\frac{1-p}{1-pq}\left(1-\delta\left(l|H\right)\right)+\left(1-\Delta\right)\beta_{\varnothing}\right]}{c}. \tag{8}$$

Let us note that $\lambda < 1$ ensures that the tax manager always engages in *some* tax planning, independent of the tax authority's and controversy manager's decisions. In addition, we require $c \geq 1$ to guarantee an interior tax planning effort $\alpha < 1$ if the tax manager's enforcement-related costs are very small ($\lambda \to 0$).

Absent a controversy manager's investigation ($\Delta = 0$), the tax manager's tax planning effort decreases in the probability $\beta_{\varnothing}$ that the tax authority enforces a high tax liability. This captures the enforcement effect on tax planning. When a controversy manager conducts an investigation ($\Delta = 1$), she affects the enforcement effect in two ways. First, she protects the tax manager from adverse dispute outcomes (and the related costs) that would result from the tax authority falsely enforcing the high tax in a tax dispute. Second, her persuasion also convinces the tax authority to agree with low reports that stem from a high true tax liability with probability $\delta\left(l|H\right)$. While both empirical (e.g., Hoopes et al. 2012, Nessa et al. 2020) and theoretical (Blaufus et al. 2024, Reineke et al. 2025) work has scrutinized the enforcement effect on firms' tax outcomes, we emphasize that the enforcement effect depends on the presence of a controversy manager.

3.4. Equilibrium without a controversy manager

In this section, we establish the equilibrium without the controversy manager (i.e., $\Delta = 0$). This equilibrium provides a benchmark for isolating the impact of a controversy manager.

Absent a controversy manager, the tax authority chooses the probability $\beta_{\varnothing}$, which crucially depends on the prior at the dispute stage $1-\mu_P(\alpha)$ that the firm has unfavorable tax conditions. In particular, the tax authority chooses L^{TA} when $1-\mu_P(\alpha) < \frac{\theta}{1+\theta}$ and enforces H^{TA} if $1-\mu_P(\alpha) > \frac{\theta}{1+\theta}$. As $1-\mu_P(\alpha)$ is a function of the tax planning effort α, there is a critical level of tax planning α^*, which determines the tax authority's decision.

Lemma 2. *There exists* $\alpha^* = \frac{pq\theta}{pq\theta+1-p(1+\theta)} \in (0, \frac{1}{c})$*, such that, if* $\alpha > \alpha^*$ *(*$\alpha < \alpha^*$*), the tax authority's best response is* $\beta_{\varnothing} = 1$ *(*$\beta_{\varnothing} = 0$*).* α^* *increases in the tax technology quality* q*.*

The observation in Lemma 2 and the tax manager's optimal tax planning effort (equation 8) allow us to establish the equilibrium without a controversy manager, enforcing all conjectures.

Proposition 1. *Without a controversy manager, an equilibrium between the tax manager and the tax authority entails the following strategies.*

i) Suppose $\alpha^* < \frac{1-\lambda}{c}$.

- *a) Upon observing a high signal from the tax technology* h^{tec}*, the tax manager chooses tax planning effort* $\alpha^{NCM} = \frac{1-\lambda}{c}$.
- *b) The tax authority enforces* H^{TA} *with probability* $\beta_{\varnothing} = 1$.

ii) Suppose $\alpha^* > \frac{1-\lambda}{c}$.

- *a) Upon observing a high signal from the tax technology* h^{tec}*, the tax manager chooses tax planning effort* $\alpha^{NCM} = \alpha^*$.
- *b) The tax authority enforces* H^{TA} *with probability* $\beta_{\varnothing} = \frac{1-c\alpha^*}{\lambda}$.

Proposition 1 shows that equilibria in which the tax authority sometimes or always enforces aggressively exist, depending on the size of α^*. α^* captures the relevant characteristics of the tax dispute environment, including the quality of the firm's tax technology q, the tax authority's litigation exposure θ, and the underlying tax facts p. We are particularly interested in how the technology quality q affects the equilibrium behavior. The next observation demonstrates the equilibrium effects.

Corollary 1. *Absent a controversy manager, an increase in the quality of tax technology q affects the tax manager's tax planning effort α^{NCM} and the tax authority's enforcement aggressiveness $\beta_{\varnothing}$ as follows.*

i) If the tax authority's litigation exposure is low ($\theta < \overline{\theta}$), α^{NCM} and $\beta_{\varnothing}$ are unaffected.

ii) If the litigation exposure is high ($\theta > \overline{\theta}$), there exists a unique threshold value $\underline{q} \in (0,1)$ such that:

a) If the tax technology quality is sufficiently low ($q < \underline{q}$), α^{NCM} and $\beta_{\varnothing}$ are unaffected.

b) If the tax technology quality is sufficiently high ($q > \underline{q}$), α^{NCM} increases and $\beta_{\varnothing}$ decreases.

Corollary 1 shows that the effect of the tax technology quality q depends on the tax authority's litigation exposure. For example, a high-exposure environment is characterized by taxpayers' easy access to the legal system and effective arbitration procedures (Markham 2018, Martini et al. 2025). Generally, q directly decreases the prior belief $1-\mu_P(q)$ that enforcing H^{TA} in a tax dispute is beneficial and does not directly affect the tax manager's incentive to engage in tax planning. However, when litigation exposure is low, the tax authority's decreasing enforcement incentives never induce a change in the equilibrium enforcement aggressiveness $\beta_{\varnothing}$. Therefore, even when the tax technology quality is perfect ($q = 1$), the tax authority's enforcement aggressiveness, and, in turn, the tax planning effort remain unaffected.

When litigation exposure is high, the same economic rationale operates. If the quality of the tax technology quality is low enough, $q < \underline{q}$, the tax authority's enforcement incentives decrease but are insufficient to induce a change in equilibrium behavior. However, if the quality is sufficiently high $q > \underline{q}$, the authority reduces its equilibrium enforcement aggressiveness. Then the tax manager's expected enforcement-related costs decrease, and he increases his tax planning effort in equilibrium.

3.5. Equilibrium with a controversy manager

Next we establish the equilibrium with a controversy manager in Proposition 2.

Proposition 2. *With a controversy manager, an equilibrium between the tax manager, the controversy manager, and the tax authority entails the following strategies.*

i) Suppose $\alpha^* < \frac{1-\lambda\left[\frac{1-p-\theta p(1-q)}{1-pq}\right]}{c}$.

a) Upon observing a high signal from the tax technology h^{tec}*, the tax manager chooses tax planning effort* $\alpha^{CM} = \frac{1-\lambda\left[\frac{1-p-\theta p(1-q)}{1-pq}\right]}{c}$.

b) The controversy manager conducts an investigation ($\Delta = 1$*) with investigation properties* $\delta(l|L) = 0$ *and* $\delta(l|H) = \theta\frac{\mu_P(\alpha^{CM})}{1-\mu_P(\alpha^{CM})}$ *(Lemma 1).*

c) The tax authority enforces H^{TA} *after tax opinion* $\{l,h\}$ *with probabilities* $\beta_h = 1, \beta_l = 0$*, and off the equilibrium path strategy* $\beta_\varnothing = 1$ *.*

ii) Suppose $\alpha^* > \frac{1-\lambda\left[\frac{1-p-\theta p(1-q)}{1-pq}\right]}{c}$.

a) Upon observing a high signal from the tax technology h^{tec}*, the tax manager chooses tax planning effort* $\alpha^{CM} = \alpha^*$.

b) The controversy manager does not conduct an investigation ($\Delta = 0$*).*

c) The tax authority enforces H^{TA} *after tax opinion* $\varnothing$ *with probability* $\beta_\varnothing = \frac{1-c\alpha^*}{\lambda}$*, and off the equilibrium path strategies* $\beta_l = \frac{1-c\alpha^*}{\lambda}, \beta_h = 1$.

With a controversy manager, we also identify two types of equilibria, depending on the characteristics of the tax dispute environment α^*. When α^* is sufficiently low, the tax authority credibly threatens to enforce a high tax liability $\beta_\varnothing = 1$ if it does not observe an additional tax opinion. This incentivizes the controversy manager to investigate ($\Delta = 1$), which persuades the tax authority to agree with the tax manager's report L^{TM} with positive probability. When α^* is sufficiently high, the tax authority cannot credibly threaten to enforce the high tax. In that case, it only enforces the high tax in a fraction of disputed cases, and the controversy manager does not investigate ($\Delta = 0$), as she cannot affect the dispute's outcome.

Next we show how the tax technology quality q affects the equilibrium behavior when a controversy manager is present.

Corollary 2. *An increase in the quality of tax technology q affects the tax manager's tax planning effort α^{CM}, the controversy manager's dispute resolution decisions Δ and $\delta(l|H)$, and the tax authority's enforcement decision β_j as follows.*

i) If the tax authority's litigation exposure is low ($\theta < \overline{\theta}$), α^{CM} decreases, $\delta(l|H)$ increases, and Δ and β_j with $j \in \{l, h, \varnothing\}$ are unaffected.

ii) If the litigation exposure is high ($\theta > \overline{\theta}$), there exists a unique threshold value $\overline{q} \in (0,1)$ such that:

a) If the tax technology quality is sufficiently low ($q < \overline{q}$), α^{CM} decreases, $\delta(l|H)$ increases, and Δ and β_j with $j \in \{l, h, \varnothing\}$ are unaffected.

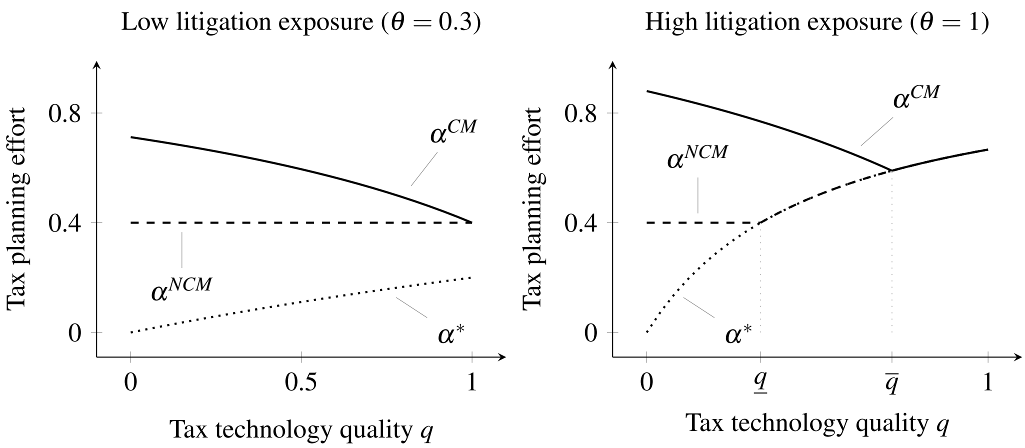
b) If the tax technology quality is sufficiently high ($q > \overline{q}$), α^{CM} increases, $\beta_\varnothing$ decreases, and $\Delta, \delta(l|H), \beta_l$ and β_h are unaffected.

Corollary 2 highlights that the impact of tax technology quality q also depends on the authority's litigation exposure when a controversy manager is present. If the litigation exposure is low, the controversy manager always submits an informative tax opinion l or h to the tax authority. This makes the tax authority's enforcement decision nonstrategic and thus independent of q. However, the controversy manager internalizes the tax authority's enforcement incentives in her equilibrium choice $\delta(l|H)$. An increasing quality q decreases the tax authority's expected benefits of enforcing the high tax liability. This creates room for the controversy manager to increase the probability of her favorable dispute outcome L^{TA}. She accomplishes this by increasing the frequency with which a low tax opinion is submitted when the true tax liability is high ($\delta(l|H)$ increases), while leaving the tax authority's enforcement strategies β_j unaffected.

Further, we show that an increase in the quality of tax technology q unambiguously decreases a tax manager's tax planning effort. Although the result seems to be trivial, the underlying economics are more intricate. On the one hand, an increase in q strengthens the tax planning property of the controversy manager's investigation (her findings become more favorable to a low tax), incentivizing a higher tax planning effort. On the other hand, an increase in q weakens the investigation's reassurance property (preventing overpayment when the tax authority would falsely enforce the high tax), incentivizing less tax planning effort. In equilibrium, we show that the impact on the reassurance property dominates, such that the tax planning effort decreases.[17]

If the litigation exposure is high, the same economic effects as in a low-exposure environment are at work if the quality of tax technology is sufficiently low, $q < \overline{q}$. By contrast, if the quality is sufficiently high, $q > \overline{q}$, the controversy manager's presence does not affect the dispute's outcome anymore. Therefore, the effects of q resemble those described absent a controversy manager. Interestingly, this implies that the tax planning effort has a unique minimum at $\overline{q}$ in a high-exposure environment. Figure 3 illustrates the effect of the tax technology quality on the tax manager's tax planning effort, depending on the presence of the controversy manager and the litigation exposure.

Figure 3. Effect of tax technology quality on the tax manager's tax planning effort



Notes: This figure illustrates Corollary 1 and 2. The results are shown for a low litigation exposure (left, $\theta = 0.3$) and a high litigation exposure (right, $\theta = 1$) . The dashed (solid) lines constitute the effort, absent a controversy manager α^{NCM} (with a controversy manager α^{CM}). The dotted lines depict the critical value α^*, which determines the obtained equilibrium (Propositions 1 and 2). The other parameters are chosen as $\lambda = 0.6, c = 1, p = 0.4$.

[17]The tax reassurance and planning *property* are related to, but distinct from the tax reassurance and planning *effect*. The *properties* refer to how the tax manager's equilibrium effort is affected by the investigation, while the *effects* are evaluated on an ex ante basis and include the resulting impact of this effort on dispute outcomes.

4. Preferences over tax department design

In the previous section, we treated the firm's tax technology quality q and the presence of the controversy manager as given. In this section, we think of both tax risk management practices as being determined by the firm.[18] We consider three firm tax metrics that might be considered when designing the tax department: the tax dispute probability (or short-term tax payments), the probability of unfavorable dispute outcomes, and the probability of low final tax payments. For expositional convenience, we will focus on environments in which the controversy manager has an incremental impact and conducts an informative investigation ($\Delta = 1$).

Tax dispute probability To begin, we consider the tax dispute probability with D^{CM} and without a controversy manager D^{NCM}. The difference between these probabilities constitutes the controversy manager's effect on the tax dispute probability DE. In our setting, the tax dispute probability equals the probability that the tax manager submits a low report L^{TM} after the tax planning and reporting stage, because a low report L^{TM} is always challenged by the tax authority and culminates in a tax dispute.

Firms may aim to avoid tax disputes (Klassen et al. 2017) because of the uncertainty they create, which can have undesirable real effects, such as reduced capital investments (Jacob et al. 2022). However, strictly avoiding disputes implies a poor tax performance H^{TM}, as also all upside potential is foregone. Therefore, tax disputes might reflect a firm's desire to enhance its (final) tax performance (Klassen et al. 2017). Additionally, a firm may seek to improve its short-term tax performance by reducing cash taxes for liquidity purposes (Law and Mills 2015) or achieving a low effective tax rate to boost capital market performance (Frischmann et al. 2008, Desai and Dharmapala 2009, Flagmeier et al. 2021).

[18]We assume that altering tax technology quality or implementing a controversy manager is costless to isolate the strategic effect of these practices. However, our metrics could easily be extended to incorporate such costs.

The tax dispute probabilities with and without controversy manager, respectively, are given by

$$D^{CM} = pq + (1 - pq)\,\alpha^{CM}, \tag{9}$$

$$D^{NCM} = pq + (1 - pq)\,\alpha^{NCM}. \tag{10}$$

Thus, the controversy manager's effect on the tax dispute probability is given by

$$DE = D^{CM} - D^{NCM} = (1 - pq)\left(\alpha^{CM} - \alpha^{NCM}\right). \tag{11}$$

Both with and without a controversy manager, increasing the quality of tax technology q directly affects the tax dispute probabilities (see also Lemma 4, Appendix A). On the one hand, increased tax technology quality mechanically increases the probability of the technology signal l^{tec} that results in a tax manager report L^{TM} (and dispute) with certainty. On the other hand, it mechanically decreases the probability of signal h^{tec}, where the report L^{TM} (and dispute) depend on the tax manager's tax planning effort. Since $\alpha^{NCM} < 1$ and $\alpha^{CM} < 1$, the net direct effect is positive.

An increase in the quality of tax technology q also indirectly affects the tax planning effort and thus the dispute probabilities. *Without* a controversy manager, this indirect effect on D^{NCM} complements the direct positive effect (Corollary 1), making the overall effect on D^{NCM} positive. This implies that the lowest dispute probability occurs for $q = 0$. *With* a controversy manager, an increase in q crowds out the tax planning effort (Corollary 2), making the indirect effect on D^{CM} negative. We show that, if the costs for tax planning are sufficiently low ($c < c^D$), the negative crowding-out effect dominates the positive direct effect, such that D^{CM} unambiguously decreases in q. Intuitively, low tax planning costs make the tax planning effort sensitive to changes in q. This might occur, for example, if anti-tax avoidance rules are lenient (Reineke et al. 2025). In this case, the lowest dispute probability can be achieved with an intermediate quality $q = \overline{q}$ if litigation exposure is high and with the maximum quality $q = 1$ if litigation exposure is low. Otherwise, the lowest dispute probability is achieved at $q = 0$.

In addition, we show that the tax dispute probability increases with a controversy manager ($DE > 0$). As we have already documented, the controversy manager's investigation serves as an insurance for the tax manager, which shields the tax manager from enforcement-related costs of unfavorable dispute outcomes. Thus, in the presence of a controversy manager, the tax manager increases his tax planning effort, particularly at low technology quality levels.

Figure 4 (top panel) at the end of this section shows tax dispute probabilities with and without a controversy manager (left) as well as the change in the tax dispute probability when employing one (right).

Probability of unfavorable dispute outcome There is a common understanding that firms (and managers) consider tax risk in their decision-making (Neuman et al. 2020, Brühne and Schanz 2022).[19] In our context, the probability of an unfavorable dispute outcome reflects the firm's residual tax risk (i.e., after the implementation of tax risk management practices) and is defined as the probability that the tax authority enforces a high tax liability H^{TA} after a low tax report L^{TM}. This definition encompasses most tax risk dimensions identified in the literature. We capture economic risk and tax law ambiguity (Neuman et al. 2020), political risk (Brühne and Schanz 2022) in the uncertainty about the true tax liability, inaccurate information processing (Neuman et al. 2020) and tax process risk (Brühne and Schanz 2022) in our tax planning and reporting stage and financial and enforcement risk (Neuman et al. 2020, Brühne and Schanz 2022) in the tax dispute stage. The probability of an unfavorable dispute outcome with and without a controversy manager is given by

$$UD^{CM} = (1-p)\alpha^{CM}(1-\delta(l|H)), \tag{12}$$

$$UD^{NCM} = \left(p(q+(1-q)\alpha^{NCM}) + (1-p)\alpha^{NCM}\right)\beta_{\varnothing} = \left(pq+(1-pq)\alpha^{NCM}\right)\beta_{\varnothing}. \tag{13}$$

[19] Neuman et al. (2020) and Brühne and Schanz (2022) broadly define tax risk as the uncertainty about (future) tax outcomes. According to Neuman et al. (2020), tax risk has three key dimensions: economic risk, tax law ambiguity, and inaccurate information processing. Brühne and Schanz (2022) suggest that tax risk has six dimensions: financial, reputational, political, compliance, tax process, and personal liability risk.

The reduction in unfavorable dispute outcomes achieved by employing a controversy manager is

$$\begin{aligned} UDE &= UD^{NCM} - UD^{CM} \\ &= \underbrace{p(q + (1-q)\alpha^{NCM})\beta_{\varnothing}}_{\text{tax reassurance effect}} + \underbrace{(1-p)\left(\alpha^{NCM}\beta_{\varnothing} - \alpha^{CM}\left(1-\delta\left(l|H\right)\right)\right)}_{\text{tax planning effect}}. \end{aligned} \tag{14}$$

The overall impact of a controversy manager on a firm's unfavorable dispute outcomes can be separated into two components, which we label *tax reassurance effect* and *tax planning effect*. The former effect captures all cases in which the tax authority would falsely enforce a high tax. The controversy manager's tax opinion supports a low tax in all of these cases, and, in equilibrium, the tax authority follows that opinion. The tax planning effect captures all cases with a high true tax that eventually result in a tax dispute. In these cases, the presence of a controversy manager affects the probability of a low tax report and the tax authority's subsequent enforcement decision. We can show that if the tax technology quality is sufficiently low ($q < q^{UDE}$) and the tax manager's enforcement-related costs are sufficiently high ($\lambda > \lambda^{UDE}$), the increase in disputes is so high that unfavorable dispute outcomes increase in total. Then, the negative tax planning effect overcompensates the positive tax reassurance effect.

The quality of tax technology q influences unfavorable dispute outcomes in a nontrivial way (Lemma 5, Appendix A). Without a controversy manager, an increase in q has a direct positive effect on unfavorable dispute outcomes. This is because the technology provides the tax manager with a low signal, which he subsequently reports. When faced with a tax authority enforcing the high tax liability, this increases unfavorable dispute outcomes. When the technology quality exceeds $\underline{q}$, the players' equilibrium strategies come to depend on q. Therefore, unfavorable dispute outcomes are also indirectly affected via the equilibrium strategies. We identify conditions in which the net indirect effects dominate the direct effect, such that unfavorable dispute outcomes decrease when improving intermediate-quality technologies.

With a controversy manager, we show that unfavorable dispute outcomes unambiguously decrease in technology quality q. Then, unfavorable dispute outcomes can be minimized by choosing the maximum feasible quality at which the controversy manager conducts informative investigations. If litigation exposure is low, unfavorable dispute outcomes are minimized if the technology quality is perfect ($q = 1$), and in a high-exposure environment, they are minimized at an intermediate level ($q = \overline{q}$). These results particularly highlight the importance of considering the interdependent effects of tax risk management practices. Absent a controversy manager, an intermediate technology quality can *maximize* unfavorable dispute outcomes, while it can *minimize* them with a controversy manager. Figure 4 (middle panel) illustrates the effects, depending on the quality of the tax technology q.

Probability of low final tax payments Achieving low final tax payments and thus a high final tax performance is obviously of significant interest for the firm (e.g., Armstrong et al. 2012, Klassen et al. 2017). The probabilities of ensuring low final tax payments are given by

$$LT^{CM} = pq + p(1-q)\alpha^{CM} + (1-p)\alpha^{CM}\delta\,(l|H)\,, \tag{15}$$

$$LT^{NCM} = \Big(pq + p(1-q)\alpha^{NCM} + (1-p)\alpha^{NCM}\Big)\,(1-\beta_{\varnothing}). \tag{16}$$

The controversy manager's effect on the probability of low final tax payments is thus given by

$$LTE = LT^{CM} - LT^{NCM} = \Big(D^{CM} - UD^{CM}\Big) - \Big(D^{NCM} - UD^{NCM}\Big) = DE + UDE. \tag{17}$$

The probability for low final tax payments is the difference between dispute probability and unfavorable dispute outcomes. Most interestingly, we show that the controversy manager consistently increases the probability for low tax payments ($LTE > 0$), independent of tax technology quality. Intuitively, the downside potential of more unfavorable dispute outcomes is always lower than the upside potential of a dispute in achieving low tax payments.

We also show that, in the absence of a controversy manager, the probability for low tax payments increases in technology quality q (Lemma 6, Appendix A). The reason is that the unambiguous positive effect of q on tax dispute probability overcompensates for the (case-dependent) ambiguous effect on an unfavorable dispute outcome, particularly if the litigation exposure is high. By contrast, in the presence of a controversy manager, an increase in q can decrease the probability for low tax payments due to the potential decreasing dispute probability, which is a prerequisite for low tax payments. Additionally, we find that the controversy manager's value added for low tax payments is often maximized at an intermediate technology quality level. Figure 4 (bottom panels) illustrates the results for low final tax payments and Proposition 3 summarizes the results for all tax metrics.

Proposition 3. *The controversy manager has the following effects on a firm's tax metrics:*

i) She increases the tax dispute probability ($DE > 0$), and DE strictly decreases in q.

ii) She affects the probability of unfavorable dispute outcomes (UDE) via a tax reassurance effect and a tax planning effect. The tax reassurance effect always reduces UDE, whereas the tax planning effect can decrease or increase UDE.

