

Dyck, Daniel; Lorenz, Johannes; Sureth, Caren

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Daniel Dyck, Johannes Lorenz, Caren Sureth-Sloane

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How do tax technology and controversy expertise affect tax disputes?*

Daniel Dyck

Johannes Lorenz

Caren Sureth-Sloane

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Abstract

Given the rising number, magnitude, and harshness of tax disputes between firms and tax authorities, firms increasingly call on tax technology and controversy expertise to try to resolve these disputes. This study investigates how tax technology embedded in the firm's Tax Risk Management System (TRMS) and the expertise of tax controversy managers affect dispute outcomes and compliance incentives. Using a game-theoretic model, we derive equilibrium strategies for a tax manager's compliance effort, a controversy manager's dispute resolution effort, and a tax authority's litigation decision. Absent a controversy manager, we find that improving a firm's TRMS quality unambiguously decreases the litigation probability. However, in the presence of a controversy manager, we surprisingly find that improving TRMS quality crowds out compliance efforts and can increase litigation probability. Overall we find that a high-quality TRMS is essential to take advantage of the dispute resolution function of a controversy manager.

Keywords: tax dispute resolution, tax risk management, tax technology, controversy expertise, litigation

JEL classification: H25, H26, C72, K34

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1 Introduction

We study how tax technology and controversy expertise within a firm affect the strategic resolution of disputes with a tax authority, either by upfront settlement or litigation. Using a game-theoretic model and assuming that a filed tax position is uncertain for both the firm and the tax authority, we investigate the conditions under which improving a firm's tax risk management system (TRMS, i.e., tax technology) reduces litigation, depending on the presence or absence of a controversy manager (i.e., controversy expertise).

This study is important and timely because the number, magnitude and harshness of disputes have increased considerably (KPMG 2019, EY 2021) and so have resulting compliance costs. Tax disputes exhibit significant tax risks, due to the unpredictability of litigation (Blaufus et al. 2016, Markham 2018), the potential high cash outflow (e.g., White 2020), and reputational costs on the individual and firm level (Mulligan and Oats 2009, Graham et al. 2014, Neuman et al. 2020). Therefore tax risk and dispute management matter to firms' executive teams. As a result, anecdotal and survey evidence consistently highlight the necessity of "building [the] tax controversy department of the future" (EY 2021, p. 4).

Tax disputes have gained increased attention in firms over recent years. Mandated tax-related disclosures (Mills et al. 2010, Bozanic et al. 2017, Casi et al. 2021) and more intensive and targeted risk-based tax audits (EY 2021, Eberhartinger et al. 2021) have increased the salience of uncertain 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), advance tax rulings (e.g., Diller et al. 2017), and advance pricing agreements (e.g., De Waegenare et al. 2007), often do not fully shield against tax risk. In addition, tight fiscal and tax authority budgets (Nessa et al. 2020, Holt et al. 2022) put more pressure on tax collection and increase the probability of (unilateral) corrections of firms' tax positions (Markham 2018, KPMG 2019).

Therefore understanding how alternative channels might help resolve tax disputes as well

as the unintended consequences of the interactions of professionals within tax departments and with tax authorities matters to firms. We follow Dyreng and Maydew's (2018) call to look inside the black box of firms' tax strategies and focus on their tax controversy strategies. To mitigate tax risk and reduce litigation, two dispute resolution channels for tax departments have received considerable attention in practice (KPMG 2016, 2019, EY 2021).

As a first channel, firms implement and improve their TRMS. We define a TRMS 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" (Brühne and Schanz 2022, p. 35). Specifically, we focus on the reactive function of a TRMS, which provides guidance on how to proceed when a dispute occurs. We attribute the emergence of tax disputes to deficiencies in the dispute prevention function of a TRMS, which are aggravated by uncertainty (Mills et al. 2010), complexity (Hoppe et al. 2021), and resource constraints (X. Chen et al. 2021) in pre-audit tax risk management.

As a second channel, firms can consult external controversy managers (e.g., attorneys or specialized tax advisors) or employ internal controversy managers in their tax department. While using external controversy managers is a well-known part of firms' tax controversy strategies (e.g., Acito and Nessa 2021), employing a controversy manager in the tax department only recently became widespread across multinational firms (KPMG 2016, 2019).¹ One advantage of consulting with or employing a controversy manager is that tax dispute responsibility is improved by a clear assignment of duty and accountability. A controversy manager possesses additional tax litigation expertise and can provide experience-based strategic advice for ongoing disputes (KPMG 2016, 2019) that complements the expertise of common tax managers. This comports with specialized tax experts improving tax outcomes (e.g., Beck, Davis, et al. 1996, Kubick et al. 2020).

¹In particular, KPMG (2019) reports that 14% of worldwide multinationals have implemented a "global head of controversy" within the tax department, noting that this "may become a leading practice in the years to come" (KPMG 2019, p. 9).

To analyze the implications of these two dispute resolution channels, we develop a game-theoretic model with a tax manager (he), a tax authority (it) and a potentially engaged controversy manager (she). Our setting starts after the tax manager submits the firm's tax return. The tax authority disagrees with and challenges a tax position in the tax return. We assume that the tax manager and the controversy manager strive for compliance. However, the true tax position is unknown to both managers and the tax authority. Thus no party can predict the litigation outcome. The managers respond to the tax authority's disagreement by submitting additional information to substantiate the tax position; that is, they provide an elaborated final tax opinion.² We call the probability that the "correct" tax opinion is submitted "specification quality." A "correct" specification implies that an adjudication of the disputed tax position reveals a tax liability identical to the submitted tax opinion, while an incorrect specification implies an adjustment of the position upon adjudication.

In a tax department with a TRMS but *without* a controversy manager, the specification quality is determined by the tax manager's compliance effort and, in case of a high compliance effort, jointly with the activated but imperfect TRMS. In a tax department *with* a controversy manager, the controversy manager can further improve the specification quality by exerting a high dispute resolution effort. In particular, when the tax manager's compliance effort is insufficient, she uses her expertise and initiates the necessary actions indicated by the activated TRMS. Therefore our model demonstrates that improvements to the specification quality by the controversy manager are inevitably linked to the firm's TRMS.³ Ultimately, the tax authority decides to either settle the dispute by agreeing with the submitted opinion or to litigate. Its litigation prospects crucially depend on anticipating the decision-making within the tax department.

In a tax department *without* a controversy manager, the tax manager's compliance incentives

²We restrict our analysis to disputes in which both tax and controversy managers are eager to comply and do not deliberately manipulate the submitted final tax opinion. We thus establish a dispute setting with a minimum requirement for litigation to occur, even though the compliance preferences are common knowledge.

³Our model captures this novel feature of controversy management. Importantly, external tax advisors (in our setting, external controversy managers) cannot be seen as acting independently of the firm's internal information environment and processes (Van der Rijt et al. 2019, Chyz et al. 2021, Cools and Rossing 2021).

arise from his ambition to minimize the reputational costs from unfavorable litigation outcomes. However, anecdotal and survey evidence suggests that the controversy manager becomes fully responsible for (un-)favorable litigation outcomes (KPMG 2016, 2019) and can identify a tax manager's insufficient effort.⁴ Hence, *with* a controversy manager, the tax manager's compliance incentives are a function of his personal compliance reputation inside the tax department, while the controversy manager's reputation is tied to the tax authority's litigation decision and depends on (un-)favorable litigation outcomes.

We use the equilibrium strategies to illuminate the complex interactions and mechanisms. We find that the litigation probability can generally be higher in a tax department with a TRMS and strategic controversy manager, compared to a tax department with a TRMS only. Further, in a tax department with a TRMS only, we find that improving its quality unambiguously decreases the litigation probability. However, TRMS quality ambiguously affects the litigation probability in a tax department with a TRMS and controversy manager. While we also identify a lower litigation probability from improving high-quality TRMS, we find the reversal for improving low-quality TRMS. Thus improving TRMS quality impairs dispute resolution for firms with a strategic controversy manager and a low-quality TRMS.

Intuitively, the differential impact of increasing TRMS quality arises from the effect of the controversy manager on the underlying equilibrium mechanisms. *Without* a controversy manager, the tax authority decreases the litigation probability, which reflects the unambiguously increasing compliance incentives of the tax manager. *With* a controversy manager, the ambiguous response of the tax authority to an improved TRMS reflects the nuanced impact on the controversy manager's dispute resolution incentives. Her incentive erodes under a low-quality TRMS but is strengthened under a high-quality TRMS. The reason is that, for low-quality (high-quality) TRMS, the tax and controversy managers' efforts are strategic complements (substitutes). Since increasing TRMS quality always induces the tax manager to choose a low

⁴From an interview with a controversy manager, we learned a controversy manager's intervention into a dispute may lead to personal costs, e.g., frustration from loss of control, on the side of the tax manager, which is in line with identifying insufficient low efforts in the tax risk management process.

compliance effort more often, this translates into decreasing (increasing) dispute resolution incentives.⁵ Further, our analysis reveals that the tax authority adjusts its litigation strategy, conditional on both the presence of a controversy manager and TRMS quality. This behavior of tax authorities is likely to gain even more relevance in the future, as these authorities are increasingly equipped with enhanced access to and understanding of information about uncertain tax positions and corporate dispute resolution channels (OECD 2022).

We contribute to the literature in three ways. First, we analyze how enhancing tax technology and controversy expertise impact the dispute resolutions when firms and tax authorities strategically interact. Our study is one of the few that shift the focus from a standard tax compliance game (Graetz et al. 1986) to tax disputes at risk of litigation. There are several extensions of the standard tax compliance game, including information acquisition by the tax authority (Sansing 1993), taxpayer uncertainty about taxable income (e.g., Beck and Jung 1989), or the role of third parties, such as external advisors (Beck, Davis, et al. 1996), or a court of appeals (Krenn and Niemann 2021). To the best of our knowledge, only Franzoni (2004) integrates tax litigation into a tax compliance game. He analyzes how discretionary settlements influence tax enforcement and finds that these settlements enable the tax authority to take advantage of its soft information collected in audits. His study builds on civil litigation models on the signalling and screening effect of settlement offers by either a plaintiff or a defendant (Bebchuk 1984, Reinganum and Wilde 1986, Hay 1995). Our three-party litigation model goes beyond this literature, as it captures three important and often disregarded characteristics of tax disputes.⁶

As a first characteristic, we assume uncertainty about the “true” assessment of the disputed tax position for both the firm and the tax authority. This setting more adequately reflects the uncertainty and complexity of tax disputes for all parties (Blaufus et al. 2016, Tran-Nam and

⁵This effect persists as long as the specification quality does not depend on the TRMS in case both managers’ efforts are low. That is, the TRMS is not activated for low efforts.

⁶Three-party litigation models are also present in the accounting literature; e.g., Schantl and Wagenhofer (2020). One key difference with our three-party model is that Schantl and Wagenhofer (2020) analyze two strategically interacting enforcement institutions to detect a manager’s deliberate misreporting, while we focus on one tax enforcement institution to identify a nondeliberate, incorrect tax specification influenced by two managers.

Walpole 2016, Markham 2018). As a second characteristic, we capture that managers' decisions are considerably driven by reputational concerns of unfavorable litigation outcomes (Graham et al. 2014, Donohoe et al. 2014), especially when facing tax disputes that attract significant public attention. However, tax compliance games are typically limited to whether and what extent tax savings exceed potential direct costs of noncompliance. As a third characteristic, in contrast to settings with civil court disputes, we model that the burden of proof in (out-of-court) tax disputes *de facto* lies on the firm's side.

Second, we analyze how tax and controversy managers interact in managing tax risks that result from tax disputes. Therefore we model within-tax-department decision-making and contribute to explaining the black box of tax departments (Feller and Schanz 2017, Dyreng and Maydew 2018, X. Chen et al. 2021).

Third, we contribute to the literature on TRMS. To the best of our knowledge, a TRMS as a source of tax (dispute) information, to date, has only been addressed in survey- and interview-based investigations (Wunder 2009, Brühne and Schanz 2022). While the effect of firms' TRMS on tax outcomes is partly reflected in empirical studies of firms' internal information environment (Gallemore and Labro 2015, McGuire et al. 2018, H. Chen et al. 2020), information technology systems (Hamilton and Stekelberg 2017, Klein et al. 2021) or holistic enterprise risk management programs (Eastman et al. 2022), we are the first researchers to theoretically model and explicitly identify the effects of a TRMS on tax disputes.

As pressures to manage tax risks are increasing (Brühne and Schanz 2022), which demands that firms implement a TRMS of reasonable quality (Goslinga et al. 2019, PwC 2020, KPMG 2022), our results indicate that strategic controversy managers improve dispute resolution only when accompanied by very high-quality TRMS. Notably, firms should consider the interaction of tax technology and controversy expertise but not the latter in isolation when designing their controversy strategy.

2 Tax department with a TRMS

2.1 Model setup

We employ a game-theoretic model with three risk-neutral players: a tax manager (he), a controversy manager (she) and a tax authority (it).⁷ Figure 1 illustrates the intra-firm decision-making with regard to tax disputes, taking the implementation of the TRMS and the controversy manager as given.⁸ In the benchmark setting without a controversy manager, we focus on the interaction of a tax manager, who is responsible for the firm’s tax audit matters, and the tax authority. The notation is summarized in Table A1 in the Appendix.

[Figure 1 about here]

We assume that tax manager’s assessment, represented by the filed tax return, is challenged by the tax authority, culminating in a dispute. The underlying tax position is characterized by complexity, uncertainty, and ambiguity, because, no matter how detailed the tax code and how much effort the tax manager has put into assessing the tax position, the relevant laws and regulations typically can be interpreted in multiple ways, yielding different tax liabilities (Diller et al. 2017). Neither the tax manager’s pre-audit (tax risk) assessment of this position nor the tax authority’s audit have been sufficient to identify the “true” tax assessment. 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 (e.g., Beck and Jung 1989, Mills et al. 2010). Alternatively, a corresponding transfer pricing dispute can occur when the tax manager chooses a particular transfer pricing method at the low-tax end of a compliance range, while the tax authority prefers an alternative at the high end.⁹

⁷Assuming risk neutrality is a common practice in studies which examine three-party interactions (e.g., Reinganum and Wilde 1991, Jacob et al. 2019, Krenn and Niemann 2021). It allows us to keep the model tractable and to focus on strategic interactions between the players.

⁸Typically, it is the CFO’s decision to design the firm’s TRMS (Wunder 2009, Brühne and Schanz 2022) and hire a controversy manager. However, our focus is on the effect of controversy expertise once a given tax department structure is in place, rather than its initial design.

⁹Even if the associated tax position is not necessarily of a binary nature, we assume that the tax manager and the tax authority prefer a tax favorable position within the compliance range. We thereby model a more general

At the start of the game (stage 0), nature determines the value of the true tax liability $t_i \in \{t_L, t_H\}$ with $0 \leq t_L < t_H$, which is only revealed to the tax manager and the tax authority if the dispute is litigated (see Figure 2). Both the tax manager and tax authority have a symmetric probability assessment with regard to the uncertain position. They expect that the true tax liability is low with probability $Pr(t_L) = p$ and high with probability $Pr(t_H) = 1 - p$. Without loss of generality, we assume $Pr(t_L) = Pr(t_H) = \frac{1}{2}$.¹⁰

At stage 1, the tax manager chooses his unobservable compliance effort $a^{TM} \in \{a_L, a_H\}$, which influences his ability to specify the correct final tax opinion.¹¹ The compliance effort can be interpreted as an additional, nonroutine risk management effort. Examples for this nonroutine 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 $K^{TM}(a_H) = A > K^{TM}(a_L)$, which reflect the tax manager's opportunity costs and inability to comply with all tax authority requests. For simplicity and without loss of generality, we assume $K^{TM}(a_L) = 0$.