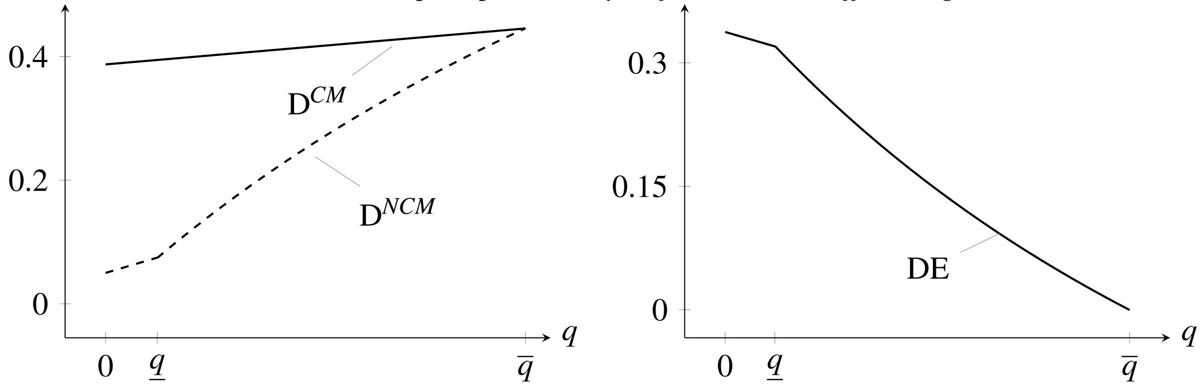
Overall, she increases unfavorable dispute outcomes ($UDE < 0$) if the tax technology quality is sufficiently low ($q < q^{UDE}$) and the tax manager's enforcement-related costs are sufficiently high ($\lambda > \lambda^{UDE}$) . Otherwise, she decreases unfavorable dispute outcomes ($UDE > 0$). UDE can increase or decrease in q.

iii) She increases the probability of low final tax payments ($LTE > 0$). LTE can increase or decrease in q.

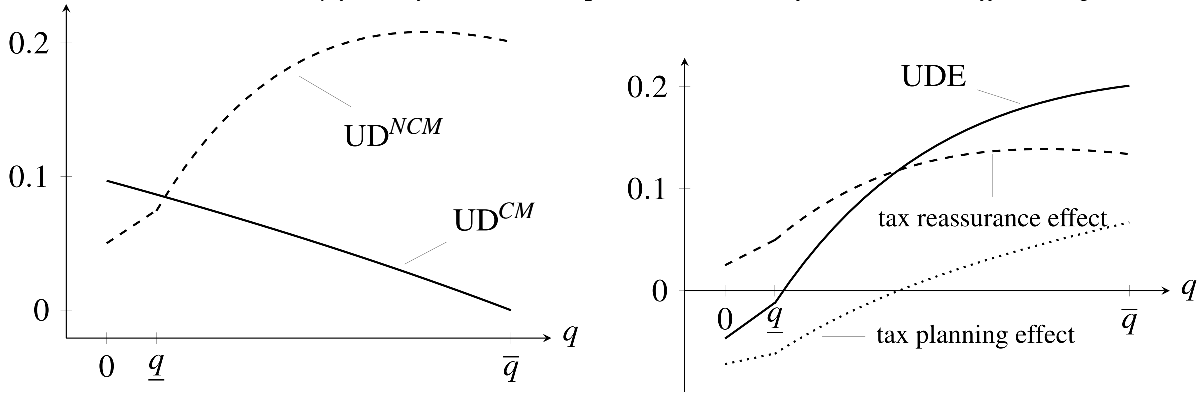
To sum up, our nuanced findings caution against adopting a one-size-fits-all approach to tax risk management. The optimal design of the tax department depends on a firm's weighting of tax metrics, tax manager characteristics, and the tax authority's litigation exposure.

Figure 4. Tax metrics and controversy manager's effect depending on technology quality

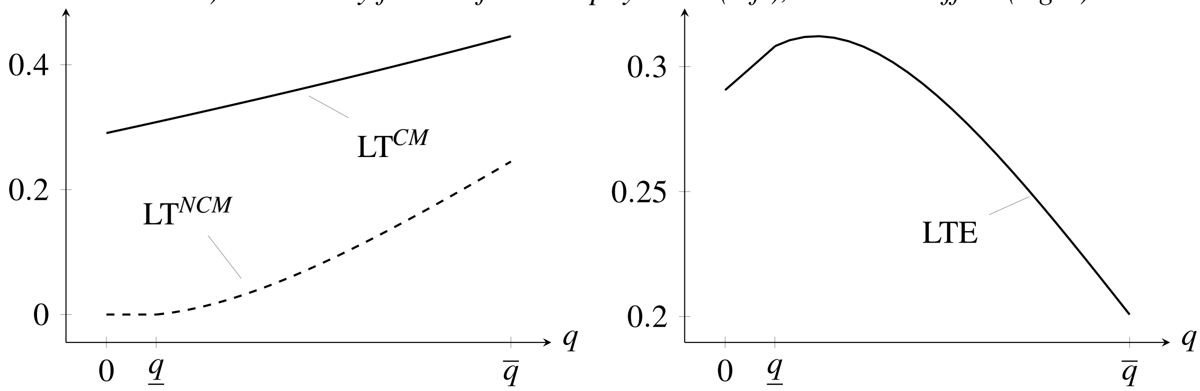
Panel a) Tax dispute probability (left) and CM's effect (right)



Panel b) Probability for unfavorable dispute outcome (left) and CM's effect (right)



Panel c) Probability for low final tax payments (left), and CM's effect (right)



Notes: This figure illustrates Proposition 3, and Lemmas 5, and 6. Panel a): tax dispute probability. Panel b): probability of unfavorable dispute outcome. Panel c): probability of low final tax payments. On the left, we plot the corporate metrics with (solid lines) and without a controversy manager (dashed lines). On the right, we plot the (absolute) difference, that is, the effect of the controversy manager. Parameters are $\theta = p = 0.5, \lambda = 0.9, c = 2$, which constitute a high litigation exposure. We have $\underline{q} = 0.05, \overline{q} = 0.42$.

5. Private tax authority information

Our basic model assumes that the sender (controversy manager) and receiver of information (tax authority) have a common prior μ_P at the start of the tax dispute. This assumption is consistent with settings in which all material documents have been exchanged through the tax return declaration process (Yoon 2000). In this section, we extend the model and explore a scenario in which the tax authority obtains additional private information about the true tax liability at the outset of the dispute.[20] For example, this information may come from a foreign tax authority via information exchange agreements (e.g., Diller et al. 2025). We model this additional information as a signal that is correct with probability $\Pr(l^{TAinfo}|L) = \Pr(h^{TAinfo}|H) = \frac{1+\psi}{2}$, where $\psi \in [0,1]$ measures the quality of the signal. $\psi = 0$ corresponds to the case of a completely random signal or one where the tax authority does not receive additional information. $\psi = 1$ captures the case where the tax authority can perfectly observe whether the true tax liability is low or high. Table 1 in Appendix B shows the tax authority's prior beliefs in the tax dispute induced by this signal and their distribution. For expositional convenience, we choose $c = 2$ and, without loss of generality, set the controversy manager's utility from sustaining a final low tax equal to one ($u^{CM}(L^{TA}) = 1$).

As shown by Alonso and Câmara (2016), the receiver's posterior can be expressed as a function of the sender's and receiver's priors and the sender's posterior.[21] This allows the sender's value function to be formulated solely in terms of the sender's posterior. The value of the optimal signal (and, in turn, the optimal signal) is then given by the value of the concavification[22] of the value function at the (sender's) prior.[23]

[20]Conversely, the controversy manager may also possess different information than the tax authority. For instance, if the tax technology signal is part of the tax file, it is visible to both the controversy manager and the tax authority. Assume the controversy manager trusts the technology signal, while the tax authority mistrusts it and adheres to its prior, creating heterogeneous priors. These heterogeneous priors, however, yield the same optimal investigation property $\delta(l|H)$ as in our basic model (Lemma 1). Intuitively, this is because the controversy manager's utility does not depend on whether the tax liability *truly* is low or high but only on the tax authority's enforcement decision. Consequently, only the tax authority's prior is relevant to her.

[21]Applied to our setting, the tax authority's posterior is $\mu^{TA} = \mu^{CM} \frac{\frac{\mu_P^{TA}}{\mu_P^{CM}}}{\mu^{CM}\frac{\mu_P^{TA}}{\mu_P^{CM}} + (1-\mu^{CM})\frac{1-\mu_P^{TA}}{1-\mu_P^{CM}}}$.

[22]The concavification of a function f is the smallest concave function that is everywhere weakly greater than f.

[23]C.f. Proposition 2 (ii) in Alonso and Câmara (2016). This method also offers a foundation for analyzing scenarios involving a common prior and costly sender investigation; see Gentzkow and Kamenica (2014).

The tax authority has two different priors, depending on which signal it receives. Accounting for this, the controversy manager's expected value function is given by

$$v^{CM} = \Pr(l^{TAinfo})u^{CM}(\mu^{TA}(\mu^{CM};\mu^{TA}_{P,l^{TAinfo}})) + \Pr(h^{TAinfo})u^{CM}(\mu^{TA}(\mu^{CM};\mu^{TA}_{P,h^{TAinfo}})), \qquad (18)$$

where $\mu^{TA}_{P,l^{TAinfo}}$ and $\mu^{TA}_{P,h^{TAinfo}}$ denote the tax authority's prior after receiving a low or high tax information signal, respectively. μ^{CM}_{P} $(= \mu_P)$ is the unchanged controversy manager's prior, and μ^{TA} and μ^{CM} denote the tax authority's and the controversy manager's posteriors, respectively. Inserting the respective priors and posteriors from Table 1 and rearranging equation (18) gives

$$v^{CM} = \begin{cases} 0 & \mu^{CM} < \frac{1-\psi}{1-\psi+\theta(1+\psi)} \\ \frac{1}{2}\left(1+\frac{\psi(p(1+\alpha-(1-\alpha)(1-q))-\alpha)}{\alpha+(1-\alpha)pq}\right), & \frac{1-\psi}{1-\psi+\theta(1+\psi)} \leq \mu^{CM} < \frac{1+\psi}{1+\psi+\theta(1-\psi)} \\ 1 & \frac{1+\psi}{1+\psi+\theta(1-\psi)} \leq \mu^{CM}. \end{cases} \qquad (19)$$

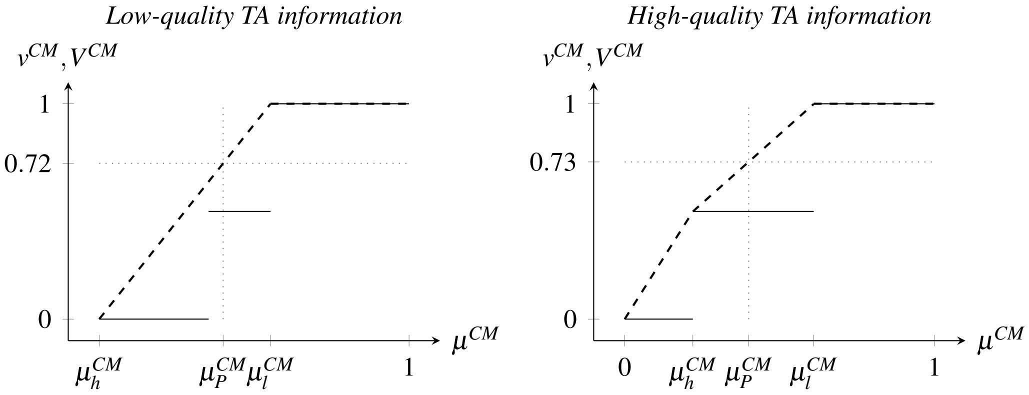
Denote V^{CM} the concavification of v^{CM}. There are two cases, which we refer to as "low-quality information," where ψ is below some threshold (left-hand side in Figure 5), and "high-quality information," with ψ above this threshold (right-hand side in Figure 5).[24] The optimal controversy manager's posteriors, their distribution, and the optimal investigation that they induce are shown in Table 2 in Appendix B.

Increasing ψ shifts the second piece of the controversy manager's value function to the left and the third piece to the right. Adjusting ψ until the middle piece meets the concavification provides the condition for the low-quality case:

$$\frac{(1-\psi)(1+\psi+\theta(1-\psi))}{(1+\psi)(1-\psi+\theta(1+\psi))} > \frac{1}{2}\left(1+\frac{\psi(p(1+\alpha-(1-\alpha)(1-q))-\alpha)}{\alpha+(1-\alpha)pq}\right). \qquad (20)$$

[24]For particular parameter constellations—in the high-quality tax authority information case—the controversy manager's prior may be within the first interval of V^{CM}. In this case, we obtain optimal posterior controversy manager beliefs $\mu^{CM}_h = 0, \mu^{CM}_l = \frac{1-\psi}{1-\psi+\theta(1+\psi)}$. This requires a combination of low probability of true low tax L and a high litigation exposure θ. A necessary condition that excludes this case is $p > \sqrt{5}-2 \approx 0.24$. We make this assumption to focus on parameter constellations that describe real situations.

Figure 5. Controversy manager's value function with private tax authority information



Notes: The black lines show the controversy manager's value function and the black dashed lines its concavification. We choose exogenous priors (independent from α) for expositional purposes. The tax authority's priors are assumed equally distributed for the same reason. Parameters are $\theta = 1, \mu_P^{CM} = 0.4$ as well as $\mu_{P,l}^{TA} = 0.55, \mu_{P,h}^{TA} = 0.35$ (left-hand side) and $\mu_{P,l}^{TA} = 0.7, \mu_{P,h}^{TA} = 0.3$ (right-hand side). When the middle piece of the value function touches the concavification (right-hand side), a qualitatively new set of optimal posteriors of the controversy manager is induced, especially, $\mu_h^{CM} > 0$. This requires that the controversy manager's prior lies within the second piece of the value function; see footnote 24.

If inequality (20) is not fulfilled, the high-quality information case prevails. Then, unlike our basic model, the controversy manager's optimal investigation involves some high tax opinions, although the true tax is low: $\delta(h|L) \equiv \delta_{\uparrow} > 0$. For clarity, we denote $\delta(l|H) \equiv \delta_{\downarrow}$.

Lemma 3. *With tax authority's private information, the following applies:*

i) The critical tax manager effort level necessary for an informative investigation is given by $\alpha_{\psi}^{*} = \frac{pq\theta(1-\psi)}{pq\theta(1-\psi)+(1-p)(1+\psi)-p\theta(1-\psi)}$. *Increasing information quality ψ increases the parameter range in which an informative investigation is possible.*

ii) There exist $\underline{\psi}$ and $\overline{\psi}$ such that: If $\psi < \underline{\psi}$ the low-quality tax authority information case applies over the whole range of feasible effort levels α, and if $\psi > \overline{\psi}$, the high-quality case applies over the whole range of feasible effort levels α. If $\underline{\psi} < \psi < \overline{\psi}$, there exists a critical tax manager effort level α^{crit} that separates the low-quality and high-quality information cases. If $\alpha < \alpha^{crit}$, the low information quality case applies, and vice versa.

Lemma 3 i) demonstrates how the characteristics of the tax dispute environment change when considering private tax authority information. If the tax authority receives useless private information ($\psi = 0$), we have $\alpha^*_\psi = \alpha^*$, as in the base model (Lemma 2). By contrast, if the tax authority receives perfect information ($\psi \to 1$), we have $\alpha^*_\psi = 0$, and the controversy manager conducts an (informative) investigation for all tax planning effort levels $\alpha \in [0,1]$, independent of the litigation exposure θ. Thus, when dealing with privately informed tax authorities, her range of influencing tax disputes increases.

Tax manager's tax planning effort Since the controversy manager's investigation sometimes leads to tax opinion h, despite a low true tax liability, the tax manager has to additionally account for cases where a high tax technology signal originates from a low true tax. The tax manager's problem is to choose α so as to maximize

$$u^{TM}(\alpha|h^{tec}) = \alpha - \alpha \cdot \left(\frac{1-p}{1-pq} \cdot (1-\delta_\downarrow) + \frac{p(1-q)}{1-pq} \cdot \delta_\uparrow \right) \cdot \lambda - \alpha^2. \tag{21}$$

Proposition 4 shows the equilibrium tax planning effort with private tax authority information.

Proposition 4.

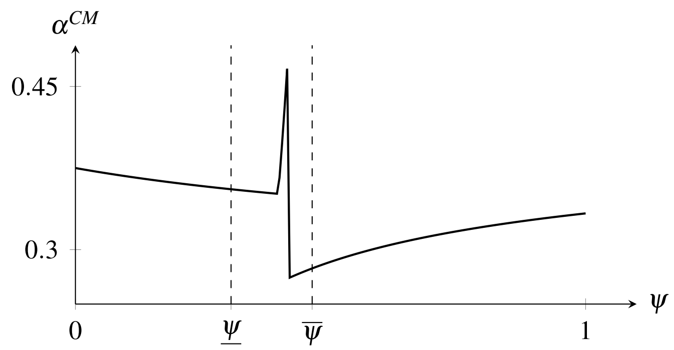
i) Suppose the tax authority receives low-quality private information $\psi < \underline{\psi}$. Then the tax manager's optimal effort $\alpha^{CM}_{\underline{\psi}}$ is the interior maximum of (21). Increasing information quality ψ decreases the tax manager's tax planning effort.

ii) Suppose the tax authority receives high-quality private information $\psi > \overline{\psi}$. Then the tax manager's optimal effort $\alpha^{CM}_{\overline{\psi}}$ is the unique local maximum of (21).

Moving from the the low-quality information case ($\psi < \underline{\psi}$) to the region where the information environment depends on α ($\underline{\psi} < \psi < \overline{\psi}$), tractability suffers. Using a numerical example, we illustrate in Figure 6 how the tax manager's optimal effort α^{CM} can depend on the tax authority's information quality ψ. From zero to $\underline{\psi}$, α^{CM} decreases, consistent with Proposition 4 i). As ψ continues to increase within the intermediary information quality range, the solution for α^{CM} eventually transitions from being interior to lying on the left boundary of the tax manager's objective function $u^{TM}_{\underline{\psi}}$. Specifically, the tax manager chooses $\alpha^{CM} = \alpha^{crit}$. The critical value

α^{crit} increases with ψ, leading to a sharp rise in α^{CM} over a narrow range of ψ—a spike illustrated in Figure 6. As ψ increases further, there comes a point where the maximum value of the tax manager's objective function under the high-quality information environment exceeds the maximum under the low-quality environment ($\max u^{TA}_{\overline{\psi}} > \max u^{TA}_{\underline{\psi}}$). The (interior) arg max of $u^{TA}_{\overline{\psi}}$ is considerably smaller, accounting for the drop depicted in Figure 6. Beyond this point, as the tax authority's information quality continues to improve, α^{CM} increases steadily with ψ.

Figure 6. Effect of the tax authority's private information quality on tax planning effort



Notes: This figure illustrates Proposition 4. Parameters are $p = \theta = \lambda = q = \frac{1}{2}$.

In summary, we demonstrate that increasing the precision of private tax authority information might have a nonmonotonic and nonlinear impact on the tax manager's tax planning effort. As the information precision improves, the tax manager's effort can spike before declining again. This relationship also influences the probability of tax disputes: although additional private information generally reduces disputes by discouraging tax planning, intermediate-quality information can sharply increase the dispute probability.

6. Conclusions

We examine how tax technology and controversy experts affect a firm's probability of tax disputes, unfavorable dispute outcomes, and low final tax payments. In our model, a tax manager exerts tax planning effort given the imperfect signal of the firm's tax technology. If a tax dispute arises, a controversy manager assesses the risky tax position to support the firm's interest and provides a substantiated tax opinion, which the tax authority considers alongside the tax manager's initial report when enforcing the tax liability.

From the firm's perspective, we show that the controversy manager has a dual role in tax disputes. First, in a *tax reassurance* role, she reduces the risk of the tax authority falsely enforcing a high tax. Second, in a *tax planning* role, she increases the likelihood that the tax authority accepts a lower tax than the tax conditions otherwise suggest. Both roles weaken the deterrent effect of enforcement on risky tax planning, leading to greater tax planning effort and a higher tax dispute probability. This increase in tax disputes has a potential downside, in terms of more unfavorable outcomes, and an upside, in terms of greater opportunities for the controversy manager to persuade the tax authority and secure low final tax payments.

Surprisingly, we identify conditions under which a controversy manager increases unfavorable dispute outcomes. This effect is particularly evident in firms with low-quality tax technology, where the increase in disputes outweighs her ability to resolve them favorably. However, in most cases, her tax reassurance and tax planning roles reduce unfavorable outcomes. Finally, we show that tax technology quality can either increase or decrease the probability of low final tax payments, depending on tax planning costs and the tax authority's litigation exposure, with intermediate quality often improving the controversy manager's value added.

Our findings have important policy implications for the organization of tax departments. Regulators should be cautious when mandating high-quality tax technologies, as this may unintentionally increase tax disputes. Moreover, our results warrant empirical testing. For example, leveraging the variation in certified and non-certified Tax Control Frameworks as proxies for tax technology quality, future research can assess a controversy manager's impact on firms' effective tax rates, tax dispute propensity and outcomes.

References

Acito, A. A., & Nessa, M. (2022). Law Firms as Tax Planning Service Providers. *The Accounting Review*, *97*(4), 1–26.

Alonso, R., & Câmara, O. (2016). Bayesian Persuasion with Heterogeneous Priors. *Journal of Economic Theory*, *165*, 672–706.

Armstrong, C. S., Blouin, J. L., & Larcker, D. F. (2012). The Incentives for Tax Planning. *Journal of Accounting and Economics*, *53*(1-2), 391–411.

Bebchuk, L. (1984). Litigation and Settlement Under Imperfect Information. *The RAND Journal of Economics*, *15*(3), 404–415.

Beck, P. J., Davis, J. S., & Jung, W.-O. (1996). Tax Advice and Reporting under Uncertainty: Theory and Experimental Evidence. *Contemporary Accounting Research*, *13*(1), 49–80.

Beck, P. J., & Jung, W.-O. (1989). Taxpayers' Reporting Decisions and Auditing under Information Asymmetry. *The Accounting Review*, *64*(3), 468–487.

Belnap, A., Hoopes, J. L., & Wilde, J. H. (2023). Who Really Matters in Corporate Tax? *Journal of Accounting and Economics*, 101609.

Blaufus, K., Bob, J., Lorenz, D., & Trinks, M. (2016). How Will the Court Decide?–Tax Experts' versus Laymen's Predictions. *European Accounting Review*, *25*(4), 771–792.

Blaufus, K., Reineke, J., & Trenn, I. (2023). Perceived Tax Audit Aggressiveness, Tax Control Frameworks and Tax Planning: An Empirical Analysis. *Journal of Business Economics*, *93*(3), 509–557.

Blaufus, K., Schöndube, J. R., & Wielenberg, S. (2024). Information Sharing between Tax and Statutory Auditors: Implications for Tax Audit Efficiency. *European Accounting Review*, *33*(2), 545–568.

Bozanic, Z., Hoopes, J. L., Thornock, J. R., & Williams, B. M. (2017). IRS Attention. *Journal of Accounting Research*, *55*(1), 79–114.

Brühne, A. I., & Schanz, D. (2022). Defining and Managing Corporate Tax Risk: Perceptions of Tax Risk Experts. *Contemporary Accounting Research*, *39*(4), 2861–2902.

Chen, K.-P., & Chu, C. Y. C. (2005). Internal Control versus External Manipulation: A Model of Corporate Income Tax Evasion. *Rand Journal of Economics*, *36*(1), 151–164.

Crocker, K. J., & Slemrod, J. (2005). Corporate Tax Evasion with Agency Costs. *Journal of Public Economics*, *89*(9-10), 1593–1610.

De Simone, L., Sansing, R. C., & Seidman, J. K. (2013). When are Enhanced Relationship Tax Compliance Programs Mutually Beneficial? *The Accounting Review*, *88*(6), 1971–1991.

De Waegenaere, A., Sansing, R. C., & Wielhouwer, J. L. (2007). Using Bilateral Advance Pricing Agreements to Resolve Tax Transfer Pricing Disputes. *National Tax Journal*, *60*(2), 173–191.

Desai, M. A., & Dharmapala, D. (2009). Corporate Tax Avoidance and Firm Value. *The Review of Economics and Statistics*, *91*(3), 537–546.

Diller, M., Lorenz, J., Schneider, G., & Sureth-Sloane, C. (2025). Is Tax Transfer Pricing Harmonization a Panacea? Real Effects of Global Tax Transparency and Standards Consistency. *The Accounting Review*, *100*(2), 71–102.

Dyreng, S. D., & Maydew, E. L. (2018). Virtual Issue on Tax Research Published in the Journal of Accounting Research. *Journal of Accounting Research*, *56*(2), 311.

Eberhartinger, E., Safaei, R., Sureth-Sloane, C., & Wu, Y. (2022). Is Risk Profiling in Tax Audit Case Selection Rewarded? An Analysis of Corporate Tax Avoidance. *TRR 266 Accounting for Transparency Working Paper Series No. 60*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3911228

Elitzur, R., & Yaari, V. L. (2024). Tax Advisors and Tax Aggressiveness: a Bargaining Model. *Journal of Accounting, Auditing & Finance*, *39*(1), 160–180.

EY. (2021). 2021 EY Tax Risk and Controversy Survey. https://www.ey.com/content/dam/ey-unified-site/ey-com/en-gl/campaigns/tax-leader/documents/ey-the-tax-leader-imperative-adapt-to-the-changing-tax-risk-landscape.pdf

EY. (2023). Why Tax Governance Is Key in an Era of More Tax Risk and Controversy. https://www.ey.com/en_gl/insights/tax/why-tax-governance-is-key-in-an-era-of-more-tax-risk-and-controversy

Feller, A., & Schanz, D. (2017). The Three Hurdles of Tax Planning: How Business Context, Aims of Tax Planning, and Tax Manager Power Affect Tax Expense. *Contemporary Accounting Research*, *34*(1), 494–524.