When the tax manager chooses a low compliance effort, the specified and submitted opinion \hat{t}_i is correct with probability $Pr(\hat{t}_i|t_i; a_L) = \underline{q}$ (specification quality) and incorrect with probability $Pr(\hat{t}_i|t_j; a_L) = 1 - \underline{q}$, where $i \neq j \in \{L, H\}$. With a high compliance effort, the specification quality is $Pr(\hat{t}_i|t_i; a_H) = \bar{q}$, and an incorrect specification occurs with probability $Pr(\hat{t}_i|t_j; a_H) = 1 - \bar{q}$. For simplification purposes, the set of specified tax opinions corresponds with the set of

type of uncertainty rather than addressing the peculiarities of specific tax issues. 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.

¹⁰For example, the symmetric probability assessment may reflect the observability of the tax manager's pre-audit tax risk management procedure by the tax authority, either because the tax authority can identify pre-audit tax risk management effort from standard documentation handed in with the tax return or because routine pre-audit tax risk management effort is always high, compared to nonroutine effort levels in tax disputes. An alternative example would be that, even if the tax manager had private information before submitting the tax return, the tax authority could provide new arguments against the initial tax treatment upon detecting it, necessitating re-evaluation of the strategy by the tax manager.

¹¹For simplicity, we assume that the tax manager submits a tax opinion rather than submitting taxable income. The underlying economics of the model, however, are independent of what is declared to the tax authority, since the tax manager can easily calculate the tax liability resulting from a specific amount of taxable income.

possible true tax liabilities: $t_i = \hat{t}_i, i \in \{L, H\}$. Further, the tax manager does not deliberately manipulate the tax opinion but truthfully submits the specified opinion \hat{t}_i to the tax authority. However, the tax opinion may be unintentionally incorrect, for example, because of time and cognitive constraints.¹²

We interpret \bar{q} as the firm’s quality of the TRMS, which captures the relation between managerial effort and the firm’s exogenous information and tax risk management environment. Thus, when the tax manager effectively uses the tools and guidelines provided by the TRMS (high compliance effort), the correct specification of the tax opinion depends on the given “technology” in the firm.¹³ We assume $1 > \bar{q} > \underline{q} \geq \frac{1}{2}$, so that high effort improves the specification quality and low effort is not worse than flipping a coin. However, the submitted opinion is never perfect, irrespective of the compliance effort, because, by assumption, the tax manager cannot resolve uncertainty without the additional expertise of the controversy manager, given an imperfect TRMS.

At stage 2, the tax authority observes the submitted tax opinion \hat{t}_i . However, the tax authority cannot observe whether the tax manager chose a low or high compliance effort at stage 1 and therefore cannot assess the underlying specification quality. Depending on the submitted opinion, the tax authority can take two actions $b^{TA} \in \{b_{set}, b_{lit}\}$ to maximize its net revenue.¹⁴

¹²With 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. Truth-telling 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. However, managers face time and cognitive constraints that can lead to a low specification quality. 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) 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). Further, the truth-telling assumption is often used in disclosure settings, including those related to tax (e.g., Mills et al. 2010).

¹³We acknowledge that a TRMS also has a significant preventive function (Brühne and Schanz 2022), in that its quality could affect the quality of filed tax returns, which would decrease the likelihood that the true tax liability is high at the start of the game. However, if we assume that $Pr(t_H) = \frac{1}{2} - \mu\bar{q}$, where $\mu > 0$ reflects the preventive power of the TRMS, our results in the benchmark setting hold as long as $\mu \leq \mu_{crit}$, that is, the preventive power is not too large. In the full model equilibrium with a controversy manager, we lose analytical tractability for $\mu > 0$, but our numerical analyses similarly show that our results are robust. Overall this comports with typical tax dispute characteristics, such as uncertainty and complexity accompanied by a limited preventive impact of the TRMS.

¹⁴Net 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,

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 .¹⁵ 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 is an imperfect estimate of the true tax liability, 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 costs in a lawsuit), and thus there is no litigation incentive when the authority observes a high tax opinion \hat{t}_H . By contrast, in the case 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. In that case, the tax manager faces reputational costs from an unfavorable litigation outcome, leading to additional tax and penalty payments, which 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 $K^{TM}(a^{TM})$ against the reputational costs from unfavorable litigation outcomes, which are scaled by the sensitivity parameter $\lambda^{TM} > 0$.

Figure 2 summarizes the sequence of events in the benchmark setting, with stages -2 and -1 having already occurred.

[Figure 2 about here]

2.2 Equilibrium

We solve the game via backward induction, starting with the tax authority's decision to settle or litigate, conditional on the observed tax opinion \hat{t}_i . All formal proofs are given in the Appendix.

such as the Internal Revenue Service (Nessa et al. 2020).

¹⁵We 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 is presumed to have the bargaining power (e.g., Franzoni 2004), and we do not want to specify which party has the bargaining power. Rather we want to emphasize the implicit bargaining power the firm generates through its controversy expertise, that is, the TRMS quality, and additionally the controversy manager's expertise in section 3.3.

As mentioned earlier, the tax authority always settles upon observing a submitted high tax opinion. However, upon observing a low tax opinion, the authority has to figure out whether settlement is the dominant strategy. The tax authority's expected payoff from settling the dispute is given by

$$\mathbb{E} \left(u^{TA} (b_{set} | \hat{t}_L; a^{TM}) \right) = t_L, \quad (1)$$

independent of the tax manager's effort choice. The corresponding payoff 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 $z \equiv \pi(t_H - t_L)$. Then we obtain the expected payoffs

$$\mathbb{E} \left(u^{TA} (b_{lit} | \hat{t}_L; a^{TM}) \right) = t_L + \Pr(t_H | \hat{t}_L; a^{TM}) z - B. \quad (2)$$

Equation (2) highlights that the tax authority always receives $t_L - B$ when litigating, plus the value in dispute z , depending on the probability of an incorrect tax opinion. Comparing the expected utilities from settlement and litigation, the tax authority will litigate the dispute if $\Pr(t_H | \hat{t}_L; a^{TM}) z > B$. Depending on the compliance effort, the conditional probabilities of an incorrectly submitted tax opinion are given by

$$\Pr(t_H | \hat{t}_L; a_L) = \frac{(1-p)(1-q)}{(1-p)(1-q) + pq} = 1 - \underline{q}, \quad (3)$$

$$\Pr(t_H | \hat{t}_L; a_H) = \frac{(1-p)(1-\bar{q})}{(1-p)(1-\bar{q}) + p\bar{q}} = 1 - \bar{q}. \quad (4)$$

Throughout this study, we assume $(1 - \underline{q})z := \bar{B}^* > B$, 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 controversy

manager, and the quality of the TRMS \bar{q} .¹⁶

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 low or high compliance effort depends on the compliance costs only:

$$\mathbb{E} (u^{TM} (a^{TM} | b_{set})) = -K^{TM}(a^{TM}) . \quad (5)$$

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 payoff is given by

$$\mathbb{E} (u^{TM} (a^{TM} | b_{lit})) = -\frac{1}{2} \Pr (t_H | \hat{t}_L; a^{TM}) \lambda^{TM} z - K^{TM} (a^{TM}) . \quad (6)$$

Comparing the expected payoffs for a low and high compliance effort (6) reveals that the tax manager prefers a high compliance effort if $(\bar{q} - q) \frac{\lambda^{TM}}{2} z \geq A$, which is thus a necessary condition for the existence of a high compliance effort.

To identify the equilibrium in the absence of a controversy manager where both parties play a nontrivial role, we search for the tax manager's low compliance 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

$$B = \underbrace{(\alpha(1 - q) + (1 - \alpha)(1 - \bar{q}))}_{\Pr(t_H | \hat{t}_L; \alpha)} z . \quad (7)$$

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

¹⁶Some firms let their TRMS be certified by external advisors and thereby signal TRMS quality \bar{q} to the tax authority (PwC 2020). Further, tax authorities might infer the quality of firms' TRMS from previous audits, supporting the observability assumption.

is given by

$$A = (1 - \beta) \left(\frac{1}{2} \lambda^{TM} z (\bar{q} - \underline{q}) \right). \quad (8)$$

The tax manager trades off the costs against the utility benefit of a high compliance effort, where the utility benefit arises from preventing reputational costs following an unfavorable adjustment of the tax position. Lemma 1 describes the equilibrium.

Lemma 1 (*Equilibrium in a tax department with a TRMS*)

Given the tax manager's compliance costs are sufficiently low ($A \leq \bar{A}^*$) and the tax authority's litigation costs are sufficiently high ($B \geq \underline{B}^*$), a mixed strategy equilibrium entails the following conditions:

- a) The tax manager chooses a low compliance effort with probability $\alpha^* = \frac{B - (1 - \bar{q})}{z(\bar{q} - \underline{q})}$;
- b) the tax authority settles the dispute with probability $\beta^* = 1 - \frac{2A}{\lambda^{TM} z (\bar{q} - \underline{q})}$, given the submission of a low tax opinion \hat{t}_L , and always, given the submission of a high tax opinion \hat{t}_H , resulting in a total settlement probability $TSP^* = \frac{1 + \beta^*}{2}$,

with

$$\bar{A}^* = \frac{\lambda^{TM} z}{2} (\bar{q} - \underline{q}) \quad \underline{B}^* = (1 - \bar{q})z .$$

Comparative statics reveal how the equilibrium strategies change with respect to the model parameters. Proposition 1 summarizes how increasing the firm's TRMS quality affects the equilibrium behavior in the benchmark setting.

Proposition 1 (*Effect of tax technology in the benchmark setting*)

Absent of a controversy manager, an increase in the quality of the firm's TRMS \bar{q}

a) increases the tax manager's probability for a low compliance effort and

b) decreases the tax authority's (total) litigation probability.

The TRMS quality has a twofold effect on equilibrium behavior. First, increasing TRMS quality crowds out the tax manager's compliance effort. Intuitively, this is because TRMS quality attenuates litigation incentives, and, in equilibrium, the tax manager responds by decreasing his compliance effort to render the tax authority indifferent (equation (7)). Therefore higher TRMS quality does not necessarily lead to a better specification of the tax opinion. Second, the tax authority settles the dispute more often. This effect is intuitive, as an enhanced TRMS quality increases the tax authority's confidence in the submitted tax opinion. However, in a strategic interaction with the tax manager, the increasing equilibrium settlement probability of the tax authority is a response to the tax manager's increasing compliance incentive following enhanced TRMS quality (equation (8)).

3 Tax department with a TRMS and a controversy manager

3.1 Model setup

We now extend the benchmark setting by integrating a controversy manager into the dispute resolution process. Similar to the tax manager and the tax authority, the controversy manager has no private knowledge about the true tax liability at stage 0 (see Figure 3). However, the controversy manager knows that there is an open tax dispute. This is because firms with a TRMS typically require internal (external) controversy managers to be informed (engaged) when the disputed value exceeds a specific materiality threshold (KPMG 2016, KPMG 2019).¹⁷

In addition to the tax manager choosing his compliance effort at stage 1, the controversy manager decides on her dispute resolution effort $d^{CM} \in \{d_L, d_H\}$ to deal with the tax dispute.

¹⁷In the following, we do not distinguish between internal and external controversy managers. This comports with the results of X. Chen et al. (2021), who identify a substitutive relation between investments in tax department personnel and auditor-provided tax services on tax avoidance and tax risk.

Both managers decide on their effort level independent from each other. With a high dispute resolution effort, the controversy manager provides strategic direction in the dispute by bringing in her additional dispute expertise. For example, given that tax authorities often challenge uncertain tax positions on two dimensions, namely on an economic dimension (e.g., size of a transfer price) and a legal dimension (e.g., violation of duties to cooperate), she may be an expert on at least one of these dimensions. However, a high dispute resolution effort involves opportunity costs $K^{CM}(d_H) = D > K^{CM}(d_L) = 0$. Besides the controversy manager's effort and expertise, we assume that the tax manager's compliance effort is also crucial for the specification quality, for example, because of his specific tax expertise about the reported tax return, the local tax code, or the firm's (tax risk management) activities.¹⁸ Thus the specification quality depends on the combination of both managers' effort levels, the TRMS quality, and the controversy manager's level of expertise as follows.

If the controversy manager's dispute resolution effort is low, the probabilities for correctly specifying the tax opinion depend on the tax manager's compliance effort only and equal those in the benchmark setting. If the controversy manager's effort is high and the tax manager's effort is low, a correct specification occurs with probability $Pr(\hat{t}_i|t_i; d_H, a_L) = \bar{q}\theta > \underline{q} > 0$, and an incorrect specification occurs with positive probability $Pr(\hat{t}_i|t_j; d_H, a_L) = 1 - \bar{q}\theta > 0$. We interpret θ as a parameter for the controversy manager's degree of expertise: For $\theta < 1$ ($\theta \geq 1$), the controversy manager's expertise is less (more) important for the specification quality, compared to the the TRMS quality. One reason for the scenario $\theta < 1$ could be the tax advisor bias identified by Blaufus et al. (2016), including overconfidence in identifying complex litigation outcomes. If both managers exert high effort, they can overcome potential limitations of the TRMS, even for lower levels of the controversy manager's expertise $\theta \leq 1$.

¹⁸The literature on an external tax advisor's influence on *tax reporting* often assumes that the advisor can resolve uncertainty completely, not depending on the expertise of another party (e.g., Beck, Davis, et al. 1996). We take a different view because our setting deals with more complex *tax disputes*, which require tacit firm knowledge to be perfectly resolved. This comports with the argument that tax advisors also need knowledge flow from the firm (Van der Rijt et al. 2019, Chyz et al. 2021, Cools and Rossing 2021) and face trade-offs with regard to their consulting accuracy (Grottko and Lorenz 2017), challenging the conventional view of tax consultants as universal experts, especially with regard to complex tax disputes.

Then, as a simplifying assumption, the submitted tax opinion always equals the true tax liability.¹⁹ However, due to the strategic nature of the interaction, high effort levels of the tax and controversy manager are not guaranteed.

The controversy manager's incentives to bring in her additional dispute expertise arise due to her responsibility for the firm's tax disputes (KPMG 2016, 2019). We model her responsibility by assuming that she suffers from reputational costs in case of an unfavorable litigation outcome. In case the final tax opinion cannot be sustained upon litigation, she incurs a disutility of $\lambda^{CM} z > 0$, with $\lambda^{CM} > 0$ being a scaling factor for her reputational costs. To fully capture the controversy manager's responsibility and keep the analysis tractable, we assume that $\lambda^{TM} = 0$ if a controversy manager is present. Thus the controversy manager's responsibility shields the tax manager from reputational costs of unfavorable litigation outcomes.

Anecdotal evidence suggests that the controversy manager further influences the tax manager's compliance incentives, as she possesses a largely neglected role for the tax manager's internal compliance with the tax risk management procedure (internal compliance role).²⁰ Once the controversy manager decides to bring in her additional expertise in the dispute (high effort) by scrutinizing the documents and tax risk management processes, she would identify whether the tax manager's compliance effort has been insufficient. In that case, we assume that the tax manager incurs additional personal costs $K^{TM}(a_L; d_H) = C > A > 0$.²¹ The personal costs are twofold. First, they may include reputational costs from identified noncompliance

¹⁹The simplifying assumption $Pr(\hat{t}_i | t_i; d_H, a_H) = 1$ might seem restrictive because the specification quality of the tax opinion is independent of the controversy manager's expertise level and the TRMS quality when both managers exert high effort. However, we can relax this assumption by assuming an imperfect specification quality, which depends on both types of controversy expertise, that is, $Pr(\hat{t}_i | t_i; d_H, a_H) = \gamma \bar{q} \theta \in (\max\{\bar{q}, \bar{q}\theta\}, 1)$, where $\gamma > 1$ is a parameter for the team's synergy, without altering our basic results. Similarly, our results are robust to a setting in which TRMS quality \bar{q} and the controversy manager's expertise θ are substitutes rather than complements.

²⁰We are grateful for the corresponding insights provided to us by a controversy manager in an interview.