Flagmeier, V., Müller, J., & Sureth-Sloane, C. (2021). When Do Firms Highlight Their Effective Tax Rate? *Accounting and Business Research*, *53*(1), 1–37.

Franzoni, L. (2004). Discretion in Tax Enforcement. *Economica*, *71*(283), 369–389.

Friedman, H. L., Hughes, J. S., & Michaeli, B. (2020). Optimal Reporting when Additional Information Might Arrive. *Journal of Accounting and Economics*, *69*(2-3), 101276.

Friedman, H. L., Hughes, J. S., & Michaeli, B. (2022). A Rationale for Imperfect Reporting Standards. *Management Science*, *68*(3), 2028–2046.

Frischmann, P. J., Shevlin, T., & Wilson, R. (2008). Economic Consequences of Increasing the Conformity in Accounting for Uncertain Tax Benefits. *Journal of Accounting and Economics*, *46*(2-3), 261–278.

Gallemore, J., & Labro, E. (2015). The Importance of the Internal Information Environment for Tax Avoidance. *Journal of Accounting and Economics*, *60*(1), 149–167.

Gentzkow, M., & Kamenica, E. (2014). Costly Persuasion. *American Economic Review*, *104*(5), 457–62.

Giese, H., Lynch, D., Schulz, K. A., & Sureth-Sloane, C. (2025). The Effects of Tax Reform on Labor Demand within Tax Departments. *TRR 266 Accounting for Transparency Working Paper Series No. 171*. http://dx.doi.org/10.2139/ssrn.5068550

Göx, R. F., & Michaeli, B. (2019). Optimal Information Design and Incentive Contracts with Performance Measure Manipulation. *SSRN Electronic Journal*. https://ssrn.com/abstract=3484199

Graetz, M. J., Reinganum, J. F., & Wilde, L. L. (1986). The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement. *Journal of Law, Economics, & Organization*, *2*(1), 1–32.

Graham, J. R., Hanlon, M., Shevlin, T., & Shroff, N. (2014). Incentives for Tax Planning and Avoidance: Evidence from the Field. *The Accounting Review*, *89*(3), 991–1023.

Gregor, M., & Michaeli, B. (2025). Board Bias, Information, and Investment Efficiency. *Review of Accounting Studies*, *30*, 1432–1462.

Hamilton, R., & Stekelberg, J. (2017). The Effect of High-quality Information Technology on Corporate Tax Avoidance and Tax Risk. *Journal of Information Systems*, *31*(2), 83–106.

Hay, B. L. (1995). Effort, Information, Settlement, Trial. *The Journal of Legal Studies*, *24*(1), 29–62.

Hennigs, R. (2021). Conflict Prevention by Bayesian Persuasion. *Journal of Public Economic Theory*, *23*(4), 710–731.

Hoopes, J. L., Mescall, D., & Pittman, J. A. (2012). Do IRS Audits Deter Corporate Tax Avoidance? *The Accounting Review*, *87*(5), 1603–1639.

Jacob, M., Rohlfing-Bastian, A., & Sandner, K. (2019). Why Do Not All Firms Engage in Tax Avoidance? *Review of Managerial Science*, *15*(2), 459–495.

Jacob, M., Wentland, K., & Wentland, S. A. (2022). Real Effects of Tax Uncertainty: Evidence from Firm Capital Investments. *Management Science*, *68*(6), 4065–4089.

Jehiel, P. (2015). On Transparency in Organizations. *The Review of Economic Studies*, *82*(2), 736–761.

Joshi, P. (2020). Does Private Country-by-Country Reporting Deter Tax Avoidance and Income Shifting? Evidence from BEPS Action Item 13. *Journal of Accounting Research*, *58*(2), 333–381.

Jung, W.-O. (1995). Tax Litigation, Tax Reporting Game, and Social Costs. *Journal of the American Taxation Association*, *17*(2), 1–19.

Kaçamak, A. Y. (2022). The Role of Information Aggregators in Tax Compliance. *International Tax and Public Finance*, *29*(2), 237–285.

Kamenica, E. (2019). Bayesian Persuasion and Information Design. *Annual Review of Economics*, *11*(1), 249–272.

Kamenica, E., & Gentzkow, M. (2011). Bayesian Persuasion. *American Economic Review*, *101*(6), 2590–2615.

Klassen, K. J., Lisowsky, P., & Mescall, D. (2017). Transfer Pricing: Strategies, Practices, and Tax Minimization. *Contemporary Accounting Research*, *34*(1), 455–493.

Koethenbuerger, M., Mardan, M., & Stimmelmayr, M. (2019). Profit Shifting and Investment Effects: The Implications of Zero-Taxable Profits. *Journal of Public Economics*, *173*, 96–112.

Kohlhase, S., & Wielhouwer, J. L. (2023). Tax and Tariff Planning through Transfer Prices: The Role of the Head Office and Business Unit. *Journal of Accounting and Economics*, *75*(2-3), 101568.

KPMG. (2016). Global Tax Disputes Benchmarking Survey 2016. https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2016/11/the-global-tax-disputes-environment.pdf

KPMG. (2019). The Global Tax Disputes Environment. https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2019/10/the-global-tax-disputes-environment.pdf

KPMG. (2023). Navigating the Global Tax Disputes Landscape. https://kpmg.com/xx/en/our-insights/transformation/navigating-the-global-tax-disputes-landscape.html

Kronenberger, S., Kronenberger, S., & Ye, M. (2023). Audit Committee Independence and Auditor-Manager Disputes. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3671569

Krupa, T., & Mullaney, M. (2025). The Use of Artificial Intelligence in Decision-Making: Evidence from the Effectiveness of Corporate Tax Strategies. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4710463

Kubick, T. R., Li, Y., & Robinson, J. R. (2020). Tax-savvy Executives. *Review of Accounting Studies*, *25*(4), 1301–1343.

Law, K. K. F., & Mills, L. F. (2015). Taxes and Financial Constraints: Evidence from Linguistic Cues. *Journal of Accounting Research*, *53*(4), 777–819.

LeBlanc, T. (1998). Accountant-Client Privilege: The Effect of the IRS Restructuring and Reform Act of 1998. *UMKC Law Review*, *67*, 583–594.

Li, J., & Okafor, O. N. (2024). Tax Employee Careers and Corporate Tax Outcomes. *European Accounting Review, forthcoming*, 1–26. https://doi.org/10.1080/09638180.2024.2386144

Lindsey, B. P., McDonnell, S., & Moser, W. J. (2023). Do United States Tax Court Judge Attributes Influence the Resolution of Corporate Tax Disputes? *Journal of Accounting and Public Policy*, *42*(6), 107156.

Lipatov, V. (2012). Corporate Tax Evasion: The Case for Specialists. *Journal of Economic Behavior & Organization*, *81*(1), 185–206.

Markham, M. (2018). Litigation, Arbitration and Mediation in International Tax Disputes: An Assessment of whether this Results in Competitive or Collaborative Relations. *Contemporary Asia Arbitration Journal*, *11*(2), 277–304.

Martini, J. T., Niemann, R., Simons, D., & Voeller, D. (2025). Incentive Effects of Tax Transparency: Does Country-by-Country Reporting Call for Arbitration? *Journal of Accounting and Public Policy*, *49*, 107278.

Melumad, N. D., Wolfson, M. A., & Ziv, A. (1994). Should Taxpayers Be Subsidized to Hire Third-Party Preparers? A Game-Theoretic Analysis. *Contemporary Accounting Research*, *11*(1), 553–594.

Michaeli, B. (2017). Divide and Inform: Rationing Information to Facilitate Persuasion. *The Accounting Review*, *92*(5), 167–199.

Mills, L. F., Robinson, L. A., & Sansing, R. C. (2010). FIN 48 and Tax Compliance. *The Accounting Review*, *85*(5), 1721–1742.

Nessa, M., Schwab, C. M., Stomberg, B., & Towery, E. M. (2020). How do IRS Resources Affect the Corporate Audit Process? *The Accounting Review*, *95*(2), 311–338.

Neuman, S. S., Omer, T. C., & Schmidt, A. P. (2020). Assessing Tax Risk: Practitioner Perspectives. *Contemporary Accounting Research*, *37*(3), 1788–1827.

Nguyen, A., & Tan, T. Y. (2021). Bayesian Persuasion with Costly Messages. *Journal of Economic Theory*, *193*, 105212.

Niemann, R., & Sailer, M. (2023). Is Analytical Tax Research Alive and Kicking? Insights from 2000 until 2022. *Journal of Business Economics*, *93*(6-7), 1149–1212.

OECD. (2023). Tax Administration 2023: Comparative Information on OECD and other Advanced and Emerging Economies, 1–174. https://www.oecd.org/ctp/tax-administration-23077727.htm

Phillips, J., & Sansing, R. C. (1998). Contingent Fees and Tax Compliance. *The Accounting Review*, *73*(1), 1–18.

Reineke, R., Weiskirchner-Merten, K., & Wielenberg, S. (2023). When Do Firms Use One Set of Books in an International Tax Compliance Game? *Review of Accounting Studies*, *28*(3), 1856–1885.

Reineke, R., Weiskirchner-Merten, K., & Wielenberg, S. (2025). Real Effects of the Enforcement of Anti-Avoidance Regulation. *WU International Taxation Research Paper Series No. 2023-01*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4352522

Reinganum, J., & Wilde, L. (1986). Settlement, Litigation, and the Allocation of Litigation Costs. *RAND Journal of Economics*, *17*(4), 557–566.

Rhoades, S. C. (1997). Costly False Detection Errors and Taxpayer Rights Legislation: Implications for Tax Compliance, Audit Policy and Revenue Collections. *The Journal of the American Taxation Association*, *19 (Supplement)*, 27–47.

Rhoades, S. C. (1999). The Impact of Multiple Component Reporting on Tax Compliance and Audit Strategies. *The Accounting Review*, *74*(1), 63–85.

Schantl, S. F., & Wagenhofer, A. (2020). Deterrence of Financial Misreporting when Public and Private Enforcement Strategically Interact. *Journal of Accounting and Economics*, *70*(1), 101311.

Spier, K. E. (2007). Chapter 4 Litigation. In *Handbook of Law and Economics* (pp. 259–342, Vol. 1). North-Holland.

Tran-Nam, B., & Walpole, M. (2012). Independent Tax Dispute Resolution and Social Justice in Australia. *UNSW Law Journal*, *35*(2), 470–500.

Tran-Nam, B., & Walpole, M. (2016). Tax Disputes, Litigation Costs and Access to Tax Justice. *eJournal of Tax Research*, *14*(2), 319–336.

Yoon, S.-S. (2000). Multiple Taxpayers and Litigation Cost Reimbursement Rules. *Journal of the American Taxation Association*, *22*(1), 78–88.

Appendix A

Proof of Lemma 1

The proof follows the notion in Kamenica and Gentzkow (2011). First, an optimal informative investigation implies $\delta(l|L) = 1$ and $\delta(h|L) = 0$. Otherwise, we would have $\delta(l|L) < 1$. Then, the controversy manager would be better off by setting $\delta(l|L) = 1$, because she thereby increases the probability of l, and decreases $\Pr(H|l)$ and thus the tax authority's willingness for β_l. Second, $\delta(l|H)$ makes the tax authority just indifferent between H^{TA} and L^{TA} after observing l

$$\Pr(H|l)\cdot z - \Pr(L|l)\cdot\theta z = \frac{(1-\mu_P(\alpha))\,\delta(l|H)\,z}{(1-\mu_P(\alpha))\,\delta(l|H)+\mu_P(\alpha)} - \frac{\mu_P(\alpha)\,\theta z}{\mu_P(\alpha)+(1-\mu_P(\alpha))\delta(l|H)} \overset{!}{=} 0$$
$$\implies \delta(l|H) = \theta\frac{\mu_P(\alpha)}{1-\mu_P(\alpha)}.$$

Proof of Lemma 2

Note that $1-\mu_P(\alpha) = \frac{(1-p)\alpha}{(1-p)\alpha+pq+p(1-q)\alpha}$ increases in α, as $\frac{\partial 1-\mu_P(\alpha)}{\partial\alpha} = \frac{(1-p)pq}{(\alpha+(1-\alpha)pq)^2} > 0$. α^* is the level of tax planning for which the tax authority is indifferent when $j = \varnothing$, that is,

$$(1-\mu_P(\alpha))\cdot z - \mu_P(\alpha)\cdot\theta z \overset{!}{=} 0 \implies \alpha^* = \frac{pq\theta}{pq\theta+1-p(1+\theta)}.$$

Then, we have that $\alpha^* \in (0,1)$, because $\alpha^* < 1$ requires $\theta < \frac{1-p}{p}$ and Assumption 1 is even stricter. Next, observe $\frac{\partial\alpha^*}{\partial q} = \frac{1-p(1+\theta)}{(pq\theta+1-p(1+\theta))^2} > 0$. Lastly, $\alpha^* < \frac{1}{c}$ is visible when considering $\frac{\partial\alpha^*}{\partial q} > 0$ and rearranging $\alpha^*(q=1) < \frac{1}{c}$ for θ, which exactly yields the condition stated in Assumption 1. Overall, we have $\alpha^* \in (0, \frac{1}{c})$.

Proof of Proposition 1

Observe that $\alpha^* \in (0, \frac{1}{c})$. Now, suppose $\alpha^* < \frac{1-\lambda}{c}$. Then, from Lemma 2, we have $\beta_\varnothing = 1$, and from equation (8), we see that $\alpha^{NCM} = \frac{1-\lambda}{c}$ is a best response absent a controversy manager ($\Delta = 0$).

Next, suppose $\frac{1-\lambda}{c} < \alpha^* < \frac{1}{c}$. Then, there exists no equilibrium in which the tax authority chooses a pure strategy. Thus, given the tax manager's strategy $\alpha^{NCM} = \alpha^*$, we know from Lemma 2 that the tax authority is indifferent between L^{TA} and H^{TA}, as the first-order condition yields $(1-\mu_P(\alpha^*))z - \mu_P(\alpha^*)\theta z = 0$. Further, given the tax authority's strategy $\beta_\varnothing = \frac{1-c\alpha^*}{\lambda}$, equation (8) shows that the tax manager's optimal response is $\alpha^{NCM} = \alpha^*$ when $\Delta = 0$.

Lastly, an equilibrium with $\beta_\varnothing = 0$ and $\alpha^{NCM} = \frac{1}{c}$ does not occur, as it would require $\alpha^* > \frac{1}{c}$.

Proof of Corollary 1

When $\alpha^* < \frac{1-\lambda}{c}$, we have $\frac{\partial \alpha^{NCM}}{\partial q} = 0$ and $\frac{\partial \beta_\varnothing}{\partial q} = 0$. This equilibrium obtains over the whole range of tax technology qualities if $\alpha^*(q=1) < \frac{1-\lambda}{c}$, which makes use of the insight from Lemma 2 that α^* increases in q. Rearranging the inequality for θ yields $\theta < \overline{\theta} \equiv \frac{1-p}{p}\frac{1-\lambda}{c}$. By contrast, if $\theta > \overline{\theta}$, we know that $\alpha^*(q=0) = 0 < \frac{1-\lambda}{c} < \alpha^*(q=1)$. As $\frac{\partial \alpha^*}{\partial q} > 0$ and α^* is continuous, this implies the existence of a unique threshold value $\underline{q} = (\alpha^*)^{-1}\left(\frac{1-\lambda}{c}\right)$, such that if $q < \underline{q}$ ($q > \underline{q}$), we have $\frac{\partial \alpha^{NCM}}{\partial q} = 0$ and $\frac{\partial \beta_\varnothing}{\partial q} = 0$ ($\frac{\partial \alpha^{NCM}}{\partial q} > 0$ and $\frac{\partial \beta_\varnothing}{\partial q} < 0$).

Proof of Proposition 2

Suppose $\alpha^* < \frac{1-\lambda\left[\frac{1-p-\theta p(1-q)}{1-pq}\right]}{c} \equiv \alpha_1^{CM}$. Then, from Lemma 2, the enforcement action absent a tax opinion is $\beta_\varnothing = 1$, and we know that this equilibrium exists, because $\alpha^*(q=0) = 0 < \alpha_1^{CM}(q = 0) = \frac{1-\lambda[1-p(1+\theta)]}{c}$. $\beta_\varnothing = 1$ implies that the controversy manager conducts an investigation $\Delta > 0$. Moreover, the investigation is informative, as $\alpha^* < \alpha_1^{CM}$ implies $\delta\left(l|H\right)\big|_{\alpha^{CM}=\alpha_1^{CM}} < 1 = \delta\left(l|H\right)\big|_{\alpha^{CM}=\alpha^*}$. Then, the tax authority weakly prefers $\beta_l = 0$,[25] implying $\Delta = 1$. Inserting these optimal tax authority and controversy manager responses in equation (8), we see that $\alpha^{CM} = \alpha_1^{CM}$ is the tax manager's best response.

Next, suppose $\alpha_1^{CM} < \alpha^*$. This equilibrium can exist when $\theta > \overline{\theta}$, which can be observed when considering $\frac{\partial \alpha^*}{\partial q} > 0$ and the insight in Corollary 2 below showing $\frac{\partial \alpha_1^{CM}}{\partial q} < 0$. Then, rearranging $\alpha_1^{CM}(q=1) < \alpha^*(q=1)$ for θ yields $\theta > \overline{\theta}$. When $\alpha_1^{CM} < \alpha^*$, there exists no equilibrium in which the tax authority chooses $\beta_\varnothing = 1$. Thus, given the tax manager's strategy

[25] Note again that we could explicitly express $\delta\left(l|H\right)$ as $\delta\left(l|H\right) = \theta\frac{\mu_P}{1-\mu_P} - \varepsilon$, with $\varepsilon > 0$ being arbitrarily small. Then, the tax authority strictly prefers $\beta_l = 0$. We drop $\varepsilon > 0$ for convenience.

$\alpha^{CM} = \alpha^*$, we know from Lemma 2 that the tax authority is indifferent between L^{TA} and H^{TA} if $j = \varnothing$, as the tax authority's first-order condition yields $(1 - \mu_P(\alpha^*))z - \mu_P(\alpha^*)\theta z = 0$. In addition, when $\alpha^{CM} = \alpha^*$, we would have $\delta(l|H) = 1$. Thus, the signal l would be completely uninformative, implying $\mu_P(\alpha^*) = 1/(1+\theta)$ and $\beta_l = \beta_\varnothing$. According to equation (6), these responses make the controversy manager indifferent between conducting an investigation or not, and we use the convention that she then chooses $\Delta = 0$. Inserting these optimal responses in equation (8), we see that $\alpha^{CM} = \alpha^*$ is indeed the tax manager's best response. Off the equilibrium path, Bayes' rule does not restrict β_j with $j \in \{l, h\}$. We impose the plausible off the equilibrium strategies $\beta_h = 1$ and $\beta_l = \beta_\varnothing$, such that the controversy manager has no incentive to deviate.

Proof of Corollary 2

Suppose $\alpha^* < \alpha_1^{CM}$. Then, $\frac{\partial \alpha_1^{CM}}{\partial q} = -\frac{\lambda}{c}\frac{p(1-p)}{(1-pq)^2}(1+\theta) < 0$. This equilibrium obtains over the whole range of tax technology qualities if $\alpha^*(q=1) < \alpha_1^{CM}(q=1) = \frac{1-\lambda}{c}$, which yields $\theta < \overline{\theta}$. Next, observe that $\frac{d\delta(l|H)}{dq} = \frac{\partial\delta(l|H)}{\partial q} + \frac{\partial\delta(l|H)}{\partial\alpha}\frac{\partial\alpha}{\partial q}$. Considering $\frac{\partial\delta(l|H)}{\partial q} = \theta\frac{p(1-\alpha)}{(1-p)\alpha} > 0$ and $\frac{\partial\delta(l|H)}{\partial\alpha} = -\frac{p\theta q}{(1-p)\alpha^2} < 0$, as well as $\frac{\partial\alpha_1^{CM}}{\partial q} < 0$, we get $\left.\frac{d\delta(l|H)}{dq}\right|_{\alpha=\alpha_1^{CM}} > 0$. The other equilibrium strategies are independent of q.

By contrast, if $\theta > \overline{\theta}$, we know that $\alpha^*(q=0) = 0 < \frac{1-\lambda}{c} = \alpha_1^{CM}(q=1) < \alpha^*(q=1)$. As $\frac{\partial\alpha^*}{\partial q} > 0$ and α^* is continuous, this implies the existence of a unique threshold value $\overline{q} = (\alpha^*)^{-1}\left(\alpha_1^{CM}\right)$, such that if $q < \overline{q}$ ($q > \overline{q}$), we have $\frac{\partial\alpha^{CM}}{\partial q} < 0$ and $\frac{\partial\delta(l|H)}{dq} > 0$ ($\frac{\partial\alpha^{CM}}{\partial q} > 0$ and $\frac{\partial\beta_\varnothing}{\partial q} = \frac{\partial\beta_l}{\partial q} < 0$). The other equilibrium strategies are independent of q.

Proof of Proposition 3 i)

We focus on cases with $DE \neq 0$, excluding trivial effects when $\theta > \overline{\theta}$ and $q > \overline{q}$. To begin, we establish the following lemma.

Lemma 4. *(Tax dispute probability)*

i) D^{NCM} *strictly increases in the tax technology quality q.*

ii) There exists a unique threshold value c^D *such that: If* $c < c^D$, D^{CM} *strictly decreases in q. If* $c > c^D$, D^{CM} *strictly increases in q.*

Note that

$$\frac{dD^{NCM}}{dq} = p(1-\alpha^{NCM}) + (1-pq)\frac{\partial \alpha^{NCM}}{\partial q} > 0,$$

because we know that $\frac{\partial \alpha^{NCM}}{\partial q} \geq 0$ from Corollary 1. This shows Lemma 4 i). Next,

$$\frac{dD^{CM}}{dq} = p(1-\alpha^{CM}) + (1-pq)\frac{\partial \alpha^{CM}}{\partial q} = \frac{p}{c}\left(c-(1+\lambda\theta)\right) \propto c-(1+\lambda\theta).$$

Since $c \geq 1$, this implies the existence of a unique threshold value $c^D \in (1,\infty)$, such that if $c > c^D$ ($c < c^D$), we have $\frac{dD^{CM}}{dq} > 0$ ($\frac{dD^{CM}}{dq} < 0$). This completes the proof of Lemma 4 ii).

Further, note that $\alpha_1^{CM} > \alpha^{NCM}$, because Assumption 1 guarantees $0 < \frac{1-p-\theta p(1-q)}{1-pq} < 1\ \forall q \in [0,1)$. Thus, we have $DE > 0$. Lastly, observe that

$$\frac{dDE}{dq} = (1-pq)\left(\frac{\partial \alpha^{CM}}{\partial q} - \frac{\partial \alpha^{NCM}}{\partial q}\right) - p\left(\alpha^{CM} - \alpha^{NCM}\right)\Big|_{\alpha^{CM}=\alpha_1^{CM}} < 0,$$

because we have already shown that $\alpha_1^{CM} > \alpha^{NCM}$, $\frac{\partial \alpha_1^{CM}}{\partial q} < 0$, and $\frac{\partial \alpha^{NCM}}{\partial q} \geq 0$. This proves Proposition 3 i).

Proof of Proposition 3 ii)

To begin, we establish the following lemma.

Lemma 5. *(Probability of unfavorable dispute outcomes)*

i) *a) If litigation exposure is low ($\theta < \overline{\theta}$), UD^{NCM} strictly increases in q.*

b) There exists a threshold value $\theta^{UD} \in (\overline{\theta}, \overline{\overline{\theta}})$ such that: If $\theta < \theta^{UD}$ with $\lambda > 1/2$, UD^{NCM} strictly increases in q. Otherwise, there exists a unique threshold value $q^{UD} \in [\underline{q}, 1)$, such that if $q < q^{UD}$, UD^{NCM} strictly increases in q, and if $q > q^{UD}$, UD^{NCM} strictly decreases in q.

ii) *UD^{CM} strictly decreases in q.*

Note that

$$\frac{dUD^{NCM}}{dq} = \beta_{\varnothing}\left[p(1-\alpha^{NCM}) + (1-pq)\frac{\partial \alpha^{NCM}}{\partial q}\right] + \frac{\partial \beta_{\varnothing}}{\partial q}\left[(1-pq)\alpha^{NCM} + pq\right].$$

If the litigation exposure is low with $\theta < \overline{\theta}$ and exposure is high with $\theta > \overline{\theta}$ and $q < \underline{q}$, we have $\frac{\partial \beta_{\varnothing}}{\partial q} = \frac{\partial \alpha^{NCM}}{\partial q} = 0$, implying $\frac{dUD^{NCM}}{dq} > 0$. However, if $\theta > \overline{\theta}$ and $q \geq \underline{q}$, we have $\frac{\partial \beta_{\varnothing}}{\partial q} < 0$ and $\frac{\partial \alpha^{NCM}}{\partial q} > 0$. Further simplification yields

$$\begin{aligned}
\left.\frac{dUD^{NCM}}{dq}\right|_{\alpha^{NCM}=\alpha^*} &= \frac{p(1-p)(1+\theta)(1-p(1+\theta))}{\lambda\left[1-p(1+\theta(1-q))\right]^3}\Omega_q^{UD^{NCM}}, \text{ where} \\
\Omega_q^{UD^{NCM}} &\equiv 1 - p\left(1+\theta+q\theta(2c-1)\right).
\end{aligned}$$

Due to Assumption 1, we have $1 > p(1+\theta)$, which implies $\frac{dUD^{NCM}}{dq}\big|_{\alpha^{NCM}=\alpha^*} \propto \Omega_q^{UD^{NCM}}$. Further, observe that $\frac{d\Omega_q^{UD^{NCM}}}{dq} < 0$, and

$$\begin{aligned}
\lim_{q \to \underline{q}} \Omega_q^{UD^{NCM}} &= \frac{c(1-p(1+\theta))}{c-1+\lambda} \cdot (2\lambda - 1) \propto 2\lambda - 1, \\
\lim_{q \to 1} \Omega_q^{UD^{NCM}} &= 1 - p(1+2c\theta).
\end{aligned}$$

Thus, if $\lambda < 1/2$, we have that $\frac{dUD^{NCM}}{dq} > 0$ if $q < q^{UD} = \underline{q}$ and $\frac{dUD^{NCM}}{dq} < 0$ if $q > q^{UD} = \underline{q}$.