²¹For an equilibrium to occur in which all players randomize, $C > A > 0$ is a necessary assumption combined with our modelling choice of the controversy manager's responsibility for tax disputes, that is, $\lambda^{CM} > 0$ and $\lambda^{TM} = 0$. The assumption $\lambda^{TM} = 0$ contrasts with the benchmark setting. 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 controversy manager. Further, note that the personal costs C may also be expected costs, where a high dispute resolution effort reveals noncompliance with an exogenous probability.

with the firm's risk management guidelines or, second, frustration from loss of control (e.g., Van der Rijt et al. 2019).²²

At stage 2, the tax authority observes the submitted tax opinion. As extension of our benchmark setting without the controversy manager, the tax authority will additionally anticipate the strategic behavior of the controversy manager and the response by the tax manager when making a settlement or litigation decision.

Figure 3 summarizes the sequence of events with the controversy manager involved in dispute resolution.

[Figure 3 about here]

3.2 Preliminary analysis

We start the analysis by identifying the players' indifference conditions. Analyzing the tax authority deciding on settlement or litigation, we focus on cases in which a low tax opinion \hat{t}_L has been submitted.

First, we identify the tax manager's expected utility from a low and high compliance effort in the presence of a controversy manager. We denote δ as the probability for a low dispute resolution effort by the controversy manager. Conditional on the other parties' strategies, the tax manager's expected utility is given by

$$\mathbb{E}(u^{TM}(a_L|\beta, \delta)) = -(1 - \delta)C, \quad (9)$$

$$\mathbb{E}(u^{TM}(a_H|\beta, \delta)) = -A. \quad (10)$$

²²As will be shown in the following sections, the fact that the tax manager's compliance incentives arise from the behavior of a party closely linked to the tax department, that is, the controversy manager, rather than from an external party, that is, the tax authority, fundamentally changes the equilibrium mechanism.

Thus the tax manager is indifferent if and only if

$$A = (1 - \delta)C . \quad (11)$$

Due to the controversy manager's responsibility role ($\lambda^{TM} = 0$), 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 an identified low compliance effort by the controversy manager.

Next we turn to the controversy manager's expected utilities from a low and high dispute resolution effort. These are given by

$$\mathbb{E} \left(u^{CM} (d_L | \alpha, \beta) \right) = -\lambda^{CM} \frac{z}{2} (1 - \beta) [\alpha(1 - \underline{q}) + (1 - \alpha)(1 - \bar{q})] , \quad (12)$$

$$\mathbb{E} \left(u^{CM} (d_H | \alpha, \beta) \right) = -\lambda^{CM} \frac{z}{2} (1 - \beta) \alpha(1 - \bar{q}\theta) - D . \quad (13)$$

Therefore the controversy manager is indifferent between choosing a low and high dispute resolution effort if

$$D = \lambda^{CM} \frac{z}{2} (1 - \beta) [\alpha(\bar{q}\theta - \underline{q}) + (1 - \alpha)(1 - \bar{q})] . \quad (14)$$

The indifference condition highlights the controversy manager'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 payoffs, conditional on the submission of a

low tax opinion. For the settlement and litigation decision, these are given by

$$\mathbb{E} \left(u^{TA} (b_{set} | \alpha, \delta) \right) = t_L, \quad (15)$$

$$\mathbb{E} \left(u^{TA} (b_{lit} | \alpha, \delta) \right) = t_L + \Pr(t_H | \hat{t}_L; \alpha, \delta) z - B, \quad (16)$$

with $\Pr(t_H | \hat{t}_L; \alpha, \delta) = \delta(\alpha(1 - \underline{q}) + (1 - \alpha)(1 - \bar{q})) + (1 - \delta)\alpha(1 - \bar{q}\theta)$. Hence the tax authority is indifferent between settlement and litigation if

$$B = [\delta(\alpha(1 - \underline{q}) + (1 - \alpha)(1 - \bar{q})) + (1 - \delta)\alpha(1 - \bar{q}\theta)] z. \quad (17)$$

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 quality of the firm's TRMS. The indifference conditions (14) and (17) allow us to state comparative static results in the three-player game with a strategic tax authority, which will help 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 controversy manager (i.e., with a nonstrategic tax manager choosing a low compliance effort with an exogenous probability α), the tax authority will increase the probability of litigation if and only if the controversy manager's expertise θ decreases, the probability for a low compliance effort α decreases for a high-quality TRMS ($\bar{q} \geq \frac{1+q}{1+\theta}$) and increases for a low-quality TRMS ($\bar{q} < \frac{1+q}{1+\theta}$), and the TRMS quality \bar{q} decreases (increases) for $\alpha \geq \frac{1}{1+\theta}$ ($\alpha < \frac{1}{1+\theta}$).

b) and a strategic tax manager (i.e., with a nonstrategic controversy manager choosing a low dispute resolution effort with an exogenous probability δ), the tax manager will increase

his compliance effort iff the probability for a low dispute resolution effort δ increases, TRMS quality \bar{q} decreases, and the controversy manager's expertise θ decreases.

Lemma 2, part a) gives rise to two important preliminary results. First, in contrast to a change in the controversy manager's expertise θ , TRMS quality ambiguously affects the tax authority's best response. Second, contrary to intuition, the tax authority will increase its litigation probability for high-quality TRMS when the tax manager chooses a high compliance effort more often. The second result is due to the fact that a high-quality TRMS combined with a high compliance effort improves the controversy manager's benefit of a low dispute resolution effort. Then the tax authority's equilibrium response is to litigate the dispute more often. Lemma 2, part b) underlines that both managers' efforts as well as both dispute resolution channels (TRMS quality and the controversy manager's expertise) influence the litigation decision similarly. From the perspective of the tax authority, more effort and enhanced resolution channels decrease the litigation prospects. As an equilibrium response, the tax manager will thus more frequently choose a low effort. Therefore enhanced dispute resolution channels 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 $\alpha^\#$, $\beta^\#$ and $\delta^\#$ of the players. Lemma 3 summarizes the result.

Lemma 3 *(Equilibrium with a TRMS and a controversy manager)*

When the controversy manager's dispute resolution costs are sufficiently low ($D \leq \bar{D}^\#$) and the tax authority's litigation costs take an intermediate value ($\underline{B}^\# \leq B \leq \bar{B}^\#$), a mixed-strategy equilibrium entails the following:

- a) *The controversy manager chooses a low dispute resolution effort with probability $\delta^\# = \frac{C-A}{C}$,*

b) the tax manager chooses a low compliance effort with probability

$$\alpha^\# = \frac{\frac{B}{z} - \delta^\#(1-\bar{q})}{(1-\delta^\#)(1-\bar{q}\theta) + \delta^\#(\bar{q}-q)}, \text{ and}$$

c) the tax authority settles with probability $\beta^\# = 1 - \frac{2D}{\lambda^{CM}z(\alpha^\#(\bar{q}\theta - q) + (1-\alpha^\#)(1-\bar{q}))}$, given the submission of a low tax opinion \hat{t}_L , and always, given the submission of a high tax opinion \hat{t}_H , resulting in a total settlement probability $TSP^\# = \frac{1+\beta^\#}{2}$,

with

$$\begin{aligned} \bar{D}^\# &= \frac{\lambda^{CM}z [B((1+\theta)\bar{q} - 1 - q) + z(1 - \bar{q}\theta)]}{2 [(1-\delta^\#)(1-\bar{q}\theta) + \delta^\#(\bar{q}-q)]} \\ \underline{B}^\# &= \delta^\#(1-\bar{q})z \quad \bar{B}^\# = [(1-\delta^\#)(1-\bar{q}\theta) + \delta^\#(1-q)]z \end{aligned}$$

As we have established in Lemma 2, both managers' effort levels are (partially) substitutable, because they can improve the correct specification of the 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 benchmark setting, which can be seen from $\underline{B}^\# < \underline{B}^*$ and $\bar{B}^\# < \bar{B}^*$.

We are interested in how the two dispute resolution channels influence the players' equilibrium strategies. With regard to the controversy manager's expertise θ , we can establish the following result.

Proposition 2 (*Effect of the controversy manager's expertise*)

Increasing the expertise level θ of the controversy manager

- a) *does not change the probability for the controversy manager'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 controversy manager's expertise increases the specification quality, the tax authority's litigation prospects decrease. However, this is reflected in the increasing low compliance probability $\alpha^\#$ and not in the equilibrium settlement probability $\beta^\#$. In equilibrium, the tax manager renders the tax authority indifferent between settlement and litigation, which is only possible when he decreases his compliance effort, given an increasing level of expertise θ (Lemma 2, part b). Higher levels of expertise thus crowd out the tax manager's compliance efforts. Similarly, the controversy manager's probability for a low dispute resolution effort is constant because the tax manager's compliance incentives are independent from the controversy manager's expertise, while expertise indeed affects the controversy manager's dispute resolution incentives. Choosing a high dispute resolution effort becomes more valuable for the controversy manager with an increasing expertise level θ (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 TRMS. This is reflected in the increasing settlement probability $\beta^\#$ (Lemma 2, part a). In equilibrium, we therefore see that the tax authority keeps the controversy manager indifferent between her strategies.

Next we turn to the effect of the TRMS's quality \bar{q} on equilibrium behavior. For example, better TRMS could exist in firms with more digitalization and standardization of their tax processes (Hamilton and Stekelberg 2017, Klein et al. 2021, EY 2021). Proposition 3 formalizes our results.

Proposition 3 (*Effect of tax technology*)

In the presence of a controversy manager, an increase in the firm's TRMS quality \bar{q}

a) does not change the probability for the controversy manager'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 TRMS quality levels below

\bar{q}_{crit} and decreases the (total) litigation probability for quality levels higher than \bar{q}_{crit} ,

where $\bar{q}_{crit} = \frac{1-\alpha^\#(1-\underline{q}\theta)}{\theta} \in (\underline{q}, 1)$ is a unique minimum when $\theta > \frac{1-\alpha^\#}{1-\alpha^\#\underline{q}}$.²³

As evident from Lemma 3, the controversy manager's dispute resolution effort does not depend on TRMS quality. The tax manager's compliance effort decreases, however, with increasing TRMS quality. Intuitively, the tax manager needs to outweigh an increased "hit rate" of the TRMS by exerting less effort to hold the tax authority indifferent (Lemma 2, part b). The tax authority's reaction to a changing TRMS is more distinct. For low-quality TRMS, increasing the quality induces the tax authority to settle less often (i. e., to litigate more often), whereas for high-quality TRMS, the tax authority settles more often (litigates less). Figure 4 depicts the development of the players' equilibrium strategies as TRMS quality varies.

[Figure 4 about here]

Intuitively, the ambiguous effect of enhancing TRMS quality on the settlement probability occurs because of its ambiguous effect on the controversy manager's dispute resolution incentives. Two separate effects, the direct effect and the crowding out effect, play crucial roles, as depicted in the following inequality:

$$\underbrace{\alpha^\#(\bar{q})[1+\theta]-1}_{\text{Direct effect}} + \underbrace{\frac{\partial \alpha^\#(\bar{q})}{\partial \bar{q}} [\bar{q}(1+\theta) - \underline{q} - 1]}_{\text{Crowding-out effect}} \geq 0. \quad (18)$$

The inequality is fulfilled if the controversy manager's incentives increase, and the tax authority responds by increasing the settlement probability $\beta^\#$. The direct effect represents how an

²³It is sufficient to assume $\theta > 1$ to guarantee that \bar{q}_{crit} exists in our model. However, $\theta > 1$ is quite restrictive and only necessary for one specific parameter constellation, i.e., $\alpha^\#(\bar{q}_{crit}) = 0$. Otherwise, $\theta \leq 1$ is sufficient to guarantee that \bar{q}_{crit} is interior. In that vein, the sufficient condition $\theta > 1$ presented here is not in contrast to $\theta \leq 1$ used in Proposition 4.

exogenous variation of the compliance probability influences the controversy manager’s benefit from a high effort. When the tax manager chooses a low compliance effort, an increase in the TRMS quality \bar{q} increases her benefit, because her expertise level is complementary to \bar{q} and thus increases the specification quality. However, increasing \bar{q} comes at a cost when the tax manager chooses a high compliance effort. In that case, an increasing quality level deters dispute resolution incentives. As we have established in part a) of Lemma 2, the direct effect is positive in case $\bar{q} \geq (\alpha^\#)^{-1} \left(\frac{1}{1+\theta} \right)$, that is, the TRMS quality exceeds a specific threshold value. The crowding-out effect is also positive for high-quality TRMS, that is, $\bar{q} \geq \frac{1+g}{1+\theta}$. It occurs because an increase in \bar{q} affects the controversy manager’s cost-benefit consideration also indirectly via the equilibrium response of the tax manager. We show that there exists a critical value \bar{q}_{crit} for which condition (18) is fulfilled with equality and that thus separates the direction of how the equilibrium settlement probability $\beta^\#$ varies in the TRMS quality \bar{q} .

The controversy manager’s expertise θ and the level of tax technology \bar{q} , exert different effects on the litigation probability due to their distinct direct effects, since the crowding-out effect similarly occurs for both dispute resolution channels. While the controversy manager’s expertise only affects the specification quality positively when the tax manager chooses a low compliance effort, there is a cap for the impact when the tax manager chooses a high compliance effort. This cap makes the controversy manager’s expertise a more important determinant for choosing a high dispute resolution effort, while increasing TRMS quality “distributes” the benefits of a high dispute resolution effort, given a low and high compliance effort, as indicated by the direct effect in equation (18). Table 1 summarizes the comparative statics with regard to all model parameters.

[Table 1 about here]

In the benchmark setting, we have shown that the tax authority settles more often following enhanced TRMS quality to hold the tax manager indifferent. In the presence of a controversy manager, the tax authority anticipates the changing generation of the final tax opinion in the tax

department and holds the controversy manager indifferent. However, the ambiguous impact of TRMS quality is not a mere result of *who* is held indifferent. The reason is that an additional party comes into play, which provides partially substitutable services.

4 Comparison of different types of tax departments

So far, we have analyzed the effect of tax technology and controversy expertise as channels of dispute resolution in two different *types* of tax departments separately. First, we studied a tax department with only a TRMS, and, second, with a combination of TRMS and a controversy manager. These separate analyses, however, do not provide insights into whether and to what extent these two types of tax departments and the resulting effects of the dispute resolution channels on litigation are comparable, and, if so, under what conditions either is superior. In particular, when either type of tax department faces an identical tax dispute and tax authority, that is, an identical *dispute environment*, two questions arise. First, is the effect of enhancing TRMS quality on the litigation probability tax department-specific? Second, does implementing a tax department with a controversy manager lead to a lower litigation probability than without one?

Technically, the identified effects of tax technology and controversy expertise 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 be 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, namely TRMS quality, the tax manager's compliance costs, the value in dispute, and the tax authority's litigation costs.²⁴ Then we can show the following.

²⁴We exclude the personal cost C , the dispute resolution costs D , the scaling factors for reputational costs λ^{TM} and λ^{CM} , and the controversy manager's expertise 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.

Proposition 4 (*Tax department comparison*)

Comparing a tax department with a TRMS only and a tax department with a TRMS and controversy manager for an identical dispute environment, the following is true.

- a) Suppose that $\theta \leq 1$ and $\underline{\lambda}^{TM} < \lambda^{TM}$ with $\underline{\lambda}^{TM} := \frac{2A(1-\delta^\#)\theta}{z[1-\frac{B}{z}-q(\theta(1-\delta^\#)+\delta^\#)]}$. Then mixed strategy equilibria for both tax department types exist and the equilibrium effects are comparable for

$$\max \left\{ 1 - \frac{B}{z}, \frac{2A}{\lambda^{TM}z} + \underline{q} \right\} < \bar{q} < \min \left\{ \frac{1 - \frac{B}{z} - \delta^\# \underline{q}}{\theta(1 - \delta^\#)}, 1 \right\}.$$

- b) If the tax department types are comparable (part a), there exist dispute environments under which

- b1) improving TRMS quality increases the litigation probability in a tax department with a TRMS and controversy manager ($\frac{\partial \beta^\#}{\partial \bar{q}} < 0$) but decreases the litigation probability in a tax department with only a TRMS ($\frac{\partial \beta^*}{\partial \bar{q}} > 0$).²⁵

- b2) the litigation probability is lower in a tax department with only a TRMS, that is, $0 < \beta^\# \leq \beta^* < 1$.