Next, consider the case $\lambda > 1/2$ and thus $\lim_{q\to\underline{q}} \Omega_q^{UD^{NCM}} > 0$. Then, observe that $\lim_{q\to 1} \Omega_q^{UD^{NCM}}$ strictly decreases in θ, and

$$\lim_{\theta\to\overline{\theta}} \left(\lim_{q\to 1} \Omega_q^{UD^{NCM}} \right) > 0, \lim_{\theta\to\overline{\overline{\theta}}} \left(\lim_{q\to 1} \Omega_q^{UD^{NCM}} \right) < 0,$$

with the latter holding due to $\lambda > 1/2$. This implies that there exists a unique threshold value $\theta^{UD} \in (\overline{\theta}, \overline{\overline{\theta}})$, such that if $\theta < \theta^{UD}$, we have $\lim_{q\to 1} \Omega_q^{UD^{NCM}} > 0$, and consequently $\frac{dUD^{NCM}}{dq} > 0\, \forall\, q$. However, if $\theta > \theta^{UD}$, we know that $\lim_{q\to 1} \Omega_q^{UD^{NCM}} < 0$. This implies that there exists a unique threshold value $q^{UD} \in (\underline{q}, 1)$, such that if $q < q^{UD}(q > q^{UD})$, we have $\frac{dUD^{NCM}}{dq} > 0$ ($\frac{dUD^{NCM}}{dq} < 0$). This establishes Lemma 5 i).

Next, observe that in equilibrium, $UD^{CM} = \alpha^{CM}\left[1 - p\left(1 + \theta(1-q)\right)\right] - \theta pq$. Then,

$$\frac{dUD^{CM}}{dq} = \frac{\partial \alpha^{CM}}{\partial q}\left[1 - p\left(1 + \theta(1-q)\right)\right] - \theta p\left(1 - \alpha^{CM}\right).$$

Considering $\frac{\partial \alpha^{CM}}{\partial q}\Big|_{\alpha^{CM}=\alpha_1^{CM}} < 0$ proves $\frac{dUD^{CM}}{dq} < 0$ as established in Lemma 5 ii).

We can now finish proving Proposition 3 ii). It is easy to see that the tax reassurance effect is always positive. To see that the tax planning effect TPE can be positive or negative, observe that $TPE \equiv (1-p)\alpha^{NCM}\beta_{\varnothing} - UD^{CM}$. Then, it can be easily verified that if $\theta > \overline{\theta}$, we have $\lim_{q\uparrow\overline{q}} TPE > 0$ and if $\theta < \overline{\theta}$, we have $\lim_{q\to 1} TPE > 0$. Thus, $TPE > 0$ can occur for any θ.

Next, we identify conditions for $UDE < 0$, which necessarily imply $TPE < 0$. Considering the insights in Lemma 5, a natural candidate to identify $UDE < 0$ is a situation with low q, as we have $\frac{dUDE}{dq}\big|_{q<\underline{q}} > 0$ independent of θ. With $UDE\big|_{q<\underline{q}} = pq(1+\theta) + (1-pq)\frac{1-\lambda}{c} - (1 - p(1+\theta(1-q)))\,\alpha_1^{CM}$, it is further easy to see that $\frac{dUDE}{d\lambda} < 0$. Then, note the following

$$\lim_{\lambda\to 1} UDE\big|_{q<\underline{q}} = p(1+\theta)\left(q - \frac{(1-q)(1-p\left(1+\theta(1-q)\right))}{(1-pq)c}\right) \gtreqless 0,$$
$$\lim_{q\to 0}\left(\lim_{\lambda\to 1} UDE\right) < 0, \lim_{\lambda\to 0} UDE\big|_{q<\underline{q}} = pq\left(1 + \theta - \frac{1}{c}\right) > 0.$$

This implies that there exist threshold values λ^{UDE} and q^{UDE}, such that if $\lambda > \lambda^{UDE}$ and $q < q^{UDE}$, we have $UDE < 0$. To prove that we otherwise have $UDE > 0$, it suffices to show

$\lim_{q \uparrow \overline{q}} UDE > 0$. Since $\lim_{q \uparrow \overline{q}} \alpha_1^{CM}(1-\delta(l|H)|_{\alpha^{CM}=\alpha_1^{CM}}) = 0$, $UDE > 0$ is obvious from equation (14).

Lastly, observe that $\frac{dUDE}{dq} = \frac{dUD^{NCM}}{dq} - \frac{dUD^{CM}}{dq}$. Because $\frac{dUD^{CM}}{dq} < 0$ is always fulfilled, whenever $\frac{dUD^{NCM}}{dq} > 0$ as identified in Lemma 5, we have $\frac{dUDE}{dq} > 0$. To show that UDE can decrease in q, observe that $\frac{dUDE}{dq}$ strictly decreases in λ if $\frac{dUD^{NCM}}{dq} < 0$. Then, it can easily be verified that $\lim_{\lambda \to 0} \frac{dUDE}{dq}\big|_{q>\underline{q}} < 0$. This proves Proposition 3 ii).

Proof of Proposition 3 iii)

To begin, we establish the following lemma.

Lemma 6. *(Probability of low final tax payments)*

i) If $\theta > \overline{\theta}$ and $q > \underline{q}$, LT^{NCM} strictly increases in q. Otherwise, LT^{NCM} is independent of q.

ii) If $c < c^{LT}$ and $\theta > \theta^{LT}$, LT^{CM} strictly decreases if $q < q^{LT}$, and LT^{CM} strictly increases if $q > q^{LT}$. Otherwise, LT^{CM} strictly increases in q.

Concerning part i), observe that when $\theta < \overline{\theta}$ or when $\theta > \overline{\theta}$ and $q < \underline{q}$, we have $LT^{NCM} = 0$, implying $\frac{\partial LT^{NCM}}{\partial q} = 0$. Next, when $q > \underline{q}$ and $\theta > \overline{\theta}$, we have

$$\frac{dLT^{NCM}}{dq} = (1-\beta_{\varnothing})\left[p(1-\alpha^{NCM}) + (1-pq)\frac{\partial \alpha^{NCM}}{\partial q}\right] - \frac{\partial \beta_{\varnothing}}{\partial q}\left[(1-pq)\alpha^{NCM} + pq\right].$$

Then, from Corollary 1, we know $\frac{\partial \alpha^*}{\partial q} > 0$ and $\frac{\partial \beta_{\varnothing}}{\partial q} < 0$, implying $\frac{dLT^{NCM}}{dq}\big|_{\alpha^{NCM}=\alpha^*} > 0$.

Concerning part ii), simplification yields $LT^{CM} = p(1+\theta)\left[q + (1-q)\alpha^{CM}\right]$. Then, we get

$$\frac{dLT^{CM}}{dq} = p(1+\theta)\left[1-\alpha^{CM} + (1-q)\frac{\partial \alpha^{CM}}{\partial q}\right] \propto 1-\alpha^{CM} + (1-q)\frac{\partial \alpha^{CM}}{\partial q} \equiv \Omega_q^{LT^{CM}}.$$

Further simplification considering $\alpha^{CM} = \alpha_1^{CM}$ yields

$$\Omega_q^{LT^{CM}} = 1 - \frac{1-\lambda\left[\frac{1-p(1+\theta(1-q))}{1-pq}\right]}{c} - (1-q)\frac{\lambda p(1-p)(1+\theta)}{c\,(1-pq)^2}.$$

Note that $\frac{\partial \Omega_q^{LT^{CM}}}{\partial c} > 0 \; \forall \, c \in (1,\infty)$ and $\lim_{c\to\infty} \Omega_q^{LT^{CM}} > 0$. Further, we have

$$\lim_{c\to 1} \Omega_q^{LT^{CM}} = \frac{\lambda}{1-pq}\left[1-p(1+\theta(1-q))-(1-q)\frac{p(1-p)(1+\theta)}{1-pq}\right] = \frac{\lambda}{1-pq}\Omega_{q,c}^{LT^{CM}},$$

with $\frac{\partial \Omega_{q,c}^{LT^{CM}}}{\partial q} > 0$ and $\lim_{c\to 1} \Omega_q^{LT^{CM}} \propto \Omega_{q,c}^{LT^{CM}}$. Further, $\lim_{q\to 0} \Omega_{q,c}^{LT^{CM}} = 1-p(1+\theta)(2-p)$ and $\frac{\partial \lim_{q\to 0} \Omega_{q,c}^{LT^{CM}}}{\partial \theta} < 0$. Lastly, note $\lim_{\theta\to 0}\left(\lim_{q\to 0} \Omega_{q,c}^{LT^{CM}}\right) > 0$ and $\lim_{\theta\to \overline{\overline{\theta}}}\left(\lim_{q\to 0} \Omega_{q,c}^{LT^{CM}}\right) < 0$. This implies that there exists a threshold value $\theta^{LT} \in (0,\overline{\overline{\theta}})$, such that if $\theta < \theta^{LT}$, we have $\Omega_q^{LT^{CM}} > 0$ and consequently $\frac{dLT^{CM}}{dq} > 0$. However, if $\theta > \theta^{LT}$ and $c < c^{LT} \in (1,c^D)$, there exists a threshold value q^{LT}, such that if $q < q^{LT}$, we have $\frac{dLT^{CM}}{dq} < 0$, and if $q > q^{LT}$, we have $\frac{dLT^{CM}}{dq} > 0$. This shows Lemma 6 ii).

We can now finish proving Proposition 3 iii). To begin, note that if $\theta < \overline{\theta}$, we have $LTE = LT^{CM} > 0$. Next, if $\theta > \overline{\theta}$, we similarly have $LTE > 0$ if $0 < q \leq \underline{q}$. If $q > \underline{q}$, we can show that $\lim_{q\uparrow\overline{q}} LTE > 0$. Since LTE can decrease if $\underline{q} < q < \overline{q}$, we need to show $LTE > 0 \;\; \forall \, q \in (\underline{q},\overline{q})$. Then, note that $\frac{\partial LTE}{\partial c} < 0$ and $\frac{\partial LTE}{\partial \lambda} < 0$. Tedious calculations verify that $\lim_{c\to 1}\left(\lim_{\lambda\to 1} LTE\right) > 0$ if $q \in (\underline{q},\overline{q})$.

To show that LTE can increase or decrease in q, consider $\theta < \overline{\theta}$. Then, $\frac{dLTE}{dq} \propto \frac{dLT^{CM}}{dq}$. Further, observe that $\theta^{LT} < \overline{\theta}$ if λ is sufficiently small. Then, as established in Lemma 6 ii), $\frac{dLT^{CM}}{dq}$ decreases if $c < c^{LT}$ and $q < q^{LT}$, and increases otherwise. This proves Proposition 3 iii).

Proof of Lemma 3

Concerning part i), note that the controversy manager's investigation is not informative if the value function coincides with its concavification. This is the case if $\frac{1+\psi}{1+\psi+\theta(1-\psi)} = \mu_P(\alpha)$. Solving for α yields $\alpha_\psi^* = \frac{pq\theta(1-\psi)}{pq\theta(1-\psi)+(1-p)(1+\psi)-p\theta(1-\psi)}$. Further, we have $\alpha_\psi^*(\psi=0) = \alpha^*$, $\alpha_\psi^*(\psi=1) = 0$, and $\frac{\partial \alpha_\psi^*}{\partial \psi} = -\frac{2\theta(1-p)pq}{(p(-\psi-\theta(1-\psi)(1-q)-1)+\psi+1)^2} < 0$.

Concerning part ii), note first that the right-hand side of inequality (20) decreases in α. In the *low-quality tax authority information case*, we want to ensure that (20) holds irrespective of α.

We have a necessary condition if the inequality holds for $\alpha = 0$. Introducing $\alpha = 0$ into (20), and imposing equality, yields $\frac{8\theta\psi}{(1+\psi)(1+\theta-(1-\theta)\psi)} + \psi = 1$. Solving for ψ gives $\underline{\psi}$.

In the *high-quality tax authority information case*, we want to ensure that (20) is violated irrespective of α. We have a necessary condition if the inequality is violated for $\alpha = 1$. Introducing $\alpha = 1$ into (20), and imposing equality, yields $\frac{8\theta\psi}{(1+\psi)(1+\theta-(1-\theta)\psi)} + 2p\psi - \psi = 1$. Solving for ψ gives $\overline{\psi}$. The above results imply that for $\underline{\psi} < \psi < \overline{\psi}$ there must be α^{crit} as described in the lemma.

Proof of Proposition 4

Inserting the optimal signal for the low-quality case from Table 2, the tax manager's objective function is given by

$$u_{\underline{\psi}}^{TM} = \alpha - \alpha^2 - \alpha \cdot \left(\frac{(1-p)}{p(1-q)+(1-p)} \cdot \left(1 - \frac{\theta(1-\psi)(p(1-(1-\alpha)(1-q)))}{\alpha(1-p)(1+\psi)} \right) \right) \cdot \lambda.$$

The objective function is concave ($\frac{\partial^2 u_{\underline{\psi}}^{TM}}{\partial \alpha^2} = -2$), and the maximum is interior since

$$\lim_{\alpha \to 0} \left(\frac{\partial u_{\underline{\psi}}^{TM}}{\partial \alpha} \right) = \frac{(1-\lambda)(1-p)(1+\psi)+p(1-q)(\theta(\lambda(1-\psi))+\psi+1)}{(1+\psi)(1-pq)} > 0,$$
$$\lim_{\alpha \to 1} \left(\frac{\partial u_{\underline{\psi}}^{TM}}{\partial \alpha} \right) = -\frac{(\lambda+1)(1-p)(\psi+1)+p(1-q)(-\theta\lambda(1-\psi)+\psi+1)}{(\psi+1)(1-pq)} < 0.$$

The maximum is given by $\alpha_{\underline{\psi}}^{CM} = \frac{(1-\lambda)(1-p)(1+\psi)+p(1-q)(\theta(\lambda(1-\psi))+\psi+1)}{2(1+\psi)(1-pq)}$. Further, $\frac{\partial \alpha_{\underline{\psi}}^{CM}}{\partial \psi} = -\frac{p(1-q)\theta\lambda}{(1-pq)(1+\psi)^2} < 0$. This shows part i).

Next, the tax manager's objective function $u_{\overline{\psi}}^{TM}$ is given by introducing the optimal signal for the high-quality case from Table 2 into (21). The objective function is concave:

$$\frac{\partial^2 u_{\overline{\psi}}^{TM}}{\partial \alpha^2} = -\frac{\lambda(1-p)(1-q)q^2\left(1-\psi^2\right)+4\theta\psi(1-pq)(\alpha(1-q)+q)^3}{2\theta\psi(1-pq)(\alpha+(1-\alpha)q)^3} < 0.$$

Thus, α^{CM} is either 0, 1, or the solution to the first-order condition $\frac{\partial u_{\overline{\psi}}^{TM}}{\partial \alpha} = 0$. This shows part ii).

Appendix B

Table 1. Tax authority's prior beliefs, distribution of priors, and posterior beliefs.

TA information quality	$\psi = 0$	$0 < \psi < 1$	$\psi = 1$
$\Pr(l^{TAinfo})$, $\Pr(h^{TAinfo})$	$\frac{1}{2}, \frac{1}{2}$	$\mu_P \frac{1+\psi}{2} + (1-\mu_P)\frac{1-\psi}{2}$, $\mu_P \frac{1-\psi}{2} + (1-\mu_P)\frac{1+\psi}{2}$	$\mu_P, 1-\mu_P$
$\Pr(L \mid l^{TAinfo})$, $\Pr(L \mid h^{TAinfo})$	μ_P, μ_P	$\frac{p(\psi+1)((\alpha-1)(1-q)+1)}{-\alpha\psi+\alpha+\alpha p(\psi+\psi(1-q)-q)+p(1+\psi)q}$, $\frac{p(\psi-1)((\alpha-1)(1-q)+1)}{p(\alpha(\psi-(1-\psi)(1-q)+1)+\psi-\psi(1-q)-q)-\alpha(\psi+1)}$	$1, 0$
TA's posterior given priors, depending on CM's posterior	μ^{CM}, μ^{CM}	$\frac{(1+\psi)\mu^{CM}}{1-\psi+2\psi\mu^{CM}}, \frac{(1-\psi)\mu^{\mathrm{CM}}}{1+\psi-2\psi\mu^{CM}}$	$1, 0$

Notes: The distribution of the tax authority's prior beliefs (first row) is given by the probability that the tax authority observes the low (l^{TAinfo}) or high (h^{TAinfo}) signal realization. The second row shows the tax authority's prior belief that the true tax liability is low *after* observing the signal realization (l^{TAinfo} or h^{TAinfo}). The third row shows the tax authority's posterior as a function of its prior and the controversy manager's prior and posterior (see also Footnote 21, Alonso and Câmara 2016, Proposition 1, and Gentzkow and Kamenica 2014, p. 460).

Table 2. Optimal controversy manager's posterior belief, distribution of controversy manager's posterior beliefs, and optimal signal.

	Low-quality TA information	High-quality TA information
Optimal CM belief	$\mu_h^{CM} = 0,\ \mu_l^{CM} = \frac{1+\psi}{\theta(1-\psi)+\psi+1}$	$\mu_h^{CM} = \frac{1-\psi}{\theta(\psi+1)-\psi+1}$, $\mu_l^{CM} = \frac{1+\psi}{\theta(1-\psi)+\psi+1}$
CM belief dist.	$\Pr(\mu_l^{CM}) = \mu_P \frac{\theta(1-\psi)+\psi+1}{1+\psi}$, $\Pr(\mu_h^{CM}) = 1 - \Pr(\mu_l^{CM})$	$\Pr(\mu_l^{CM}) = \frac{\mu_h^{CM}-\mu_P}{\mu_h^{CM}-\mu_l^{CM}}$, $\Pr(\mu_h^{CM}) = 1 - \Pr(\mu_l^{CM})$
Optimal signal	$\delta_{\downarrow} \equiv \Pr(l\vert H) = \frac{1-\psi}{1+\psi}\theta\frac{p(\alpha+(1-\alpha)q)}{\alpha(1-p)}$, $\delta_{\uparrow} \equiv \Pr(h\vert L) = 0$	$\delta_{\downarrow} = \frac{\theta p(1-\psi)(1+\psi)q}{4\alpha(1-p)\psi} - \frac{\alpha(1-\psi)(1-p(1-\psi)-\theta p(\psi+1)(1-q)-\psi)}{4\alpha(1-p)\psi}$, $\delta_{\uparrow} = -\frac{(1-\psi)^2 q}{4(\psi-(1-\alpha)\psi(1-q))} + \frac{\alpha(1-\psi)(1-p(\psi+\theta(1-\psi)(1-q)+1)+\psi)}{4\theta p\psi(1-(1-\alpha)(1-q))}$

Notes: The first row shows the optimal posterior belief of the controversy manager (that the true tax is low) after her investigation leads to a high (μ_h^{CM}) or low (μ_l^{CM}) signal realization. These optimal posterior beliefs are induced by the concavification V^{CM}. The second row shows the corresponding distribution, as determined by Bayes plausibility, $\mu_P = \mu_h^{CM}\Pr(\mu_h^{CM}) + \mu_l^{CM}\Pr(\mu_l^{CM})$. Finally, the third row depicts the controversy manager's optimal investigation/the signal implied by her posterior beliefs and belief distribution.

Sloppiness in Tax Disputes: How to Prevent Litigation?*

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Abstract

This study introduces sloppiness—the inaccurate preparation of supporting information during tax disputes—as a neglected but critical factor influencing taxpayer noncompliance. We conceptualize sloppiness as arising both from imperfections in the internal information environment, exacerbated by structural uncertainty over litigation outcomes (factual dimension), and from strategic aversion to compliance effort (strategic dimension). We examine whether and to what extent improved documentation and engaging an internal monitoring expert can mitigate sloppiness and prevent litigation. Using a game-theoretic model, we derive equilibrium strategies for a tax manager's compliance effort, a monitoring expert's dispute resolution effort, and a tax authority's litigation decision. Absent a monitoring expert, we find that improved documentation consistently reduces the litigation probability. However, when a monitoring expert is present, we surprisingly find that improved documentation crowds out compliance effort and can increase the litigation probability. Overall, our results suggest that sloppiness can be overcome either through strong documentation alone or by engaging a monitoring expert when documentation is weak, with the latter approach becoming more attractive as the dispute resolution costs decline.

Keywords: sloppiness, tax dispute, monitoring experts, litigation
JEL classification: H25, H26, C72, K34

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1. Introduction

Tax disputes between firms and tax authorities are becoming increasingly frequent and severe (Markham 2018, KPMG 2023, PwC 2025). For firms, these disputes entail substantial tax risks, due to the unpredictability of litigation outcomes (Blaufus et al. 2016, Tran-Nam and Walpole 2016), the potential of significant economic losses (Lindsey et al. 2023, White 2023), and the threat of reputational costs for the managers involved (Graham et al. 2014, Neuman et al. 2020, Brühne and Schanz 2022, Li and Okafor 2024). This challenging environment is further sharpened by ongoing regulatory changes and overlapping legal frameworks (Labro and Pierk 2025), the need to navigate interactions with multiple tax authorities (Diller et al. 2025, Martini et al. 2025), and tightening fiscal constraints and limited resources at tax authorities that intensify pressure on revenue collection (Nessa et al. 2020, Blaufus et al. 2023). Together, these developments have created a highly complex and compliance-intensive tax environment in which firms increasingly struggle to satisfy escalating demands for transparency and comprehensive documentation (Donohoe et al. 2014, Brühne and Schanz 2022, Giese et al. 2025). Within this context, *sloppiness* often emerges as firms face mounting compliance burdens and limited capacity to manage complex tax disputes.

We integrate sloppiness into the analysis of tax disputes. While the strategic tax enforcement literature predominantly assumes that firms and managers engage in deliberate noncompliance (e.g., Graetz et al. 1986, Franzoni 2004, Crocker and Slemrod 2005, Slemrod 2019), we consider sloppiness as a neglected feature that can explain dispute-related noncompliance. Specifically, we study whether and under what conditions two instruments used by firms—improving documentation and involving monitoring experts—can effectively address sloppiness and prevent litigation when disputes are strategically resolved with tax authorities.

We conceptualize sloppiness as a two-dimensional feature of tax compliance. The *factual* dimension arises from imperfections in the internal information environment, limiting tax managers' ability to provide accurate support for a tax position during a dispute. These imperfections can stem, for example, from weak documentation practices and poor coordination across tax-relevant functions (Gallemore and Labro 2015, McGuire et al. 2018). In addition, structural uncertainty about future dispute requirements at the time of filing a tax position and the time gap between the initial filing and the dispute give rise to knowledge erosion (Nessa et al. 2020, PwC 2025), particularly when initial filings are handled by automated systems or with personnel changes.[1] The *strategic* dimension emerges when tax managers—despite commitment to truthful communication—rationally limit their compliance effort during the dispute. This strategic behavior may arise from the costs associated with gathering, processing, and preparing information (De Simone et al. 2013, Eichfelder and Vaillancourt 2014, Brühne and Schanz 2022) and the imperfections in the internal information environment, even at the risk of unfavorable dispute outcomes. Collectively, sloppiness reflects both informational imperfections and effort-aversion during complex tax disputes.

Addressing sloppiness during tax disputes requires looking inside the black box of firms' tax strategies. Responding to Dyreng and Maydew's (2018) call to open this black box, we focus specifically on firms' tax dispute strategies. While alternative dispute resolution instruments, such as "enhanced relationship programs" (e.g., De Simone et al. 2013), advance tax rulings (e.g., Diller et al. 2017), and advance pricing agreements (e.g., De Waegenaere et al. 2007) exist, they neither fully mitigate tax risk nor are immune to sloppiness themselves. Consequently, understanding how internal practices to address sloppiness shape dispute outcomes becomes critical. We study these practices and consider the interactions between tax professionals within firms and with tax authorities, including unintended consequences.

To mitigate unfavorable dispute outcomes arising from sloppiness, two dispute resolution practices have received considerable attention. First, firms improve their documentation quality, for example, as part of their Tax Compliance Management System (Blaufus et al. 2023, Schulz and Sureth-Sloane 2024, Siglé et al. 2024). Improved documentation strengthens the internal information environment by preserving relevant information at filing, ensuring its accessibility during the dispute, and providing structured rationales, legal references, and supporting evidence. While documentation cannot resolve the structural uncertainty about the tax position, it reduces risks of information loss or inaccessibility. The importance of documentation becomes increas-

[1] This factual dimension aligns with studies that account for organizational memory in accounting contexts (Salterio and Denham 1997, Jin et al. 2022).

ingly vital during tax disputes, as automated systems handle routine filings and tax professionals rely more heavily on documentation to manage non-routine disputes (Dallhammer and Renelt 2025, Krupa and Mullaney 2025, PwC 2025).

Second, firms engage internal monitoring experts to prevent unfavorable dispute outcomes. These specialists—reflecting the growing specialization of roles within tax departments (Brühne and Schanz 2022, Giese et al. 2025)—provide experience-based strategic guidance during disputes, thereby reducing sloppiness. Research documents increasing reliance on such professionals, including officers with dedicated risk management responsibility (Brühne and Schanz 2022) or internal controversy experts (KPMG 2019, EY 2023), and, in general, the material impact of internal professionals on tax outcomes (e.g., Belnap et al. 2023). Anecdotal evidence suggests that internal controversy experts have become increasingly common in firms in recent years. KPMG reports that 14% of worldwide firms have appointed a "global head of controversy", noting that this "may become a leading practice in the years to come" (KPMG 2019, p. 9). EY (2023) reports that 50% of worldwide firms have implemented a "tax controversy leader." In addition, a tax manager at a U.S. multinational told us in an interview:

> If there are indications of a tax dispute that has global relevance and/or requires coordination with other regions/functions, we often involve our Controversy Managers at our parent company in the U.S.
> —Tax manager, U.S. multinational, responsible for Europe, Middle East, and Africa

Two aspects make an overall assessment of an internal monitoring expert non-trivial. First, the reduction in sloppiness depends critically on the strategic interaction between the tax manager and the monitoring expert, and the firm's documentation quality. If the tax manager utilizes the available high-quality documentation, this constrains the expert's improvement scope. Otherwise, such documentation serves as a valuable input for the expert's dispute resolution efforts. Second, the monitoring expert non-trivially affects compliance incentives, consistent with the monitoring literature (Frey 1993, Dickinson and Villeval 2008). On the one hand, the clear assignment of duty and accountability to this expert (e.g., KPMG 2019) weakens compliance incentives by transferring litigation accountability (accountability role). On the other hand, monitoring intrinsically strengthens compliance through oversight (disciplining role). Overall, evaluating a monitoring expert's impact requires disentangling the strategic interactions inside the tax department and considering the firm's documentation quality.

We incorporate these aspects into a game-theoretic model with three players: a tax manager (he), a tax authority (it) and a potentially involved monitoring expert (she). The game begins with a tax dispute where the tax authority disagrees with and challenges a tax position in the firm's tax return. Crucially, the true tax liability of this position remains unknown to all players. This fundamental uncertainty makes the litigation outcome inherently unpredictable at the dispute stage. In response to the tax authority's challenge, the tax manager submits additional information through an elaborated final tax opinion. We define the degree of sloppiness as the probability that this opinion is incorrect. Specifically, a "correct" tax opinion implies that an adjudication of the disputed tax position reveals a tax liability identical to the submitted tax opinion, while an "incorrect" tax opinion implies an adjustment of the position upon adjudication. The determinants of sloppiness differ by organizational structure. In a tax department *without* a monitoring expert, the degree of sloppiness is determined by the tax manager's compliance effort and (when effort is high) the quality of the firm's imperfect documentation. In a tax department *with* a monitoring expert, the degree of sloppiness can be reduced to a lower level if the monitoring expert exerts a high dispute resolution effort. Ultimately, the tax authority chooses to either settle the dispute by accepting the submitted opinion or to litigate. Litigation and subsequent adjudication reveal the true tax liability.

We identify the equilibrium strategies to illuminate the complex strategic interactions and mechanisms. In a tax department *without* a monitoring expert, we find that improved documentation quality consistently reduces the litigation probability. This reflects the tax manager's consistently strengthened compliance incentives under improved documentation. In a tax department *with* a monitoring expert, the relationship is more nuanced: while an improvement of high-quality documentation still reduces the litigation probability, an improvement of low-quality documentation contrarily increases this probability. The difference stems from the monitoring expert's dispute resolution incentives. Intuitively, her dispute resolution incentive erodes under low-quality documentation but is strengthened under high-quality documentation. The reason is that, under low-quality documentation, the tax manager's and monitoring expert's efforts are strategic complements, while their efforts are strategic substitutes under high-quality documentation. Since improved documentation always crowds out the tax manager's compliance effort, this translates into decreasing (increasing) dispute resolution incentives when documentation quality is low (high). The tax authority responds to these internal dynamics by adjusting its litigation probability accordingly.

Our analysis further shows that the litigation probability can be higher in a tax department with a monitoring expert than in a tax department without one. This counterintuitive result occurs particularly when dispute resolution costs are sufficiently high, eroding the expert's dispute resolution incentives and thereby increasing the litigation probability. Given the structural uncertainty inherent in the factual sloppiness dimension which may complicate achieving high documentation quality, we identify two possible strategies to prevent litigation. Firms should either rely on high-quality documentation without involving a monitoring expert or involve a monitoring expert to leverage her dispute resolution ability when documentation quality is weak.

We contribute to the literature in three ways. First, we contribute to the literature on strategic tax dispute resolution via settlement or litigation. Only a few studies explicitly model dispute resolution stages. Jung (1995) and Franzoni (2004) formally extend the standard tax reporting-auditing game by Graetz et al. (1986) by allowing for endogenous settlement offers after a tax audit.[2] Kourouxous et al. (2024) and Martini et al. (2025) analyze how institutional features, such as the presence of an appeals court or different arbitration mechanisms, affect tax reporting and auditing behavior. While they do not consider endogenous settlement offers, disputes arise endogenously and their outcomes depend on the institutional features. Other studies, like ours, take the tax dispute as given. Yoon (2000) examines how multiple taxpayers with similar positions influence the authority's dispute resolution decision when taxpayers and the authority share a common expectation about litigation outcomes. Eynon and Stevens (1995) analyze taxpayers' court selection that may reveal private information about their type. Sansing (1997) considers voluntary binding arbitration as an alternative to litigation, with private information on

[2]These studies closely relate to civil dispute models on the signaling and screening effects of settlement offers by either a plaintiff or a defendant (Bebchuk 1984, Reinganum and Wilde 1986, Hay 1995, Spier 2007).

both the taxpayer and tax authority side. Different from all these models, we consider sloppiness as a neglected feature that may explain escalating tax disputes.

Second, we contribute to opening the black box of firms' tax departments (Feller and Schanz 2017, Dyreng and Maydew 2018, Chen et al. 2021, Giese et al. 2025) and to understanding the importance of specialized actors for tax outcomes (Belnap et al. 2023, Li and Okafor 2024, Dyck et al. 2025). Focusing on two common practices for addressing the adverse consequences of sloppiness during tax disputes, namely improving documentation as part of the internal information environment (Gallemore and Labro 2015, Brühne and Schanz 2022, Blaufus et al. 2023) that may mitigate factual sloppiness and strategic monitoring experts (KPMG 2019, Brühne and Schanz 2022) that may mitigate both strategic and factual sloppiness, we identify the conditions under which these practices can prevent litigation.

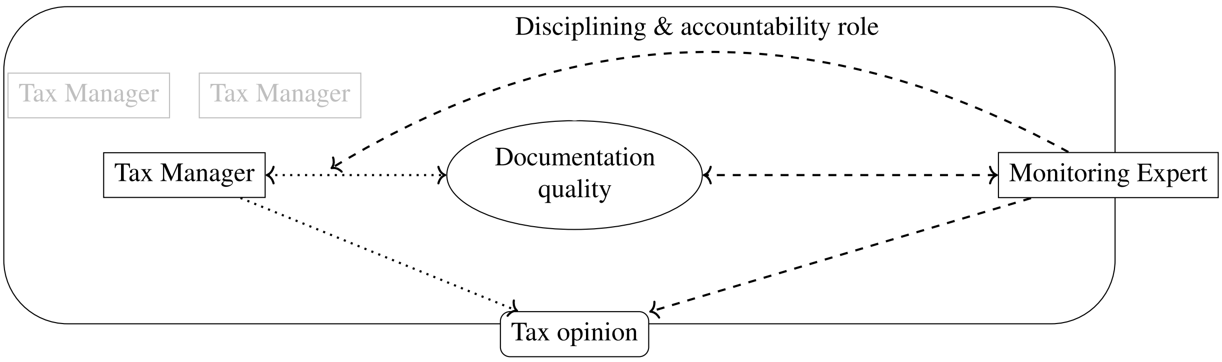
Third, we contribute to the literature on ex ante commitment to (truthful) information provision in tax (Mills et al. 2010, Dyck et al. 2025) and accounting contexts (Göx and Wagenhofer 2009, Gregor and Michaeli 2025). In contrast to prior theoretical work that predominantly focuses on deliberate tax minimization (Crocker and Slemrod 2005, Jacob et al. 2019, Dyck 2025) or financial misreporting (e.g., Ewert and Wagenhofer 2019, Schantl and Wagenhofer 2020), we adopt a compliance-based perspective and emphasize that sloppiness paired with truthful information provision can drive non-trivial strategic interactions. This perspective provides a useful benchmark in tax compliance settings (Mills et al. 2010) and is grounded in theories of individuals' truth-telling preferences (Abeler et al. 2019) and tax morale (Luttmer and Singhal 2014). Conceptually, our study incorporates the ex ante commitment assumption that underpins Bayesian persuasion models (e.g., Gentzkow and Kamenica 2014, Kamenica 2019, Nguyen and Tan 2021). However, unlike in these models where the information sender can typically choose an arbitrarily precise information system (e.g., Dyck et al. 2025, Gregor and Michaeli 2025) with precision being potentially costly (Gentzkow and Kamenica 2014, Michaeli 2017), our sender (the tax manager) is constrained by the factual sloppiness dimension absent a monitoring expert or the strategic behavior of the monitoring expert.

2. Tax department without a monitoring expert

2.1. Model setup

We employ a game-theoretic model with three risk-neutral players: a tax manager (he), a monitoring expert (she) and a tax authority (it).[3] Figure 1 illustrates the intra-firm decision-making structure during tax disputes, taking the documentation quality and the potentially present monitoring expert as given. In a tax department without a monitoring expert, we focus on the interaction of the tax manager, who is responsible for tax compliance, and the tax authority.

Figure 1. Decision-making structure in tax disputes



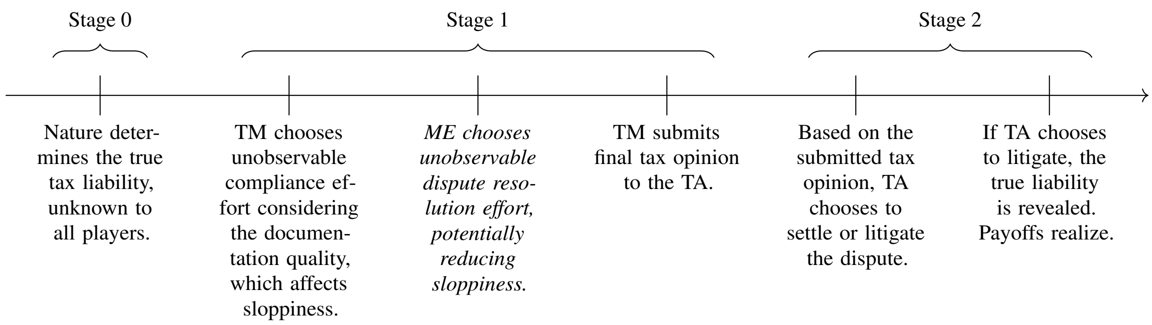
Notes: The solid rectangles and ellipses represent features that are observable for the tax authority, namely, the tax department, its structure with one tax manager (of many), one potentially involved monitoring expert, and the quality of documentation. The dotted lines illustrate that the tax manager's compliance effort affects the tax opinion's degree of sloppiness. The dashed lines illustrate that the monitoring expert can reduce the degree of sloppiness and her disciplining and accountability role.

Similar to Eynon and Stevens (1995), Sansing (1997), and Yoon (2000), we assume that the strategic game begins after the tax authority challenges the firm's initial tax assessment, as reported in its filed tax return, resulting in a dispute. The underlying tax position is characterized by uncertainty and complexity, because, no matter how detailed the tax code is, the relevant laws and regulations typically can be interpreted in multiple ways, yielding different tax liabilities (Diller et al. 2017). We restrict the resulting tax liabilities to be binary (low or high). This binary representation illustrates, for example, disputes on the deductibility of a tax expense (Jung

[3] Assuming risk neutrality is a common practice in studies that examine three-party interactions (e.g., Reinganum and Wilde 1991, Jacob et al. 2019, Blaufus et al. 2024, Kourouxous et al. 2024). It allows us to keep the model tractable and to focus on strategic interactions between the players.

1995, Yoon 2000, Mills et al. 2010). Alternatively, we can think of a transfer pricing dispute in which the application of transfer pricing methods might yield a compliant low or high tax liability (Reineke et al. 2023).[4] Figure 2 summarizes the sequence of events after the dispute has occurred.

Figure 2. Timeline of the tax dispute



Notes: This figure illustrates the timeline with a tax manager (TM), a tax authority (TA), and the event in italics only occurs if a monitoring expert (ME) is present. The setting begins after the tax authority challenges a filed uncertain tax position.

At stage 0, nature determines the true tax liability $t_i \in \{t_L, t_H\}$ with $0 \leq t_L < t_H$, where we use indices $i \in \{L, H\}$ and $j \in \{L, H\}$, with j used below, to indicate low L or high H values. The true tax is only revealed to the tax manager and the tax authority if the dispute is litigated.[5] In line with Yoon (2000), the tax manager and the tax authority share the same expectation regarding the true tax liability *after* the audit. They expect that the true tax liability is low with probability $Pr(t_L) = p$ and high with probability $Pr(t_H) = 1 - p$. For simplicity, and with only slight loss of generality, we assume $Pr(t_L) = Pr(t_H) = 1/2$.[6]

[4]We thereby model a more general type of uncertainty rather than addressing the peculiarities of specific tax issues, such as transfer pricing. Our setting can also be generalized for a more complex environment. For example, if two or more tax authorities have a stake in a specific tax dispute, we implicitly assume that the tax authority is in the high-tax country and that the tax rate in the low-tax country is equal to zero, effectively eliminating any potential double taxation issues.

[5]An alternative interpretation is as follows. After the tax audit, nature determines whether the firm has a strong case (t_L) or weak case (t_H). The internal players' efforts try to identify the strength of the case and determine whether the firm maintains the tax treatment from the tax return ($\hat{t}_L$) or not ($\hat{t}_H$). The tax authority wants to litigate weak cases and settle strong cases, given that the court fully reveals the case strength.

[6]The main results hold for the general case $Pr(t_L) = p \in (0, 1)$. However, if p takes extreme values, we cannot generally establish that the comparative statics for the equilibrium litigation probability and (ex ante) total litigation probability follow the same pattern.

At stage 1, the tax manager chooses his unobservable compliance effort $a^{TM} \in \{a_L, a_H\}$, which affects his ability to specify the correct final tax opinion. The compliance effort can be interpreted as an additional, non-routine risk management effort. Examples of this non-routine task include preparing additional documentation, checking additional databases or precedent cases, and conducting additional analysis of internal (cost) accounting numbers to substantiate the tax position in question. The compliance effort involves costs $K^{TM}(a_H) = A > 0 = K^{TM}(a_L)$, which reflect the tax manager's opportunity costs and inability to comply with all tax authority requests. In line with our compliance perspective on tax disputes, we assume that the tax manager commits *ex ante* to a truthful submission of the specified opinion $\hat{t}_i$ to the tax authority, given his available information.[7] However, he might be sloppy in this process.

We generally refer to the probability that an incorrect tax opinion is submitted as the degree of sloppiness. When the tax manager chooses a low compliance effort, the specified and submitted opinion $\hat{t}_i$ is correct with probability $Pr(\hat{t}_i|t_i;a_L) = \underline{q} \geq 1/2$ and incorrect with probability $Pr(\hat{t}_i|t_j;a_L) = 1-\underline{q}$, where $i \neq j$. When he chooses a high effort, the degree of sloppiness reduces to $Pr(\hat{t}_i|t_j;a_H) = 1-\overline{q}$. We interpret $\overline{q}$ as the firm's documentation quality, which captures the assumption that the tax manager, when exerting a high effort, makes use of the firm's documentation to its full extent. The difference $Pr(\hat{t}_i|t_j;a_L) - Pr(\hat{t}_i|t_j;a_H) = \overline{q} - \underline{q} > 0$ captures the strategic sloppiness dimension, reflecting the tax manager's strategic effort choice. The probability $Pr(\hat{t}_i|t_j;a_H) = 1-\overline{q} > 0$ captures the factual sloppiness dimension, indicating that the submitted opinion may still be incorrect even under high effort, due to structural uncertainty that cannot be addressed without the monitoring expert and the limits of the firm's documentation quality.

At stage 2, the tax authority observes the submitted tax opinion $\hat{t}_i$. However, the tax authority cannot observe whether the tax manager has chosen a low or high compliance effort at stage 1

[7] With this set of assumptions and in line with anecdotal evidence, we can examine an important benchmark setting with a minimum requirement for litigation to occur with positive probability. Truthful submission describes tax managers' behavior assuming the managers try to, first, comply with all tax authority requests, and, second, to prevent unnecessary tax overpayments given the available information. This is also consistent with the shifting structure in tax departments from being organized as profit centers to being organized as risk management centers (Donohoe et al. 2014, Blaufus et al. 2023) and with tax executives' principal goals: no surprises, no disputes, and tax savings (Armstrong et al. 2012, Graham et al. 2014, Klassen et al. 2017).

and therefore cannot assess the underlying sloppiness. Depending on the submitted opinion, the tax authority can take two actions $b^{TA} \in \{b_{set}, b_{lit}\}$ to maximize its net revenue.[8] It can either settle the dispute prior to litigation (b_{set}), or it can litigate (b_{lit}). When settling, the tax collected equals the submitted tax opinion $\hat{t}_i$.[9] It is reasonable to assume that settling involves no additional costs for the tax authority; that is, $K^{TA}(b_{set}) = 0$.

However, since the submitted tax opinion may be incorrect, the tax authority might have an incentive to litigate. Litigation is costly for the tax authority $K^{TA}(b_{lit}) = B > 0$ (e.g., direct or effort costs in a lawsuit), and thus there is no litigation incentive when the authority observes a high tax opinion $\hat{t}_H$. By contrast, when the tax manager submitted an incorrect low tax opinion $\hat{t}_L$, the tax authority additionally collects the tax difference multiplied by a penalty factor $\pi > 1$: $\pi(t_H - \hat{t}_L)$. The penalty factor includes default interest and future tax payments from an established legal precedent (Yoon 2000). In that case, the tax manager faces costs from an unfavorable litigation outcome (e.g., a reduction in the likelihood of promotion due to an impaired reputation inside or outside the tax department, a future pay cut, or a demotion; Li and Okafor 2024). This decreases the tax manager's payoff by $\lambda^{TM}\pi(t_H - \hat{t}_L)$. Thus the tax manager trades off the potential effort costs $K^{TM}\left(a^{TM}\right)$ against the costs from potentially unfavorable litigation outcomes with the latter scaled by the sensitivity parameter $\lambda^{TM} > 0$.

Figure 3 depicts the game tree without dominated strategies.

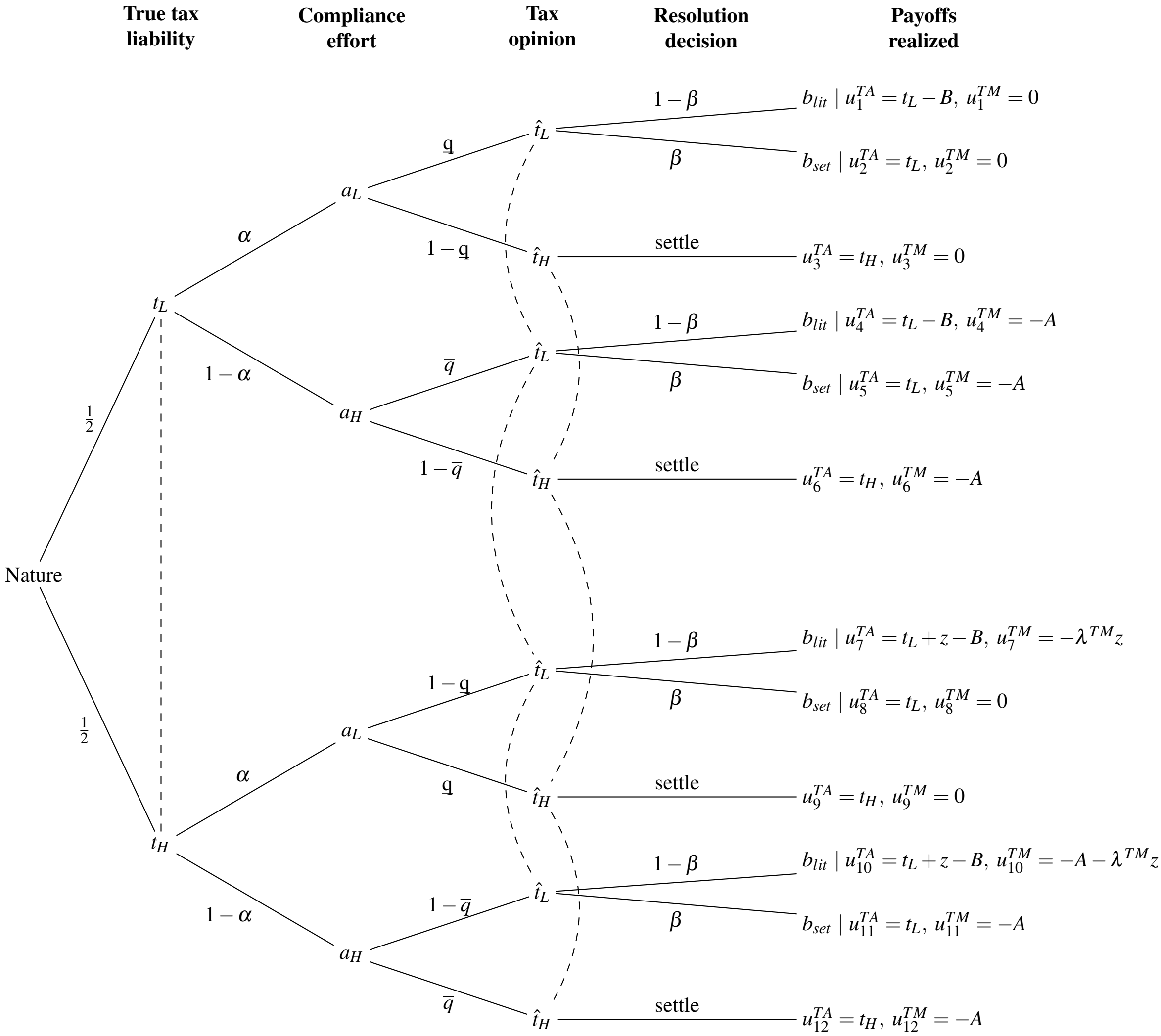
2.2. Equilibrium

We solve the game by backward induction, starting with the tax authority's dispute resolution decision given the observed tax opinion $\hat{t}_i$. All formal proofs are given in Appendix A.

[8]Net revenue maximization is a common assumption when analyzing interactions among firms and tax authorities (e.g., Graetz et al. 1986, Diller et al. 2017). Further, resource constraints significantly restrict tax authorities, such as the Internal Revenue Service (Nessa et al. 2020).

[9]Like Kourouxous et al. (2024), we abstract from compromising solutions in the tax payment range (t_L, t_H) for two reasons. First, anecdotal and survey evidence suggests that tax auditors are encouraged to offer compromise solutions less often. Second, the party that offers the settlement amount is presumed to have the bargaining power (e.g., Franzoni 2004). We are agnostic about who has the bargaining power, and rather emphasize the "bargaining power" the firm generates through (improved) documentation quality and the presence of a monitoring expert.

Figure 3. Game tree in a tax department without a monitoring expert



Notes: This figure illustrates the game tree and the payoffs in a tax department without a monitoring expert. Dominated strategies are not depicted. α denotes the low compliance effort probability and β $(1-\beta)$ denotes the tax authority's settlement (litigation) probability, given a low tax opinion is submitted.