Proposition 4, part a) establishes a sufficient requirement to compare the two available types of tax department and their differences. The lower bounds for the TRMS quality levels guarantee that settlement and a high compliance effort are not dominated strategies in the tax department with only a TRMS, while the upper bounds guarantee that litigation is not dominated in the tax department with a controversy manager and that the TRMS quality is feasible.

With regard to our first question, we find that the differential impact of enhancing low-quality TRMS on the litigation probability from the separate analysis can be generalized (part b1).

²⁵A sufficient condition for this is $C > 2A$ and $\underline{\lambda}^{TM} < \lambda^{TM}$ with $\underline{\lambda}^{TM} := \frac{2A}{(1-q)(1-\alpha^\#)z}$. $\bar{q}_{crit} \in (q, 1)$ is not necessary to show the result in part b): If $\theta < \frac{1-\alpha^\#}{1-\alpha^\#q}$, we have that $\bar{q}_{crit} > 1$, which means that $\frac{\partial \beta^\#}{\partial \bar{q}} < 0 \forall \bar{q}$.

For specific dispute environments, we find that an increase in the TRMS quality increases (decreases) the litigation probability in the presence (absence) of a controversy manager. Thus the effect of TRMS quality is tax department-specific. For this, two conditions need to be fulfilled. First, the personal costs C are sufficiently high, compared to the compliance costs A . Second, the tax manager is sufficiently sensitive to reputational costs from unfavorable litigation outcomes in the tax department without a controversy manager. Our numerical example in Figure 5 illustrates that improving TRMS quality affects the litigation probabilities $\beta^\#$ and β^* diametrically for $\bar{q} \in \left(1 - \frac{B}{z}, \bar{q}_{crit}\right)$, while it decreases the litigation probabilities for a sufficiently high TRMS quality with $\bar{q} \geq \bar{q}_{crit}$.

[Figure 5 about here]

With regard to our second question, part b2) of Proposition 4 states that the litigation probability can be higher in the tax department with a controversy manager. Intuitively, there are always dispute resolution costs of the controversy manager D , such that $\beta^\#$ becomes sufficiently small without restricting β^* or the comparability requirement. In Figure 5, we see that the litigation probability with a controversy manager is higher if the TRMS quality exceeds a specific threshold level, which, in this example, is $\beta^\# < \beta^*$ for $\bar{q} > 0.67$.²⁶

Overall Propositions 3 and 4 highlight two unintended consequences of increasing the firm's TRMS quality and implementing a controversy manager. First, increasing the TRMS quality can hinder dispute resolution, due to impaired compliance incentives. Second, the litigation probability might be higher in the presence of a strategic controversy manager. Hence, when a firm designs its tax department and overall tax controversy strategy, it must keep in mind that the costly implementation of a controversy manager and the costly increase in TRMS quality do not always simultaneously advance the goal of decreasing costly and time consuming litigation.

²⁶Several scenarios within the comparable range are possible, depending on the parameter constellation: i) $\beta^* > \beta^\# \forall \bar{q}$, ii) $\beta^\# > \beta^* \forall \bar{q}$, iii) $\beta^* > \beta^\#$ for intermediate TRMS qualities or iv) $\beta^\# > \beta^*$ for TRMS qualities above a certain threshold, as indicated in the example. However, we focus on the general statement that these situations exist rather than explicitly proving when each occurs.

More intra-firm channels to resolve disputes will not always be superior in attenuating litigation. Ultimately, the outcome depends on the set and quality of the channels implemented in the tax department.

5 Conclusions

We examine the effects of two corporate dispute resolution channels 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 tax technology by means of a TRMS and tax controversy expertise by means of having a controversy manager as an additional player who strategically decides on providing strategic direction in the tax dispute.

We find that higher levels of expertise and TRMS generally crowd out the tax manager's compliance effort. Further, we find that enhancing TRMS quality always decreases the litigation probability in the absence of a controversy manager but that this negative effect of enhanced TRMS quality on the litigation probability only prevails with a controversy manager for a high-quality TRMS. Surprisingly, we find that enhancing a low-quality TRMS can harm dispute resolution, as it increases litigation probability. The reason is that the crowding out of compliance efforts unfolds a negative impact on the controversy manager's dispute resolution incentives only for low-quality TRMS but not for high-quality TRMS. TRMS never yields a negative impact in the absence of a controversy manager.

Our investigation is subject to two limitations. First, the binary structure of the true tax liability and the effort levels as well as the perfect litigation procedure might overemphasize some of our results. Relaxing these assumptions, however, would add considerable complexity to the model without significantly altering the underlying mechanism. Second, we do not explicitly analyze the firm's decision to engage a controversy manager, nor its decision on the quality and design of the TRMS. We rather focus on the incremental effect of both channels on dispute resolution, given a firm's current controversy strategy.

Future research should address the second shortcoming by investigating the determinants of designing a TRMS. Beside the given symmetric TRMS design in our setting, firms could design their TRMS conservatively and thus further reduce potential monetary and reputational damages. However, this comes at the cost of losing focus on identifying and exploiting tax planning opportunities. This trade-off is especially interesting, given the substantial costs of implementing a symmetric high-quality TRMS. Another promising future research area is the analysis of social welfare aspects regarding the optimal level and mix of corporate channels to resolve disputes. Lastly, our results provide predictions that should be empirically tested. For example, in tax departments with a controversy manager, we predict that the effect of the TRMS quality on the frequency of tax litigation is positive until a specific TRMS quality level and negative beyond that level.

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Appendix

[Table A1 about here]

Proofs in a tax department with a TRMS

Proof of Lemma 1

The equilibrium strategies (α^*, β^*) are derived straightforwardly by rearranging the indifference conditions (7) and (8). The total settlement probability can be derived by adding up the probabilities of all possible paths leading to a settlement decision by the tax authority. This yields

$$\begin{aligned} TSP^* &= \frac{1}{2} [\alpha^*(\underline{q}\beta^* + 1 - \underline{q}) + (1 - \alpha^*)(\bar{q}\beta^* + 1 - \bar{q})] + \\ &\quad \frac{1}{2} [\alpha^*(\underline{q} + (1 - \underline{q})\beta^*) + (1 - \alpha^*)(\bar{q} + (1 - \bar{q})\beta^*)] \\ &= \frac{1}{2} (1 + \beta^*), \end{aligned}$$

which had to be shown. \square

Proof of Proposition 1

The equilibrium probabilities are given by $\alpha^* = \frac{\frac{B}{z} - (1 - \bar{q})}{\bar{q} - \underline{q}}$ and $\beta^* = 1 - \frac{2A}{\lambda TM_z(\bar{q} - \underline{q})}$. Differentiation of α^* with respect to \bar{q} gives us

$$\frac{\partial \alpha^*}{\partial \bar{q}} = \frac{\bar{q} - \underline{q} - \left(\frac{B}{z} - (1 - \bar{q})\right)}{(\bar{q} - \underline{q})^2} = \frac{1 - \underline{q} - \frac{B}{z}}{(\bar{q} - \underline{q})^2}. \quad (19)$$

Since, first, $1 - \underline{q} > \frac{B}{z}$ guarantees that the tax authority's best response to a low compliance effort is litigation, and, second, $\bar{q} > \underline{q}$, we have $\frac{\partial \alpha^*}{\partial \bar{q}} > 0$. Further, since an increase in \bar{q} decreases the subtracted term in β^* , we have $\frac{\partial \beta^*}{\partial \bar{q}} > 0$. \square

Proofs in the model with a TRMS and a controversy manager

Proof of Lemma 3

We start by identifying the controversy manager's equilibrium strategy. From the tax manager's indifference condition (equation (11)), straightforward rearranging yields the equilibrium probability $\delta^\# = \frac{C-A}{C}$. 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)) gives us

$$B = [\delta^\#(\alpha^\#(1 - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})) + (1 - \delta^\#)\alpha^\#(1 - \bar{q}\theta)]z. \quad (20)$$