The tax authority always settles upon a submitted high tax opinion. However, upon a low tax opinion, it must weigh the costs and benefits of settling versus litigating to determine its preferred strategy. The tax authority's expected utility u^{TA} from settling the dispute is given by

$$\mathbb{E}\left[u^{TA}\left(b_{set}|\hat{t}_L;a^{TM}\right)\right]=t_L\;, \tag{1}$$

independent of the tax manager's effort choice. The corresponding utility from litigating the dispute depends on the tax manager's compliance effort. For the ease of notation, we denote the value in dispute, which is the additionally collected tax plus penalty payment, as $z\equiv\pi\left(t_H-t_L\right)$. Then the expected utility from litigation is

$$\mathbb{E}\left[u^{TA}\left(b_{lit}|\hat{t}_L;a^{TM}\right)\right]=t_L+\Pr\left(t_H|\hat{t}_L;a^{TM}\right)z-B\;. \tag{2}$$

Equation (2) highlights that the tax authority always receives t_L-B when litigating, plus the value in dispute z, depending on the conditional probability of an incorrect tax opinion. Comparing the expected utilities from settlement and litigation, the tax authority will litigate the dispute if $Pr\left(t_H|\hat{t}_L;a^{TM}\right)z>B$. Depending on the compliance effort, the conditional probabilities of an incorrectly submitted tax opinion are given by

$$\Pr(t_H|\hat{t}_L;a_L)=\frac{(1-p)(1-\underline{q})}{(1-p)(1-\underline{q})+p\underline{q}}\overset{p=1/2}{=}1-\underline{q}\;, \tag{3}$$

$$\Pr(t_H|\hat{t}_L;a_H)=\frac{(1-p)(1-\overline{q})}{(1-p)(1-\overline{q})+p\overline{q}}\overset{p=1/2}{=}1-\overline{q}\;. \tag{4}$$

To rule out trivial cases, we assume $(1-\underline{q})z\equiv\overline{B}^{*}>B$, which makes the firm face a dispute with a real threat of litigation. Ultimately, the tax authority's available information upon the resolution decision comprises the tax manager's final tax opinion $\hat{t}_i$, the absence of a monitoring expert, and the documentation quality $\overline{q}$.[10]

[10] Documentation quality $\overline{q}$, as a central component of a firm's Tax Control Framework (TCF), can be signaled to the tax authority through external certification (Dallhammer and Renelt 2025). Tax authorities may further infer documentation quality from prior audits, supporting the observability assumption.

Next we identify the expected utilities of the tax manager at stage 1. If the tax authority chooses to settle the dispute, the manager's expected utility from his low or high compliance effort depends on the compliance costs only:

$$\mathbb{E}\left[u^{TM}\left(a^{TM}|b_{set}\right)\right] = -K^{TM}(a^{TM}) \,. \tag{5}$$

Thus the tax manager prefers low compliance effort if he knows the tax authority will settle the dispute. If the tax authority litigates instead, the tax manager's expected utility is given by

$$\mathbb{E}\left[u^{TM}\left(a^{TM}|b_{lit}\right)\right] = -\frac{1}{2}\Pr\left(t_H|\hat{t}_L;a^{TM}\right)\lambda^{TM}z - K^{TM}\left(a^{TM}\right) \,. \tag{6}$$

Comparing the expected utilities for a low and high compliance effort (6) reveals that the tax manager prefers a high compliance effort if $\left(\overline{q}-\underline{q}\right)\lambda^{TM}z/2 \geq A$, which is thus a necessary condition for the existence of a high effort. Intuitively, higher documentation quality $\overline{q}$ implies less pronounced factual sloppiness, and lower compliance costs A reduce the incentives for strategic sloppiness, both of which strengthen the tax manager's effort incentives.

To identify the equilibrium in the absence of a monitoring expert where both parties play a non-trivial role, we search for the tax manager's low compliance effort probability α and the tax authority's settlement probability β when the low tax opinion is submitted, at which both players are indifferent between their strategies.

The tax authority is indifferent between settlement and litigation if

$$B = \underbrace{\left(\alpha(1-\underline{q}) + (1-\alpha)(1-\overline{q})\right)}_{\Pr(t_H|\hat{t}_L;\alpha)} z \,. \tag{7}$$

The indifference condition highlights that the tax authority weighs the direct costs of litigating a low tax opinion against its expected benefit. Similarly, the tax manager's indifference condition is given by

$$A = \frac{1}{2}\left(1-\beta\right)\left(\lambda^{TM}z\left(\overline{q}-\underline{q}\right)\right). \tag{8}$$

The tax manager trades off the costs against the utility benefit of a high compliance effort, where the utility benefit arises from preventing costs following an unfavorable adjustment of the tax position. Lemma 1 describes the equilibrium.

Lemma 1. *(Equilibrium without a monitoring expert)*
Given the tax manager's compliance costs are sufficiently low ($A \leq \overline{A}^*$) and the tax authority's litigation costs are sufficiently high ($B \geq \underline{B}^*$), a mixed-strategy equilibrium entails the following:

a) The tax manager chooses a low compliance effort with probability $\alpha^* = \frac{\frac{B}{z} - (1-\overline{q})}{\overline{q} - \underline{q}}$ *;*

b) the tax authority litigates the dispute with probability $1 - \beta^* = \frac{2A}{\lambda^{TM} z (\overline{q} - \underline{q})}$ *given the submission of a low tax opinion* $\hat{t}_L$*, and never given the submission of a high tax opinion* $\hat{t}_H$*, resulting in a total litigation probability* $TLP^* = (1 - \beta^*)/2$*,*

with

$$\overline{A}^* \equiv \lambda^{TM} z(\overline{q} - \underline{q})/2 \qquad \underline{B}^* \equiv (1 - \overline{q})z \, .$$

Comparative statics reveal how the equilibrium strategies change with respect to the model parameters. Proposition 1 summarizes how increasing the firm's documentation quality affects the equilibrium behavior in a tax department without a monitoring expert.

Proposition 1. *(Effect of documentation quality)*
Absent a monitoring expert, an increase in the documentation quality $\overline{q}$

a) increases the tax manager's probability for a low compliance effort and

b) decreases the tax authority's (total) litigation probability.

The documentation quality has a twofold effect on equilibrium behavior. First, improving documentation quality crowds out the tax manager's compliance effort. Intuitively, this is because documentation quality attenuates litigation incentives, and, in equilibrium, the tax manager responds by decreasing his compliance effort to render the tax authority indifferent (equation (7)). Second, the tax authority litigates the dispute less often. This effect is intuitive, as improving documentation quality increases the tax authority's confidence in the submitted tax opinion. However, in a strategic interaction with the tax manager, the decreasing equilibrium litigation probability is a response to the tax manager's increasing compliance incentive due to improved documentation (equation (8)).

3. Tax department with a monitoring expert

3.1. Model setup

We now integrate the monitoring expert into the dispute resolution process, drawing on our anecdotal evidence.[11] While typically not involved in the preparation of the tax return, this expert is tasked with overseeing and supporting the resolution of tax disputes once they arise. A monitoring expert brings specialized—often legal—expertise to address the tax authority's challenges.[12] In contrast to external experts, she operates internally and relies more heavily on documentation within the organization and the expertise of other internal actors such as tax managers, who typically possess specialized expertise regarding the local tax regulations and firm-specific activities.[13] The monitoring expert is held accountable for the outcome of the dispute (accountability role), incurring costs in the event of unfavorable litigation. This accountability gives her an incentive to exert dispute resolution effort, thereby improving the firm's tax opinion in response to the tax authority's challenge. Her accountability is also closely

[11] Our anecdotal evidence is based on interviews with a Head of Controversy and Litigation at a Big Four firm and a tax manager working in a firm that employs an internal controversy expert.

[12] For example, tax authorities often challenge uncertain tax positions along two dimensions: the economic dimension such as the size of a transfer price and the legal dimension such as violation of cooperation duties. The monitoring expert typically possesses deep expertise in at least one of these dimensions, enabling her to address specific challenges raised by tax authorities and contribute meaningfully to the resolution process.

[13] The literature on an external expert's influence on *tax reporting* often assumes that the expert can resolve uncertainty completely, without depending on the expertise of another party (e.g., Beck et al. 1996). We take a different view because our setting involves more complex *tax disputes*. This aligns with arguments that experts also require knowledge flows from within the firm (Van der Rijt et al. 2019, Chyz et al. 2021, Cools and Rossing 2021) and face trade-offs regarding their research effort (e.g., Phillips and Sansing 1998).

linked to her ability to discipline the tax manager (disciplining role), as her scrutiny may expose insufficient compliance efforts.

Technically, our assumptions with an involved monitoring expert are as follows. Similar to the tax manager and the tax authority, the monitoring expert has no private knowledge about the true tax liability at stage 0 (see the timeline in Figure 2). In addition to the tax manager choosing his compliance effort during the dispute at stage 1, the monitoring expert decides on her dispute resolution effort $d^{ME} \in \{d_L, d_H\}$ to deal with the tax dispute. The expert and tax manager decide on their effort level independently of each other. A high dispute resolution effort entails opportunity costs of $K^{ME}(d_H) = D > K^{ME}(d_L) = 0$. Now, the degree of sloppiness is jointly determined by (i) the effort levels of the tax manager and monitoring expert, (ii) documentation quality, and (iii) the monitoring expert's resolution ability as follows.

If the monitoring expert's dispute resolution effort is low, sloppiness depends on the tax manager's compliance effort only and is identical to that in a tax department without a monitoring expert. If the tax manager's effort is low and the monitoring expert's effort is high, sloppiness reduces to $Pr(\hat{t}_i|t_j; d_H, a_L) = 1 - \overline{q}\theta < 1 - \underline{q} = Pr(\hat{t}_i|t_j; d_L, a_L)$. We interpret θ as the monitoring expert's dispute resolution ability: For $\theta < 1$ ($\theta > 1$), the tax manager's strategic sloppiness can be partially (more than fully) addressed. We impose the upper bound $\theta < 1/\overline{q}$ to guarantee some sloppiness in this case. If both exert high effort, they can also overcome factual sloppiness, even for lower levels of the monitoring expert's resolution ability. Then, as a simplifying assumption, the submitted tax opinion always equals the true tax liability.[14] In case the final tax opinion cannot be sustained upon litigation, she incurs a disutility of $\lambda^{ME}z > 0$, with $\lambda^{ME} > 0$ being a cost scaling factor. To fully capture the monitoring expert's accountability and keep the analysis tractable, we assume that $\lambda^{TM} = 0$ if a monitoring expert is present. Thus the monitoring expert's accountability shields the tax manager from costs of unfavorable litigation outcomes.

[14]The simplifying assumption $Pr(\hat{t}_i|t_j; d_H, a_H) = 0$ might seem restrictive because the degree of sloppiness is independent of the monitoring expert's resolution ability and the documentation quality when the tax manager and the monitoring expert exert high effort. However, we can relax this assumption by still requiring *some* sloppiness, that is, $Pr(\hat{t}_i|t_j; d_H, a_H) = 1 - \gamma\overline{q}\theta \in (0, \min\{1 - \overline{q}, 1 - \overline{q}\theta\})$, where $\gamma > 1$ reflects the team's synergy, without altering our basic results. Further, the results are robust to alternative specifications characterizing the impact of documentation on sloppiness, such as a generalized function $f(\overline{q}) \in (\underline{q}, 1)$ with $f'(\overline{q}) > 0$, for example, $f(\overline{q}) = \underline{q} + \sqrt{\overline{q}}$ or $f(\overline{q}) = \underline{q} + \overline{q}^2$, and $Pr(\hat{t}_i|t_j; d_H, a_L) = 1 - \theta f(\overline{q})$.

Additionally, our anecdotal evidence suggests that the monitoring expert also has a disciplining role for the tax manager's compliance effort. Therefore, we assume that when the dispute resolution effort is high, she would identify whether the tax manager's compliance effort has been insufficient. In that case, the tax manager incurs additional personal costs $K^{TM}(a_L;d_H) = C > A > 0$.[15] The personal costs are twofold. First, they may include reputational costs from identified noncompliance with the firm's documentation or, second, frustration from loss of control, capturing the non-trivial disciplining role of monitoring (Frey 1993, Dickinson and Villeval 2008).

Taken together, Figure 5 in Appendix B depicts the game tree in a tax department with a monitoring expert.

3.2. Preliminary analysis

We start the analysis by identifying the players' indifference conditions in the presence of a monitoring expert. First, we identify the tax manager's expected utility from a low and high compliance effort. We denote δ as the probability for a low dispute resolution effort by the monitoring expert. Conditional on the other parties' strategies, the tax manager's expected utility is given by

$$\mathbb{E}\left[u^{TM}(a_L|\beta,\delta)\right] = -(1-\delta)C \; , \tag{9}$$

$$\mathbb{E}\left[u^{TM}(a_H|\beta,\delta)\right] = -A \; . \tag{10}$$

Thus the tax manager is indifferent if and only if

$$A = (1-\delta)C \; . \tag{11}$$

[15] For an equilibrium to occur in which all players randomize, $C > A > 0$ is a necessary assumption combined with our modeling choice of the monitoring expert's accountability for tax disputes, that is, $\lambda^{ME} > 0$ and $\lambda^{TM} = 0$. The assumption $\lambda^{TM} = 0$ contrasts with the setting absent a monitoring expert. However, it exactly reflects the decreasing relative importance of the tax manager's disutility component $\lambda^{TM} > 0$ for any positive probability of a high dispute resolution effort, compared to a setting absent of a monitoring expert. Further, note that the personal costs C may also be expected costs, where a high dispute resolution effort reveals a low compliance effort with an exogenous probability.

Due to the monitoring expert's accountability ($\lambda^{TM} = 0$), the tax manager's compliance decision is independent of the tax authority's litigation decision and reduces to a trade-off between the costs of a high compliance effort A and the personal costs C, which may emerge from a low compliance effort identified by the monitoring expert.

Next we turn to the monitoring expert's expected utilities from a low and high dispute resolution effort. These are given by

$$\mathbb{E}\left[u^{ME}\left(d_L|\alpha,\beta\right)\right] = -\lambda^{ME}\frac{z}{2}\left(1-\beta\right)\left[\alpha(1-\underline{q})+(1-\alpha)(1-\overline{q})\right] , \tag{12}$$

$$\mathbb{E}\left[u^{ME}\left(d_H|\alpha,\beta\right)\right] = -\lambda^{ME}\frac{z}{2}\left(1-\beta\right)\alpha(1-\overline{q}\theta) - D . \tag{13}$$

Therefore the monitoring expert is indifferent between choosing a low and high dispute resolution effort if

$$D = \lambda^{ME}\frac{z}{2}(1-\beta)\left[\alpha(\overline{q}\theta-\underline{q})+(1-\alpha)(1-\overline{q})\right] . \tag{14}$$

The indifference condition highlights the monitoring expert's trade-off. She has to consider the costs of a high dispute resolution effort D (left-hand side of equation (14)) and the benefits of improving the final tax opinion (right-hand side), which come into play when the tax authority decides to litigate.

Lastly, we turn to the tax authority's expected utilities, conditional on the submission of a low tax opinion. For the settlement and litigation decision, these are given by

$$\mathbb{E}\left[u^{TA}\left(b_{set}|\alpha,\delta\right)\right] = t_L , \tag{15}$$

$$\mathbb{E}\left[u^{TA}\left(b_{lit}|\alpha,\delta\right)\right] = t_L + \Pr(t_H|\hat{t}_L;\alpha,\delta)z - B , \tag{16}$$

with $\Pr(t_H|\hat{t}_L;\alpha,\delta) = \delta(\alpha(1-\underline{q})+(1-\alpha)(1-\overline{q}))+(1-\delta)\alpha(1-\overline{q}\theta)$. Hence the tax authority is indifferent between settlement and litigation if

$$B = \left[\delta(\alpha(1-\underline{q})+(1-\alpha)(1-\overline{q}))+(1-\delta)\alpha(1-\overline{q}\theta)\right]z . \tag{17}$$

Intuitively, condition (17) emphasizes that the tax authority must weigh the costs of litigation (left-hand side) and the benefits of litigation (right-hand side), where the benefits depend on the joint efforts within the tax department and the documentation quality. The indifference conditions (14) and (17) allow us to state comparative static results in the three-player game with a strategic tax authority, which helps us to explain the mechanism in the equilibrium in which all players strategically interact.

Lemma 2. *(Comparative statics with a strategic tax authority)*
In a game between a strategic tax authority observing a low tax opinion $\hat{t}_L$

a) and a strategic monitoring expert (i.e., with a nonstrategic tax manager choosing a low compliance effort with an exogenous probability α), the tax authority increases the probability of litigation if the monitoring expert's resolution ability θ decreases, the probability for a low compliance effort α decreases (increases) for $\overline{q} > \frac{1+q}{1+\theta}$ ($\overline{q} < \frac{1+q}{1+\theta}$), and the documentation quality $\overline{q}$ decreases (increases) for $\alpha > \frac{1}{1+\theta}$ ($\alpha < \frac{1}{1+\theta}$).

b) and a strategic tax manager (i.e., with a nonstrategic monitoring expert choosing a low dispute resolution effort with an exogenous probability δ), the tax manager increases the probability for a high compliance effort if the monitoring expert's resolution ability θ decreases, the probability for a low dispute resolution effort δ increases, and the documentation quality $\overline{q}$ decreases.

Lemma 2, part a) gives rise to two important preliminary results. First, in contrast to a change in the monitoring expert's resolution ability θ, documentation quality ambiguously affects the tax authority's best response. Second, contrary to intuition, the tax authority increases the litigation probability for high-quality documentation when the tax manager chooses a high compliance effort more often. This second result arises because high-quality documentation combined with high compliance effort constrains the monitoring expert's ability to reduce sloppiness through a high dispute resolution effort. Then the tax authority responds in equilibrium by litigating more frequently.

Lemma 2, part b) underlines that both internal players' efforts as well as documentation quality and the monitoring expert's resolution ability influence the litigation decision similarly. From the perspective of the tax authority, these factors decrease its litigation prospects. As an equilibrium response, the tax manager will thus more frequently choose a low effort. Therefore higher documentation quality and resolution ability of the monitoring expert crowd out the tax manager's compliance effort.

3.3. Equilibrium

The equilibrium in which all parties strategically interact can be derived by simultaneously solving equations (11), (14) and (17) for the equilibrium strategies $\alpha^{\#}, 1-\beta^{\#}$ and $\delta^{\#}$ of the players. Lemma 3 summarizes the result.

Lemma 3. *(Equilibrium with a monitoring expert)*
Given the monitoring expert's dispute resolution costs are sufficiently low ($D < \overline{D}^{\#}$) and the tax authority's litigation costs take an intermediate value ($\underline{B}^{\#} < B < \overline{B}^{\#}$), a mixed-strategy equilibrium entails the following:

a) The monitoring expert chooses a low dispute resolution effort with probability $\delta^{\#} = (C-A)/C$,

b) the tax manager chooses a low compliance effort with probability $\alpha^{\#} = \frac{\frac{B}{z}-\delta^{\#}(1-\overline{q})}{(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(\overline{q}-\underline{q})}$, and

c) the tax authority litigates with probability $1-\beta^{\#} = \frac{2D}{\lambda^{ME}z\left(\alpha^{\#}(\overline{q}\theta-\underline{q})+(1-\alpha^{\#})(1-\overline{q})\right)}$ given the submission of a low tax opinion $\hat{t}_L$, and never given the submission of a high tax opinion $\hat{t}_H$, resulting in a total litigation probability $TLP^{\#} = \left(1-\beta^{\#}\right)/2$,

with

$$\overline{D}^{\#} = \frac{\lambda^{ME} z\left[B(\overline{q}(1+\theta)-(1+\underline{q}))+z(1-\overline{q}\theta)\right]}{2\left[(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(\overline{q}-\underline{q})\right]}$$

$$\underline{B}^{\#} = \delta^{\#}(1-\overline{q})z \qquad \overline{B}^{\#} = \left[(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(1-\underline{q})\right]z$$

As we have established in Lemma 2, both internal players' effort levels are (partially) substitutable, because they can reduce the underlying sloppiness in the final tax opinion independent from each other. Therefore the litigation costs of the tax authority need to be lower on average to guarantee a mixed strategy equilibrium, compared to the tax department without a monitoring expert, which can be seen from $\underline{B}^{\#} < \underline{B}^{*}$ and $\overline{B}^{\#} < \overline{B}^{*}$.

We are interested in how the monitoring expert's resolution ability and the firm's documentation quality influence the players' equilibrium strategies. With regard to the resolution ability θ, we can establish the following result.

Proposition 2. *(Effect of the monitoring expert's resolution ability)*
Increasing the resolution ability θ of the monitoring expert

a) does not change the probability for the monitoring expert's low dispute resolution effort,

b) increases the tax manager's probability for a low compliance effort, and

c) decreases the tax authority's (total) litigation probability.

At first sight, Proposition 2 yields an intuitive result. Since increasing the monitoring expert's resolution ability decreases sloppiness, the tax authority's litigation prospects decrease. However, this result is reflected in the increasing low compliance effort probability $\alpha^{\#}$ and not in the equilibrium litigation probability. In equilibrium, the tax manager renders the tax authority indifferent between settlement and litigation, which is only possible when he decreases his effort, given an increasing level of resolution ability (Lemma 2, part b). A higher resolution ability thus crowds out the tax manager's compliance efforts. Similarly, the monitoring expert's probability for a low dispute resolution effort $\delta^{\#}$ is constant because the tax manager's compliance incentives are independent from the monitoring expert's resolution ability, while resolution ability indeed affects the monitoring expert's dispute resolution incentives. Choosing a high dispute resolution effort becomes more valuable for the monitoring expert with an increasing resolution ability (direct effect). We show that the positive direct effect on the dispute resolution incentives dominates the negative crowding-out effect, which is present for low-quality documentation. This result is reflected in the decreasing litigation probability $(1-\beta^{\#})$ (Lemma 2, part a). In equilibrium, we therefore see that the tax authority keeps the monitoring expert indifferent between her strategies.

Next we turn to the effect of documentation quality $\overline{q}$ on equilibrium behavior. For example, better documentation could exist in firms with greater digitalization and standardization of their tax processes (Hamilton and Stekelberg 2017, Klein et al. 2021, Brühne and Schanz 2022, Blaufus et al. 2023). Proposition 3 formalizes our results.

Proposition 3. *(Effect of documentation quality)*

In the presence of a monitoring expert, an increase in the firm's documentation quality $\overline{q}$

a) does not change the probability for the monitoring expert's low dispute resolution effort,

b) increases the tax manager's probability for a low compliance effort, and

c) increases the tax authority's (total) litigation probability for documentation quality levels below $\overline{q}_{crit}$ *and decreases the (total) litigation probability for quality levels higher than* $\overline{q}_{crit}$*, where* $\overline{q}_{crit} = \frac{1-\alpha^{\#}(1-\underline{q}\theta)}{\theta} \in \left(\underline{q}, 1\right)$ *is a unique maximum when* $\theta > \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$*. For* $\theta < \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$*, the (total) litigation probability strictly increases.*

As evident from Lemma 3, in a mixed strategy equilibrium, the monitoring expert's dispute resolution effort does not depend on documentation quality. The tax manager's compliance effort decreases, however, with increasing documentation quality. Intuitively, the tax manager needs to outweigh the improved documentation by exerting less effort to hold the tax authority indifferent (Lemma 2, part b). The tax authority's reaction to a changing documentation quality is more distinct. For low-quality documentation, increasing the quality induces the tax authority to settle less often (i. e., litigate more often), whereas for high-quality documentation, the tax authority settles more often (litigates less).

Intuitively, the ambiguous effect of documentation quality on the litigation probability occurs because of its ambiguous effect on the monitoring expert's dispute resolution incentives. Two separate effects, the direct effect and the crowding-out effect, play crucial roles, as depicted in the following inequality:

$$\underbrace{\alpha^{\#}(\overline{q})\,[1+\theta]-1}_{\text{Direct effect}}+\underbrace{\frac{\partial\,\alpha^{\#}(\overline{q})}{\partial\,\overline{q}}\left[\overline{q}(1+\theta)-\underline{q}-1\right]}_{\text{Crowding-out effect}}\leq 0\,. \tag{18}$$

The inequality is fulfilled if the monitoring expert's resolution incentives weaken, prompting the tax authority to increase the litigation probability. The direct effect represents how increased documentation quality $\overline{q}$ influences the monitoring expert's benefit from high effort, holding the tax manager's compliance effort constant. When the tax manager chooses a low compliance effort, an increase in $\overline{q}$ increases the monitoring expert's benefit, because her resolution ability is tied to $\overline{q}$ and helps to reduce sloppiness. However, increasing $\overline{q}$ comes at a cost when the tax manager chooses a high effort. In that case, an increasing quality deters dispute resolution incentives, as the monitoring expert's marginal contribution declines. As we have established in Lemma 2 part a), the direct effect is negative for low-quality documentation $\overline{q} < (\alpha^{\#})^{-1}\left(\frac{1}{1+\theta}\right)$, inducing an increase in the litigation probability.

Similarly, the crowding-out effect induces an increase in the litigation probability for low-quality documentation $\overline{q} < \frac{1+\underline{q}}{1+\theta}$ because an increase in $\overline{q}$ affects the monitoring expert's cost-benefit consideration also indirectly via the equilibrium response of the tax manager. We show that under plausible conditions there exists a unique value $\overline{q}_{crit}$ for which condition (18) is fulfilled with equality and that thus separates the direction of how the equilibrium litigation probability varies in $\overline{q}$. There also exist some specific environments with a strongly negative direct effect in which the litigation probability unambiguously increases in $\overline{q}$. Then, a sufficient condition for an interior threshold value $\overline{q}_{crit}$ is that the monitoring expert's resolution ability is sufficiently high.

The monitoring expert's resolution ability and the firm's documentation quality affect the litigation probability through different direct effects, even though both give rise to a similar crowding-out effect. Resolution ability reduces sloppiness particularly under low compliance effort, making it effective in overcoming strategic sloppiness and reducing litigation. By contrast, improving documentation "distributes" the potential sloppiness reduction that drives dispute resolution effort incentives, given a low and high compliance effort, as indicated by the direct effect in equation (18). Importantly, the ambiguous impact of documentation quality is not a mere result of the monitoring expert being now held indifferent, compared to a tax department without one. The key reason is that an additional expert comes into play, which provides partially substitutable services.

Table 1 summarizes all comparative statics.

Table 1. Comparative statics in a tax department with a monitoring expert

Parameter	Description	$\alpha^{\#}$	$1-\beta^{\#}$	$\delta^{\#}$
θ	Monitoring expert's resolution ability	$+$	$-$	0
$\overline{q}$	Documentation quality	$+$	$+,-^{\dagger}$	0
λ^{ME}	Costs from unfavorable litigation outcome	0	$-$	0
z	Value in dispute	$-$	$-$	0
A	Tax manager's compliance costs	$+$	$+,-$	$-$
B	Tax authority's litigation costs	$+$	$+,-$	0
C	Tax manager's personal costs	$-$	$-,+$	$+$
D	Monitoring expert's dispute resolution costs	0	$+$	0

Notes: This table indicates how the exogenous parameters in the left-hand column affect the tax manager's equilibrium probability for a low compliance effort $\alpha^{\#}$, the tax authority's equilibrium litigation probability $1-\beta^{\#}$, and the monitoring expert's equilibrium probability for a low dispute resolution effort $\delta^{\#}$. If the effect is ambiguous, the left sign refers to the effect under low documentation quality, and the right sign under high documentation quality. $+,-^{\dagger}$ indicates that the effect is ambiguous in most feasible constellations, as detailed in Proposition 3.

4. Comparison of tax departments with and without monitoring expert

So far, we have analyzed two different *types* of tax departments, without and with a monitoring expert, separately. These separate analyses, however, do not provide insights into whether the resulting opposite effects of documentation quality on litigation can occur simultaneously, and under what conditions either tax department is superior. In particular, when either type of tax department faces an identical tax dispute and tax authority, which we call an identical *dispute* *environment*, two questions arise. First, is the effect of enhancing documentation quality on the litigation probability tax department-specific? Second, does implementing a tax department with a monitoring expert lead to a lower litigation probability than without one?

Technically, the identified effects of documentation quality and resolution ability on the litigation probability from the separate analyses (Propositions 1 to 3) are conditional on different tax department-specific threshold values (e.g., for the litigation costs), guaranteeing the existence of the mixed strategy equilibria (Lemma 1 and 3). In these separate analyses, we did not restrict the parameter values to being identical for both types of tax department. However, as a next step, we assume all possible parameter values characterizing the dispute environment to be identical for both types of tax departments, namely documentation quality, the tax manager's compliance costs, the value in dispute, and the tax authority's litigation costs.[16] Then we can show the following.

Proposition 4. *(Tax department comparison)*
Suppose that $B < \overline{B}^{\#}$ and $D < \overline{D}^{\#}$ (Lemma 3). Then, there exist dispute environments in which

a) improving documentation strictly increases the litigation probability in a tax department with a monitoring expert ($\frac{\partial\, 1-\beta^{\#}}{\partial\, \overline{q}} > 0$), but decreases it in a tax department without one ($\frac{\partial\, 1-\beta^{*}}{\partial\, \overline{q}} \leq 0$);

b) the litigation probability is higher in a tax department with a monitoring expert, and this outcome becomes more likely as the monitoring expert's dispute resolution costs increase.

With regard to our first question, Proposition 4, part a) establishes that the differential impact of improving documentation on the litigation probability from the separate analyses can be generalized. For specific dispute environments, improved documentation strictly increases the litigation probability in the presence of a monitoring expert whenever documentation quality is below $\overline{q}_{crit}$ (Proposition 3, part c), but decreases the litigation probability absent a monitoring

[16]We exclude the personal cost C, the dispute resolution costs D, the cost scaling factors λ^{TM} and λ^{ME}, and the monitoring expert's resolution ability θ from our definition of an identical dispute environment because they affect the equilibria only for one type of tax department. Technically, these parameters endow us with additional degrees of freedom for the comparison of the two types of tax departments.

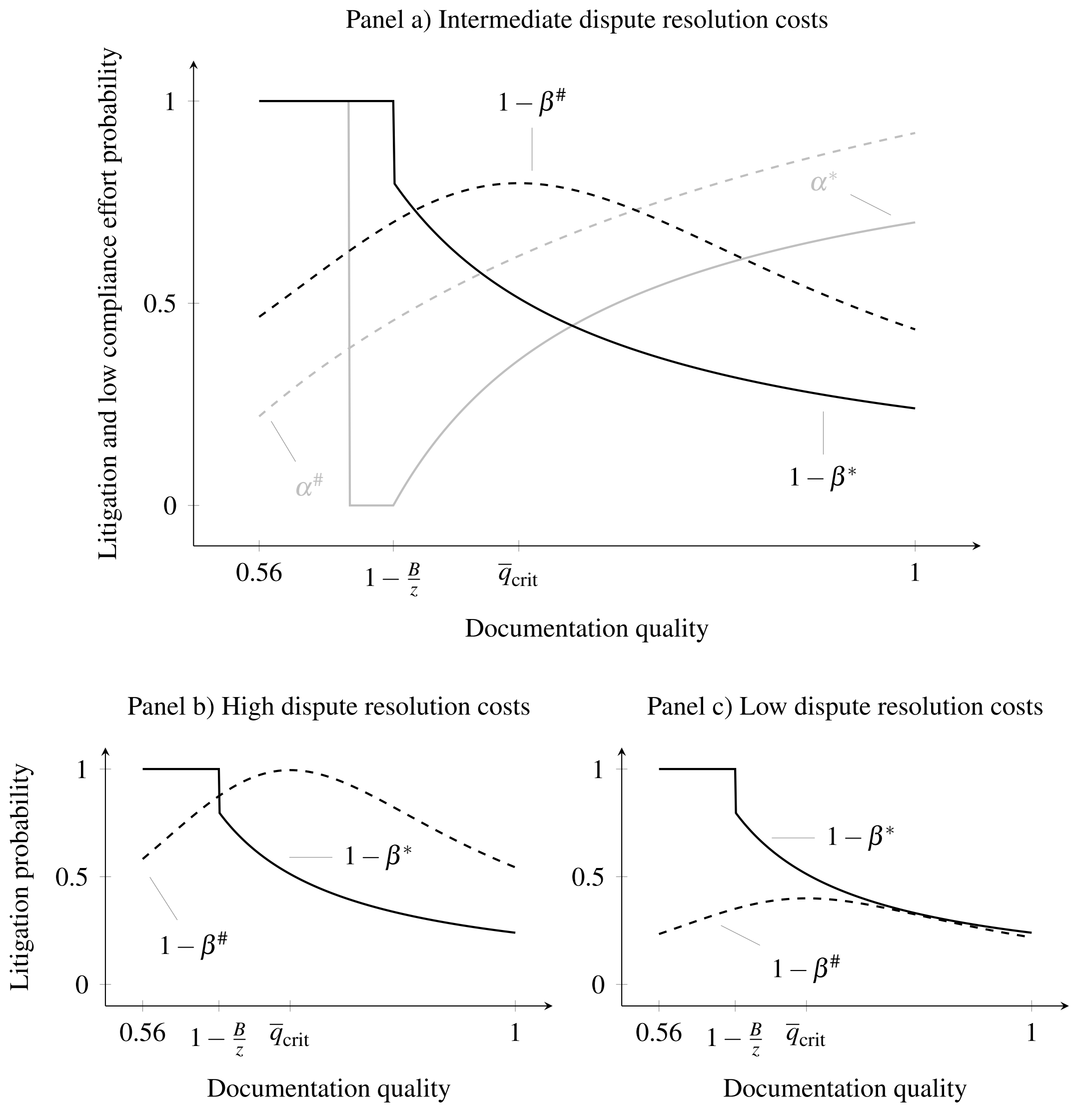
expert. If documentation quality is very low, the litigation probability only weakly decreases absent a monitoring expert, because marginal documentation improvements cannot deter the tax authority from litigation.[17] Otherwise, the litigation probability strictly decreases absent a monitoring expert. Our numerical example in Figure 4 illustrates these insights for a given dispute environment.

With regard to our second question, Proposition 4 part b) states that the litigation probability can be higher in the tax department with a monitoring expert. Intuitively, there are always sufficiently high dispute resolution costs D that, in equilibrium, induce a sufficiently high litigation probability, as the tax authority balances the monitoring expert's dispute resolution incentives. In Figure 4 (panel a), we see that the litigation probability with a monitoring expert is higher if the documentation quality exceeds a specific threshold level, which, in this example, is $\overline{q} > 0.67$. The bottom panels in Figure 4 show scenarios where the litigation probability is higher (panel b) or lower (panel c) in the tax department with a monitoring expert when restricting the focus to mixed strategy equilibria.

Overall Propositions 3 and 4 highlight two unintended consequences of increasing the firm's documentation quality and implementing a monitoring expert. First, increasing the documentation quality might not be effective in overcoming sloppiness and preventing litigation, due to impaired compliance incentives. Second, the litigation probability might be higher in the presence of a strategic monitoring expert. Hence, when a firm designs its tax department and overall tax dispute strategy, it must keep in mind that the costly implementation of a monitoring expert and the costly improvement of documentation quality do not necessarily advance the goal of decreasing costly and time-consuming litigation. Given the structural uncertainty inherent in tax disputes (factual sloppiness), firms may face limits to improving documentation quality. Our results therefore suggest that litigation is best prevented either by relying on the best feasible documentation alone or by complementing weak documentation with a monitoring expert.

[17] In this case, we have a pure strategy equilibrium absent a monitoring expert with $1-\beta^* = 1$. It occurs when $\overline{q} < \max\left\{1 - \frac{B}{z}, \frac{2A}{\lambda^{TM} z} + \underline{q}\right\}$.

Figure 4. Equilibrium strategies in both tax department types for a specific dispute environment



Notes: This figure illustrates the players' equilibrium strategies conditional on the tax department type as a function of the documentation quality. The solid black lines indicate the tax authority's litigation probability $1-\beta^*$ and the solid gray line depicts the tax manager's low compliance effort probability α^* without a monitoring expert. The dashed lines depict the respective probabilities $1-\beta^{\#}$ and $\alpha^{\#}$ with a monitoring expert. $\overline{q}_{\text{crit}}$ denotes the critical documentation quality level that separates the direction of the tax authority's equilibrium reaction with a monitoring expert. For $\overline{q} \leq 1-B/z$, the mixed strategy equilibrium effects are not comparable for the same dispute environment. Then the players choose pure strategies in the setting without a monitoring expert, with $(\alpha^*, 1-\beta^*) = (0,1)$ for $\overline{q} \in (0.62, 0.65)$ and $(\alpha^*, 1-\beta^*) = (1,1)$ for $\overline{q} \in (0.56, 0.62)$. Panel a) shows a scenario where the monitoring expert has intermediate dispute resolution costs D. The parameters are chosen with $D = 2, \theta = 0.9, \underline{q} = 0.5, \lambda^{ME} = 2.5, \lambda^{TM} = 2.5, A = 1.5, B = 3.5, C = 5, z = 10$, implying $\delta^{\#} = 0.7\ \forall\ \overline{q}$ and requiring $\overline{q} > 0.56$. The bottom panels show scenarios where, ceteris paribus, the monitoring expert has high (panel b: $D = 2.5$) or low (panel c: $D = 1$) dispute resolution costs.

5. Conclusions

We examine the effects of two corporate dispute resolution practices using a game-theoretic model with a tax manager choosing compliance effort and a tax authority deciding on settling or litigating a tax dispute. We distinguish documentation quality, which addresses factual sloppiness arising from limitations in the internal information environment, and the involvement of a strategic monitoring expert with specific dispute resolution ability, who can also contribute to mitigate strategic sloppiness stemming from the tax manager's effort aversion.

We find that both higher dispute resolution ability and improved documentation quality generally crowd out the tax manager's compliance effort. Further, we find that improving documentation decreases the probability of litigation in the absence of a monitoring expert. By contrast, if a monitoring expert is involved, then this effect only persists if the documentation quality is already high. Surprisingly, we find that improving low-quality documentation can lead to more frequent escalation of tax disputes through litigation. This outcome is driven by the crowding-out of compliance efforts, which negatively affects the monitoring expert's dispute resolution incentives for low-quality but not for high-quality documentation. The tax authority rationally incorporates this dynamic into its litigation decision. Overall, the incremental effects of improving documentation and involving a monitoring expert should be considered in future research examining how firms choose their overall dispute strategy in the first place.

Our results provide predictions that should be empirically tested. First, in tax departments with a monitoring expert, we predict that the effect of documentation quality on the litigation frequency is positive at lower documentation quality levels and negative at higher levels. Second, we find that the dispute resolution ability of a monitoring expert is especially valuable in firms with weak documentation or in enforcement environments characterized by significant structural uncertainty regarding litigation outcomes. We thus predict that the existence or involvement of internal monitoring experts either signals low-quality documentation in firms or enforcement environments characterized by significant structural uncertainties regarding litigation outcomes.

References

Abeler, J., Nosenzo, D., & Raymond, C. (2019). Preferences for Truth-telling. *Econometrica*, *87*(4), 1115–1153.

Armstrong, C. S., Blouin, J. L., & Larcker, D. F. (2012). The Incentives for Tax Planning. *Journal of Accounting and Economics*, *53*(1-2), 391–411.

Bebchuk, L. (1984). Litigation and Settlement Under Imperfect Information. *The RAND Journal of Economics*, *15*(3), 404–415.

Beck, P. J., Davis, J. S., & Jung, W.-O. (1996). Tax Advice and Reporting under Uncertainty: Theory and Experimental Evidence. *Contemporary Accounting Research*, *13*(1), 49–80.

Belnap, A., Hoopes, J. L., & Wilde, J. H. (2023). Who Really Matters in Corporate Tax? *Journal of Accounting and Economics*, 101609.

Blaufus, K., Bob, J., Lorenz, D., & Trinks, M. (2016). How Will the Court Decide?–Tax Experts' versus Laymen's Predictions. *European Accounting Review*, *25*(4), 771–792.

Blaufus, K., Reineke, J., & Trenn, I. (2023). Perceived Tax Audit Aggressiveness, Tax Control Frameworks and Tax Planning: An Empirical Analysis. *Journal of Business Economics*, *93*(3), 509–557.

Blaufus, K., Schöndube, J. R., & Wielenberg, S. (2024). Information Sharing between Tax and Statutory Auditors: Implications for Tax Audit Efficiency. *European Accounting Review*, *33*(2), 545–568.

Brühne, A. I., & Schanz, D. (2022). Defining and Managing Corporate Tax Risk: Perceptions of Tax Risk Experts. *Contemporary Accounting Research*, *39*(4), 2861–2902.

Chen, X., Cheng, Q., Chow, T., & Liu, Y. (2021). Corporate In-house Tax Departments. *Contemporary Accounting Research*, *38*(1), 443–482.

Chyz, J. A., Gal-Or, R., Naiker, V., & Sharma, D. S. (2021). The Association between Auditor Provided Tax Planning and Tax Compliance Services and Tax Avoidance and Tax Risk. *Journal of the American Taxation Association*, *43*(2), 7–36.

Cools, M., & Rossing, J. C. P. (2021). International Transfer Pricing: MNE Dependency on Knowledge of External Tax Consultants. *Journal of Management Accounting Research*, *33*(1), 33–51.

Crocker, K. J., & Slemrod, J. (2005). Corporate Tax Evasion with Agency Costs. *Journal of Public Economics*, *89*(9-10), 1593–1610.

Dallhammer, D., & Renelt, C. (2025). Digitalization and Tax Control Frameworks. *WU International Taxation Research Paper Series*, *No. 2025 - 03*. https://ssrn.com/abstract=5178245

De Simone, L., Sansing, R. C., & Seidman, J. K. (2013). When are Enhanced Relationship Tax Compliance Programs Mutually Beneficial? *The Accounting Review*, *88*(6), 1971–1991.

De Waegenaere, A., Sansing, R. C., & Wielhouwer, J. L. (2007). Using Bilateral Advance Pricing Agreements to Resolve Tax Transfer Pricing Disputes. *National Tax Journal*, *60*(2), 173–191.

Dickinson, D., & Villeval, M.-C. (2008). Does Monitoring Decrease Work Effort?: The Complementarity between Agency and Crowding-out Theories. *Games and Economic Behavior*, *63*(1), 56–76.

Diller, M., Kortebusch, P., Schneider, G., & Sureth-Sloane, C. (2017). Boon or Bane? Advance Tax Rulings as a Measure to Mitigate Tax Uncertainty and Foster Investment. *European Accounting Review*, *26*(3), 441–468.

Diller, M., Lorenz, J., Schneider, G., & Sureth-Sloane, C. (2025). Is Tax Transfer Pricing Harmonization a Panacea? Real Effects of Global Tax Transparency and Standards Consistency. *The Accounting Review*, *100*(2), 71–102.

Donohoe, M. P., McGill, G. A., & Outslay, E. (2014). Risky Business: The Prosopography of Corporate Tax Planning. *National Tax Journal*, *67*(4), 851–874.

Dyck, D. (2025). Corporate Tax Planning and Enforcement. *TRR Working Paper Series No. 186*. http://dx.doi.org/10.2139/ssrn.5186857

Dyck, D., Lorenz, J., & Sureth-Sloane, C. (2025). Tax Disputes - The Role of Technology and Controversy Expertise. *TRR 266 Accounting for Transparency Working Paper Series No. 101*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4214449

Dyreng, S. D., & Maydew, E. L. (2018). Virtual Issue on Tax Research Published in the Journal of Accounting Research. *Journal of Accounting Research*, *56*(2), 311.

Eichfelder, S., & Vaillancourt, F. (2014). Tax Compliance Costs: A Review of Cost Burdens and Cost Structures. *Hacienda Pública Española / Review of Public Economics*, *210*(3), 111–148.

Ewert, R., & Wagenhofer, A. (2019). Effects of Increasing Enforcement on Financial Reporting Quality and Audit Quality. *Journal of Accounting Research*, *57*(1), 121–168.

EY. (2023). Why Tax Governance Is Key in an Era of More Tax Risk and Controversy. https://www.ey.com/en_gl/insights/tax/why-tax-governance-is-key-in-an-era-of-more-tax-risk-and-controversy

Eynon, G., & Stevens, K. (1995). The Economics of Taxpayer Venue Choice: Effects of Informational Asymmetries. *Journal of the American Taxation Association*, *17*(1), 71–94.

Feller, A., & Schanz, D. (2017). The Three Hurdles of Tax Planning: How Business Context, Aims of Tax Planning, and Tax Manager Power Affect Tax Expense. *Contemporary Accounting Research*, *34*(1), 494–524.

Franzoni, L. (2004). Discretion in Tax Enforcement. *Economica*, *71*(283), 369–389.

Frey, B. S. (1993). Does Monitoring Increase Work Effort? The Rivalry with Trust and Loyalty. *Economic Inquiry*, *31*(4), 663–670.

Gallemore, J., & Labro, E. (2015). The Importance of the Internal Information Environment for Tax Avoidance. *Journal of Accounting and Economics*, *60*(1), 149–167.

Gentzkow, M., & Kamenica, E. (2014). Costly Persuasion. *American Economic Review*, *104*(5), 457–62.

Giese, H., Lynch, D., Schulz, K. A., & Sureth-Sloane, C. (2025). The Effects of Tax Reform on Labor Demand within Tax Departments. *TRR 266 Accounting for Transparency Working Paper Series No. 171*. http://dx.doi.org/10.2139/ssrn.5068550

Göx, R. F., & Wagenhofer, A. (2009). Optimal Impairment Rules. *Journal of Accounting and Economics*, *48*(1), 2–16.

Graetz, M. J., Reinganum, J. F., & Wilde, L. L. (1986). The Tax Compliance Game: Toward an Interactive Theory of Law Enforcement. *Journal of Law, Economics, & Organization*, *2*(1), 1–32.

Graham, J. R., Hanlon, M., Shevlin, T., & Shroff, N. (2014). Incentives for Tax Planning and Avoidance: Evidence from the Field. *The Accounting Review*, *89*(3), 991–1023.

Gregor, M., & Michaeli, B. (2025). Board Bias, Information, and Investment Efficiency. *Review of Accounting Studies*, *30*, 1432–1462.

Hamilton, R., & Stekelberg, J. (2017). The Effect of High-quality Information Technology on Corporate Tax Avoidance and Tax Risk. *Journal of Information Systems*, *31*(2), 83–106.

Hay, B. L. (1995). Effort, Information, Settlement, Trial. *The Journal of Legal Studies*, *24*(1), 29–62.

Jacob, M., Rohlfing-Bastian, A., & Sandner, K. (2019). Why Do Not All Firms Engage in Tax Avoidance? *Review of Managerial Science*, *15*(2), 459–495.

Jin, J. Y., Liu, Y., & Nainar, S. M. K. (2022). Organizational Memory and Bank Accounting Conservatism. *European Accounting Review*, *31*(3), 663–700.

Jung, W.-O. (1995). Tax Litigation, Tax Reporting Game, and Social Costs. *Journal of the American Taxation Association*, *17*(2), 1–19.

Kamenica, E. (2019). Bayesian Persuasion and Information Design. *Annual Review of Economics*, *11*(1), 249–272.

Klassen, K. J., Lisowsky, P., & Mescall, D. (2017). Transfer Pricing: Strategies, Practices, and Tax Minimization. *Contemporary Accounting Research*, *34*(1), 455–493.

Klein, D., Ludwig, C. A., & Nicolay, K. (2021). Internal Digitalization and Tax-efficient Decision Making. *ZEW - Centre for European Economic Research Discussion Paper No. 20-051*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3716119

Kourouxous, T., Krenn, P., & Niemann, R. (2024). How do Tax Courts Affect Tax Compliance and Tax Audits? A Game-theoretic Analysis. *SSRN Electronic Journal*. https://ssrn.com/abstract=4995621

KPMG. (2019). The Global Tax Disputes Environment. https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2019/10/the-global-tax-disputes-environment.pdf

KPMG. (2023). Navigating the Global Tax Disputes Landscape. https://kpmg.com/xx/en/our-insights/transformation/navigating-the-global-tax-disputes-landscape.html

Krupa, T., & Mullaney, M. (2025). The Use of Artificial Intelligence in Decision-Making: Evidence from the Effectiveness of Corporate Tax Strategies. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4710463

Labro, E., & Pierk, J. (2025). Accounting Regulation in the European Union. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.4663683

Li, J., & Okafor, O. N. (2024). Tax Employee Careers and Corporate Tax Outcomes. *European Accounting Review, forthcoming*, 1–26. https://doi.org/10.1080/09638180.2024.2386144

Lindsey, B. P., McDonnell, S., & Moser, W. J. (2023). Do United States Tax Court Judge Attributes Influence the Resolution of Corporate Tax Disputes? *Journal of Accounting and Public Policy*, *42*(6), 107156.

Luttmer, E. F., & Singhal, M. (2014). Tax Morale. *Journal of Economic Perspectives*, *28*(4), 149–168.

Markham, M. (2018). Litigation, Arbitration and Mediation in International Tax Disputes: An Assessment of whether this Results in Competitive or Collaborative Relations. *Contemporary Asia Arbitration Journal*, *11*(2), 277–304.

Martini, J. T., Niemann, R., Simons, D., & Voeller, D. (2025). Incentive Effects of Tax Transparency: Does Country-by-Country Reporting Call for Arbitration? *Journal of Accounting and Public Policy*, *49*, 107278.

McGuire, S. T., Rane, S. G., & Weaver, C. D. (2018). Internal Information Quality and Tax-Motivated Income Shifting. *The Journal of the American Taxation Association*, *40*(2), 25–44.

Michaeli, B. (2017). Divide and Inform: Rationing Information to Facilitate Persuasion. *The Accounting Review*, *92*(5), 167–199.

Mills, L. F., Robinson, L. A., & Sansing, R. C. (2010). FIN 48 and Tax Compliance. *The Accounting Review*, *85*(5), 1721–1742.

Nessa, M., Schwab, C. M., Stomberg, B., & Towery, E. M. (2020). How do IRS Resources Affect the Corporate Audit Process? *The Accounting Review*, *95*(2), 311–338.

Neuman, S. S., Omer, T. C., & Schmidt, A. P. (2020). Assessing Tax Risk: Practitioner Perspectives. *Contemporary Accounting Research*, *37*(3), 1788–1827.

Nguyen, A., & Tan, T. Y. (2021). Bayesian Persuasion with Costly Messages. *Journal of Economic Theory*, *193*, 105212.

Phillips, J., & Sansing, R. C. (1998). Contingent Fees and Tax Compliance. *The Accounting Review*, *73*(1), 1–18.

PwC. (2025). Global Tax Controversy and Dispute Resolution Survey. https://www.pwc.com/gx/en/services/tax/tax-controversy-dispute-resolution-survey.html

Reineke, R., Weiskirchner-Merten, K., & Wielenberg, S. (2023). When Do Firms Use One Set of Books in an International Tax Compliance Game? *Review of Accounting Studies*, *28*(3), 1856–1885.

Reinganum, J., & Wilde, L. (1986). Settlement, Litigation, and the Allocation of Litigation Costs. *RAND Journal of Economics*, *17*(4), 557–566.

Reinganum, J., & Wilde, L. (1991). Equilibrium Enforcement and Compliance in the Presence of Tax Practitioners. *Journal of Law, Economics, & Organization*, *7*(1), 163–181.

Salterio, S., & Denham, R. (1997). Accounting Consultation Units: An Organizational Memory Analysis. *Contemporary Accounting Research*, *14*(4), 669–691.

Sansing, R. C. (1997). Voluntary Binding Arbitration as an Alternative to Tax Court Litigation. *National Tax Journal*, *50*(2), 279–296.

Schantl, S. F., & Wagenhofer, A. (2020). Deterrence of Financial Misreporting when Public and Private Enforcement Strategically Interact. *Journal of Accounting and Economics*, *70*(1), 101311.

Schulz, K. A., & Sureth-Sloane, C. (2024). Tax Compliance Management Systeme in deutschen Betriebsprüfungen – Eine Analyse praktischer Erfahrungen. *Steuer und Wirtschaft*, *101*(4), 335–353.

Siglé, M. A., Goslinga, S., van der Hel, L. E. C. J. M., & Wilson, R. J. (2024). Tax Control and Corporate VAT Compliance: An Empirical Assessment of the Moderating Role of Tax Strategy. *Journal of International Accounting, Auditing and Taxation*, *57*, 100655.

Slemrod, J. (2019). Tax Compliance and Enforcement. *Journal of Economic Literature*, *57*(4), 904–954.

Spier, K. E. (2007). Chapter 4 Litigation. In *Handbook of Law and Economics* (pp. 259–342, Vol. 1). North-Holland.

Tran-Nam, B., & Walpole, M. (2016). Tax Disputes, Litigation Costs and Access to Tax Justice. *eJournal of Tax Research*, *14*(2), 319–336.

Van der Rijt, P., Hasseldine, J., & Holland, K. (2019). Sharing Corporate Tax Knowledge with External Advisers. *Accounting and Business Research*, *49*(4), 454–473.

White, J. (2023). Tax Disputes to Watch in 2023. *International Tax Review*. https://www.internationaltaxreview.com/article/2b4jemz5c8ygbm9qeai2o/tax-disputes-to-watch-in-2023

Yoon, S.-S. (2000). Multiple Taxpayers and Litigation Cost Reimbursement Rules. *Journal of the American Taxation Association*, *22*(1), 78–88.

Appendix A

Proof of Lemma 1

The equilibrium strategies $(\alpha^*, 1-\beta^*)$ are derived straightforwardly by rearranging the indifference conditions (7) and (8). The total litigation probability can be derived by adding up all probabilities leading to a litigation decision by the tax authority (see Figure 3). This shows

$$TLP^* = \frac{1}{2}\left[\alpha^* \underline{q}(1-\beta^*) + (1-\alpha^*)\overline{q}(1-\beta^*)\right] + \frac{1}{2}\left[\alpha^*(1-\underline{q})(1-\beta^*) + (1-\alpha^*)(1-\overline{q})(1-\beta^*)\right] = \frac{1}{2}(1-\beta^*).$$

Proof of Proposition 1

The equilibrium probabilities are $\alpha^* = \frac{\frac{B}{z}-(1-\overline{q})}{\overline{q}-\underline{q}}$ and $1-\beta^* = \frac{2A}{\lambda^{TM} z(\overline{q}-\underline{q})}$. Then, we have

$$\frac{\partial \alpha^*}{\partial \overline{q}} = \frac{\overline{q}-\underline{q}-\left(\frac{B}{z}-(1-\overline{q})\right)}{\left(\overline{q}-\underline{q}\right)^2} = \frac{1-\underline{q}-\frac{B}{z}}{\left(\overline{q}-\underline{q}\right)^2}.$$

Since $1-\underline{q} > B/z$ guarantees that the tax authority's best response to a low compliance effort is litigation and $\overline{q} > \underline{q}$, we get $\frac{\partial \alpha^*}{\partial \overline{q}} > 0$. $\frac{\partial 1-\beta^*}{\partial \overline{q}} > 0$ can be observed straightforwardly.

Proof of Lemma 2

Part a) can be identified from the indifference condition (14) that characterizes the mixed strategy equilibrium. Denote the right-hand side of (14) as Ω^{ME}_{RHS}. Then, it can be easily shown that $\frac{\partial \Omega^{ME}_{RHS}}{\partial \theta} > 0$, $\frac{\partial \Omega^{ME}_{RHS}}{\partial \alpha} = \lambda^{ME}\frac{z}{2}(1-\beta)\left[\overline{q}(1+\theta)-(1+\underline{q})\right] \propto \overline{q}(1+\theta)-(1+\underline{q})$ and $\frac{\partial \Omega^{ME}_{RHS}}{\partial \overline{q}} = \lambda^{ME}\frac{z}{2}(1-\beta)\left[\alpha(1+\theta)-1\right] \propto \alpha(1+\theta)-1$. Thus, the litigation probability $1-\beta$ increases (decreases) when the derivatives of Ω^{ME}_{RHS} with respect to the exogenous parameters decrease (increase), given that (14) holds.

Similarly, part b) can be observed from the indifference condition (17). Denote the right-hand side of (17) as Ω^{TA}_{RHS}. Then, it can be easily shown that $\frac{\partial \Omega^{TA}_{RHS}}{\partial \theta} < 0$, $\frac{\partial \Omega^{TA}_{RHS}}{\partial \delta} > 0$ and $\frac{\partial \Omega^{TA}_{RHS}}{\partial \overline{q}} < 0$.

Thus, the probability for a high compliance effort $1-\alpha$ increases (decreases) when the derivatives of Ω_{RHS}^{TA} with respect to the exogenous parameters increase (decrease).

Proof of Lemma 3

We start by identifying the monitoring expert's equilibrium strategy. From the tax manager's indifference condition (equation (11)), straightforward rearranging yields the equilibrium probability $\delta^{\#} = (C-A)/C$. This probability is between zero and one as long as $C > A > 0$, which is fulfilled by assumption.

In a next step, we identify the tax manager's probability of choosing a low compliance effort. Inserting $\delta^{\#}$ in the tax authority's indifference condition (equation (17)) yields

$$B = \left[\delta^{\#}(\alpha^{\#}(1-\underline{q}) + (1-\alpha^{\#})(1-\overline{q})) + (1-\delta^{\#})\alpha^{\#}(1-\overline{q}\theta)\right] z \, . \tag{19}$$

Rearranging for $\alpha^{\#}$ ultimately leads to

$$\alpha^{\#} = \frac{\frac{B}{z} - \delta^{\#}(1-\overline{q})}{(1-\delta^{\#})(1-\overline{q}\theta) + \delta^{\#}(\overline{q}-\underline{q})} \, . \tag{20}$$

The tax manager chooses a low effort with positive probability ($\alpha^{\#} > 0$) if $B > \delta^{\#}(1-\overline{q})z \equiv \underline{B}^{\#}$. Additionally, $\alpha^{\#} < 1$ requires

$$B < \left[(1-\delta^{\#})(1-\overline{q}\theta) + \delta^{\#}(1-\underline{q})\right] z \equiv \overline{B}^{\#} \, . \tag{21}$$

Lastly, we derive the tax authority's equilibrium litigation probability. Inserting $\alpha^{\#}$ in the indifference condition of the monitoring expert (equation (14)) gives us

$$D = \lambda^{ME} \frac{z}{2}(1-\beta) \left[\alpha^{\#}(\overline{q}\theta - \underline{q}) + (1-\alpha^{\#})(1-\overline{q})\right] . \tag{22}$$

Rearranging for the litigation probability yields

$$1-\beta^{\#}=\frac{2D}{\lambda^{ME}z\left[\alpha^{\#}(\overline{q}\theta-\underline{q})+(1-\alpha^{\#})(1-\overline{q})\right]}\;. \tag{23}$$

It is straightforward to see that $1-\beta^{\#}>0$. Further, $1-\beta^{\#}<1$ requires

$$D<\frac{\lambda^{ME}z\left[B((1+\theta)\overline{q}-1-\underline{q})+z(1-\overline{q}\theta)\right]}{2\left[(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(\overline{q}-\underline{q})\right]}\equiv D^{\#}\;. \tag{24}$$

The total litigation probability can be shown as in the setting without a monitoring expert:

$$\begin{aligned}
TLP^{\#}=&\frac{1}{2}(1-\beta^{\#})\Big[\alpha^{\#}\left(\delta^{\#}\underline{q}+(1-\delta^{\#})\overline{q}\theta\right)+(1-\alpha^{\#})\left(\delta^{\#}\overline{q}+(1-\delta^{\#})\right)\Big]+\\
&\frac{1}{2}(1-\beta^{\#})\Big[\alpha^{\#}\left(\delta^{\#}(1-\underline{q})+(1-\delta^{\#})(1-\overline{q}\theta)\right)+(1-\alpha^{\#})\delta^{\#}(1-\overline{q})\Big]\\
=&\frac{1}{2}\left(1-\beta^{\#}\right)\Big[\alpha^{\#}\delta^{\#}+\alpha^{\#}(1-\delta^{\#})+(1-\alpha^{\#})\delta^{\#}+(1-\alpha^{\#})(1-\delta^{\#})\Big]\\
=&\frac{1}{2}\left(1-\beta^{\#}\right).
\end{aligned}$$

Proof of Proposition 2

Part a) is fulfilled, since $\delta^{\#}$ does not depend on θ. To show that part b) is fulfilled, note that the derivative with respect to θ is implicitly defined by

$$\frac{\partial\,\alpha^{\#}}{\partial\,\theta}=\frac{\alpha^{\#}(1-\delta^{\#})\overline{q}}{\left[(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(\overline{q}-\underline{q})\right]}>0\;.$$

Lastly, using the implicit function theorem with three endogenous variables $(\alpha^{\#},\beta^{\#},\delta^{\#})$, the derivative of $1-\beta^{\#}$ is found to be implicitly defined by

$$\frac{\partial\,1-\beta^{\#}}{\partial\,\theta}=-\frac{(1-\beta^{\#})\alpha^{\#}\overline{q}\left(\overline{q}-\underline{q}\right)}{\left[\alpha^{\#}(\overline{q}\theta-\underline{q})+(1-\alpha^{\#})(1-\overline{q})\right]\left[(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(\overline{q}-\underline{q})\right]}<0,$$

which shows part c).

Proof of Proposition 3

Part a) is fulfilled, since $\delta^{\#}$ does not depend on $\overline{q}$. To show part b), we calculate the derivative of $\alpha^{\#}$ with respect $\overline{q}$, which is implicitly given by

$$\frac{\partial \alpha^{\#}}{\partial \overline{q}} = \frac{(1-\delta^{\#})\alpha^{\#}\theta + \delta^{\#}(1-\alpha^{\#})}{\left[(1-\delta^{\#})(1-\overline{q}\theta) + \delta^{\#}(\overline{q}-\underline{q})\right]} > 0 \; .$$

In a mixed strategy equilibrium, the positivity of the above derivative is guaranteed.

Next, we identify the effect on $1-\beta^{\#}$, considering that $\alpha^{\#}$ is a function of $\overline{q}$. Taking the derivative without explicitly inserting $\frac{\partial \alpha^{\#}}{\partial \overline{q}}$, we get

$$\frac{\partial\, 1-\beta^{\#}}{\partial \overline{q}} = \frac{2D}{\lambda^{ME} z \left[\alpha^{\#}(\overline{q}\theta-\underline{q}) + (1-\alpha^{\#})(1-\overline{q})\right]^2} \cdot \Omega_{\overline{q}}^{-\beta} \propto \Omega_{\overline{q}}^{-\beta}$$

where

$$\Omega_{\overline{q}}^{-\beta} = -\left[\frac{\partial \alpha^{\#}}{\partial \overline{q}}\left(\overline{q}(1+\theta) - \underline{q} - 1\right) + \alpha^{\#}(1+\theta) - 1\right], \tag{25}$$

which is our inequality (18) used for economic intuition. $\overline{q}_{crit}$ is the value for which the bracket term in equation (25) is zero. Further simplification yields

$$\Omega_{\overline{q}}^{-\beta} \propto -\left(\alpha^{\#}(1-\underline{q}\theta) - (1-\overline{q}\theta)\right) \; .$$

Note that $\Omega_{\overline{q}}^{-\beta}$ strictly decreases in $\overline{q}$ and observe the following characteristics:

$$\lim_{\overline{q}\to\underline{q}} \Omega_{\overline{q}}^{-\beta} > 0 \text{ and } \lim_{\overline{q}\to 1} \Omega_{\overline{q}}^{-\beta} = 1 - \theta - \alpha^{\#}(1-\underline{q}\theta) \gtreqless 0.$$

Further, note that

$$\frac{\partial \lim_{\overline{q}\to 1} \Omega_{\overline{q}}^{-\beta}}{\partial \theta} = -\frac{\partial \alpha^{\#}}{\partial \theta}(1-\underline{q}\theta) - (1-\underline{q}\alpha^{\#}) < 0, \tag{26}$$

and rearranging $\lim_{\overline{q}\to 1}\Omega_{\overline{q}}^{-\beta} = 1-\theta-\alpha^{\#}(1-\underline{q}\theta) < 0$ yields $\theta > \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$. Thus, if $\theta > \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$, there exists a unique threshold value $\overline{q}_{crit} \in (\underline{q},1)$, such that if $\overline{q} < \overline{q}_{crit}$, we have $\frac{\partial(1-\beta^{\#})}{\partial\overline{q}} > 0$, and if $\overline{q} > \overline{q}_{crit}$, we have $\frac{\partial(1-\beta^{\#})}{\partial\overline{q}} < 0$. If $\theta < \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$, we have $\frac{\partial(1-\beta^{\#})}{\partial\overline{q}} > 0\ \forall\ \overline{q} \in (\underline{q},1)$.

Proof of Proposition 4

The proof consists of two steps. First, we determine the boundaries for the documentation quality levels from the separate analyses at which the mixed strategy equilibria for both tax department types exist. Second, we derive the insights with regard to both tax department types from part a) and b).

To begin, note that $\delta^{\#}$ is independent of $\overline{q}$, and therefore does not restrict the comparable documentation quality range. Further, since $(\alpha^*, 1-\beta^*)$ is independent of D, and assuming that the dispute resolution costs are sufficiently small, that is, $D < \overline{D}^{\#}$ (Lemma 3), $\beta^{\#} \in (0,1)$ is guaranteed without restricting the comparable documentation quality range. Lastly, note that $\alpha^*(\overline{q}) < \alpha^{\#}(\overline{q})\ \forall\ \overline{q}$, so that $\alpha^* > 0$ and $\alpha^{\#} < 1$ determine boundaries for the documentation quality. This is because $\frac{\partial\alpha^{\#}}{\partial\delta} < 0$ and $\alpha^{\#}(\overline{q})\big|_{\delta=1} = \alpha^*(\overline{q})$. The upper bound for documentation quality is thus $\overline{q} = \left(\alpha^{\#}\right)^{-1}(1) = \frac{1-\frac{B}{z}-\delta^{\#}\underline{q}}{\theta(1-\delta^{\#})}$, or, alternatively, is guaranteed when $B < \overline{B}^{\#}$ (Lemma 3). The first lower bound is derived from rearranging $\overline{q} = (\alpha^*)^{-1}(0) = 1-B/z$. The second lower bound is derived from $\overline{q} = (\beta^*)^{-1}(0) = \frac{2A}{\lambda^{TM}z} + \underline{q}$, which needs to be additionally fulfilled to guarantee that a high compliance effort is not a dominated strategy in the setting without a monitoring expert. This establishes the following interval in which mixed strategy equilibria in both tax department types are present:

$$\max\left\{1-\frac{B}{z}, \frac{2A}{\lambda^{TM}z}+\underline{q}\right\} < \overline{q} < \min\left\{\frac{1-\frac{B}{z}-\delta^{\#}\underline{q}}{\theta(1-\delta^{\#})}, 1\right\}.$$

Thus, concerning part a), we know that when $D < \overline{D}^{\#}$ and $B < \overline{B}^{\#}$, the effect of documentation quality on the litigation probability $1-\beta^{\#}$ follows the pattern as established in Proposition 3, part c), implying $\frac{\partial(1-\beta^{\#})}{\partial\overline{q}} > 0\ \forall\ \overline{q} \in (\underline{q},1)$ when $\theta < \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$, or $\frac{\partial(1-\beta^{\#})}{\partial\overline{q}} > 0\ \forall\ \overline{q} \in (\underline{q},\overline{q}_{crit})$

when $\theta > \frac{1-\alpha^{\#}}{1-\alpha^{\#}\underline{q}}$. Further, if $\overline{q} > \max\left\{1-\frac{B}{z}, \frac{2A}{\lambda^{TM}z}+\underline{q}\right\}$, we have $\frac{\partial(1-\beta^{*})}{\partial\overline{q}} < 0$, and $\frac{\partial(1-\beta^{*})}{\partial\overline{q}} = 0$ otherwise.

For the statement in b) to be true, it is sufficient to derive one parameter constellation which fulfills it. Note that $\frac{\partial(1-\beta^{\#})}{\partial D} > 0$ and that $\frac{\partial(1-\beta^{*})}{\partial D} = 0$. Further, suppose that $\overline{q}_{crit} \in (\underline{q}, 1)$. Then it is obvious that $\lim_{D\to\overline{D}^{\#}} 1-\beta^{\#}(\overline{q}_{crit}) = 1 > 1-\beta^{*}(\overline{q}_{crit})$ as long as $\frac{2A}{\lambda^{TM}z}+\underline{q} \neq \overline{q}_{crit}$.

Comparative statics

We only show the non-trivial effects, which have not been shown in the other Propositions. These are the derivatives of $\alpha^{\#}$, $\delta^{\#}$ and $\beta^{\#}$ with respect to A, B, C and z, respectively. First, we identify how $\alpha^{\#}$ changes following an exogenous variation of δ, which is given by

$$\frac{\partial\alpha^{\#}}{\partial\delta} = \frac{-(1-\overline{q})\left[(1-\delta)(1-\overline{q}\theta)+\delta(\overline{q}-\underline{q})\right]-\left[\left(\frac{B}{z}-\delta(1-\overline{q})\right)\left(\overline{q}(1+\theta)-\underline{q}-1\right)\right]}{\left[(1-\delta)(1-\overline{q}\theta)+\delta(\overline{q}-\underline{q})\right]^{2}}$$

The numerator is always negative for $\overline{q} \geq \frac{1+\underline{q}}{1+\theta}$. For $\overline{q} < \frac{1+\underline{q}}{1+\theta}$, we need to show that this still applies. Given that $\alpha^{\#} \in [0,1]$, we know the following relation holds

$$(1-\delta)(1-\overline{q}\theta)+\delta(\overline{q}-\underline{q}) \geq \frac{B}{z}-\delta(1-\overline{q}) \ .$$

If we insert $B/z-\delta(1-\overline{q})$ in the numerator on the left-hand side, and the overall numerator stays negative, we have shown $\frac{\partial\alpha^{\#}}{\partial\delta} < 0$. Inserting and simplifying in the numerator yields

$$-\left(\frac{B}{z}-\delta(1-\overline{q})\right)\left(\overline{q}\theta-\underline{q}\right) < 0 \ .$$

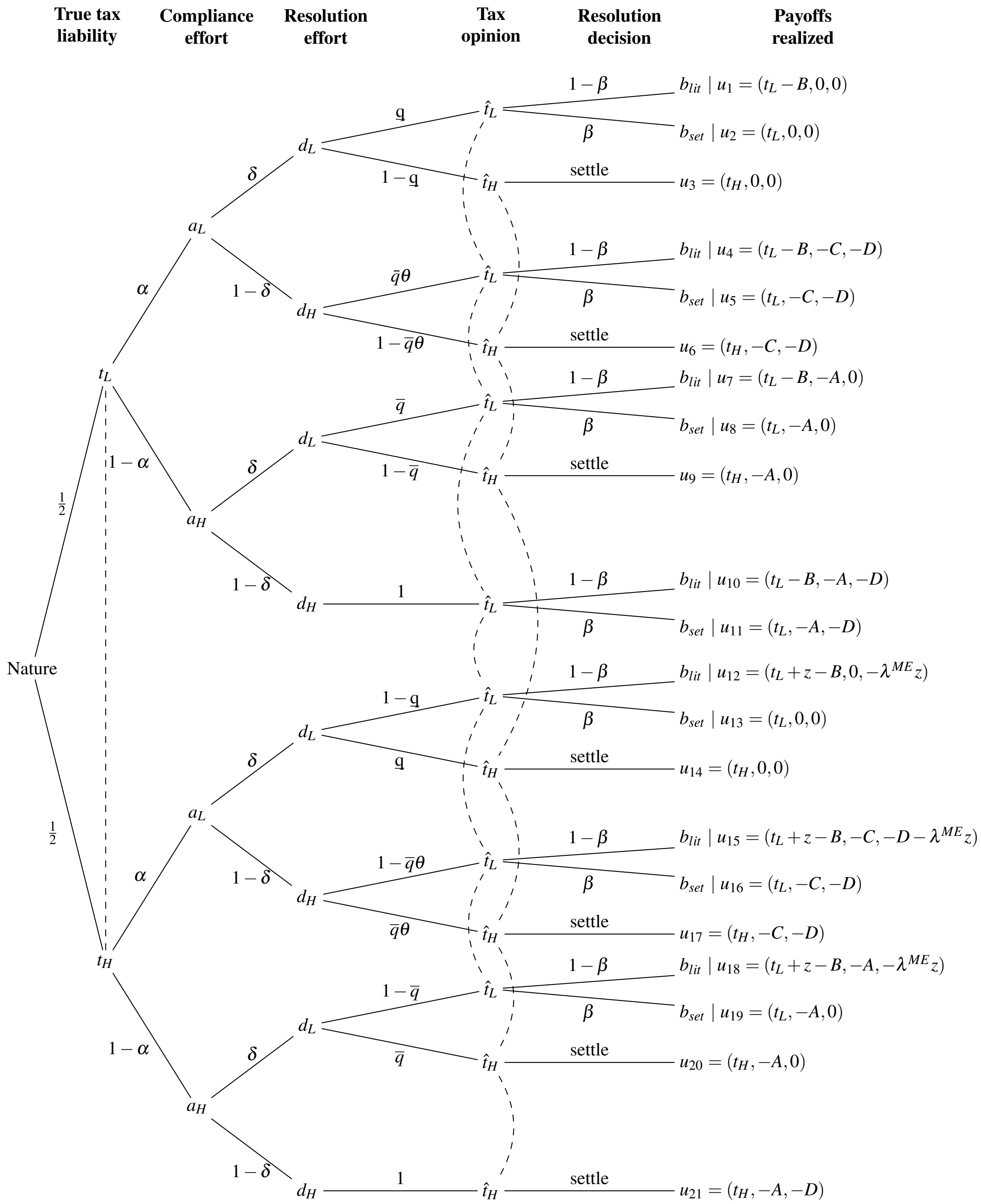
Second, recall from the proof of Lemma 2 that an exogenous variation of α has the following effect on Ω^{ME}_{RHS} and thus the equilibrium litigation probability: $\frac{\partial 1-\beta^{\#}}{\partial\alpha} \propto 1+\underline{q}-\overline{q}(1+\theta)$. The direction is obviously unclear, and depends on $\frac{1+\underline{q}}{1+\theta} \gtreqless \overline{q}$.

Since, $\frac{\partial\delta^{\#}}{\partial A} < 0$, we get $\frac{\partial\alpha^{\#}}{\partial A} > 0$. For the derivatives with respect to C, we get the opposite effect. Also, we know that $\frac{\partial\delta^{\#}}{\partial B} = 0$ and $\frac{\partial\alpha^{\#}}{\partial B} > 0$. The effect on $1-\beta^{\#}$ of all these parameters is ambiguous and depends on the above threshold value for documentation quality. For the effect of the value in dispute z, we can directly see that $\frac{\partial \delta^{\#}}{\partial z} = 0$ and $\frac{\partial \alpha^{\#}}{\partial z} < 0$. The effect on the litigation probability is implicitly defined by

$$\frac{\partial(1-\beta^{\#})}{\partial z} = -\frac{(1-\overline{q})(1-\overline{q}\theta)(1-\beta^{\#})}{\left[\alpha^{\#}(\overline{q}\theta-\underline{q})+(1-\alpha^{\#})(1-\overline{q})\right]\left[(1-\delta^{\#})(1-\overline{q}\theta)+\delta^{\#}(\overline{q}-\underline{q})\right]} < 0.$$

Appendix B

Figure 5. Game tree in a tax department with a monitoring expert



Notes: This figure illustrates the game tree and the payoffs in a tax department with a monitoring expert. Dominated strategies are not depicted. α denotes the low compliance effort probability, δ the low dispute resolution effort probability, and β $(1-\beta)$ denotes the settlement (litigation) probability, given a low tax opinion is submitted. $u_k = (u_k^{TA}, u_k^{TM}, u_k^{ME})$ denotes the payoffs of the players if equilibrium outcome k is reached.