Rearranging for $\alpha^\#$ ultimately leads to

$$\alpha^\# = \frac{\frac{B}{z} - \delta^\#(1 - \bar{q})}{(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})}. \quad (21)$$

The tax manager chooses a low effort with positive probability ($\alpha^\# > 0$) if $B > \delta^\#(1 - \bar{q})z := \underline{B}^\#$. Additionally, $\alpha^\# < 1$ requires

$$B < [(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(1 - \underline{q})]z := \bar{B}^\#. \quad (22)$$

Lastly, we derive the tax authority's equilibrium settlement probability. Inserting $\alpha^\#$ in the indifference condition of the controversy manager (equation (14)) gives us

$$D = \lambda^{CM} \frac{z}{2} (1 - \beta) [\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})]. \quad (23)$$

Rearranging for the settlement probability yields

$$\beta^\# = 1 - \frac{2D}{\lambda^{CM} z [\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})]} . \quad (24)$$

In order to guarantee an inner solution, we first check whether $\beta^\# < 1$. This is always guaranteed in our setting, because $\frac{2D}{\lambda^{CM} z [\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})]} > 0$. Contrarily, $\beta^\# > 0$ requires

$$D < \frac{\lambda^{CM} z [B((1 + \theta)\bar{q} - 1 - \underline{q}) + z(1 - \bar{q}\theta)]}{2 [(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})]} := D^\# . \quad (25)$$

The total settlement probability can be derived similar to the benchmark setting:

$$\begin{aligned} TSP^\# &= \frac{1}{2} \left[\alpha^\# (\underline{q}\delta^\#\beta^\# + (1 - \underline{q})\delta^\# + \bar{q}\theta(1 - \delta^\#)\beta^\# + (1 - \bar{q}\theta)(1 - \delta^\#)) + \right. \\ &\quad \left. (1 - \alpha^\#) (\bar{q}\delta^\#\beta^\# + (1 - \bar{q})\delta^\# + (1 - \delta^\#)\beta^\#) \right] + \\ &\quad \frac{1}{2} \left[\alpha^\# (\underline{q}\delta^\# + (1 - \underline{q})\delta^\#\beta^\# + \bar{q}\theta(1 - \delta^\#) + (1 - \bar{q}\theta)(1 - \delta^\#)\beta^\#) + \right. \\ &\quad \left. (1 - \alpha^\#) (\bar{q}\delta^\# + (1 - \bar{q})\delta^\#\beta^\# + (1 - \delta^\#)) \right] \\ &= \frac{1}{2} (1 + \beta^\#) \left[\alpha^\# \delta^\# + \alpha^\#(1 - \delta^\#) + (1 - \alpha^\#)\delta^\# + (1 - \alpha^\#)(1 - \delta^\#) \right] \\ &= \frac{1}{2} (1 + \beta^\#), \end{aligned}$$

which had to be shown. \square

Proof of Proposition 2

Part a) is fulfilled, since $\delta^\#$ does not depend on θ . Therefore $\frac{\partial \delta^\#}{\partial \theta} = 0$ is given. To show that part b) is fulfilled, note that the derivative with respect to θ is implicitly defined by

$$\frac{\partial \alpha^\#}{\partial \theta} = \frac{\alpha^\#(1 - \delta^\#)\bar{q}}{[(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})]} > 0 ,$$

which is positive in a mixed strategy equilibrium. Lastly, we check part c). Using the implicit function theorem with three endogenous variables $(\alpha^\#, \beta^\#, \delta^\#)$, the derivative is found to be implicitly defined by

$$\frac{\partial \beta^\#}{\partial \theta} = \frac{(1 - \beta^\#)\alpha^\# \bar{q} (\bar{q} - \underline{q})}{[\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})] [(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})]} > 0,$$

which is again positive in a mixed strategy equilibrium. \square

Proof of Proposition 3

Part a) is obviously fulfilled, since $\delta^\#$ does not depend on \bar{q} . To show that part b) is fulfilled, we calculate the derivative with respect to the TRMS quality \bar{q} , which is implicitly given by

$$\frac{\partial \alpha^\#}{\partial \bar{q}} = \frac{(1 - \delta^\#)\alpha^\# \theta + \delta^\#(1 - \alpha^\#)}{[(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})]} > 0.$$

In a mixed strategy equilibrium, the positivity of the above derivative is guaranteed.

Next, we identify the effect of varying \bar{q} on $\beta^\#$, considering that $\alpha^\#$ is a function of \bar{q} . Taking the derivative without explicitly inserting $\frac{\partial \alpha^\#}{\partial \bar{q}}$, we get

$$\begin{aligned} \frac{\partial \beta^\#}{\partial \bar{q}} &= \frac{2D}{\lambda^{CM_Z}} \cdot \frac{1}{[\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})]^2} \\ &\cdot \left[\frac{\partial \alpha^\#}{\partial \bar{q}} (\bar{q}\theta - \underline{q}) + \alpha^\# \theta - \frac{\partial \alpha^\#}{\partial \bar{q}} - 1 + \frac{\partial \alpha^\#}{\partial \bar{q}} \bar{q} + \alpha^\# \right] \end{aligned} \quad (26)$$

Note that the sign of the derivative equals the sign of the bracket. Simplifying the bracket yields $\frac{\partial \alpha^\#}{\partial \bar{q}} (\bar{q}(1 + \theta) - \underline{q} - 1) + \alpha^\#(1 + \theta) - 1$, which is our inequality (18) used for economic intuition, where \bar{q}_{crit} is the value for which the bracket term in equation (26) is zero. For the derivation of \bar{q}_{crit} , we again use the implicit function theorem with three endogenous variables $(\alpha^\#, \beta^\#, \delta^\#)$. Implicitly differentiating the indifference conditions with respect to \bar{q} ,

the derivative $\frac{\partial \beta^\#}{\partial \bar{q}}$ is found to be

$$\frac{\partial \beta^\#}{\partial \bar{q}} = \frac{(1 - \beta^\#) (\alpha^\#(1 - \underline{q}\theta) - (1 - \bar{q}\theta))}{[\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})] [(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})]} .$$

The sign of the derivative equals the sign of the numerator because the denominator is positive in a mixed strategy equilibrium. The sign of the numerator switches from negative to positive as \bar{q} increases at some \bar{q}_{crit} such that

$$\begin{aligned} \left. \frac{\partial \beta^\#}{\partial \bar{q}} \right|_{\bar{q}=\bar{q}_{\text{crit}}} &= 0 \\ \iff \alpha_{\text{crit}}^\# &= \frac{1 - \bar{q}\theta}{1 - \underline{q}\theta} \\ \iff \bar{q}_{\text{crit}} &= \frac{1 - \alpha^\#(1 - \underline{q}\theta)}{\theta} . \end{aligned}$$

For \bar{q}_{crit} to exist in equilibrium, we need to check whether $\underline{q} < \bar{q}_{\text{crit}} < 1$. First, $\bar{q}_{\text{crit}} > \underline{q}$ is always fulfilled, because $1 - \alpha^\# > (1 - \alpha^\#)\underline{q}\theta$. Second, $\bar{q}_{\text{crit}} < 1$ requires $\theta > \frac{1 - \alpha^\#}{1 - \alpha^\#\underline{q}}$, which is therefore a necessary condition for the existence of \bar{q}_{crit} . Note that it is sufficient to assume $\theta > 1$ for the existence of \bar{q}_{crit} , but there are also parameter constellations for which $\bar{q}_{\text{crit}} \in (\underline{q}, 1)$ when $\theta < 1$.

To see that $\beta^\#$ has a local minimum at \bar{q}_{crit} , regard the second derivative at \bar{q}_{crit} , where $\frac{\partial^2 \beta^\#}{\partial \bar{q}^2}$ can be obtained by implicitly differentiating the indifference conditions with respect to \bar{q} two times and solving the resulting system of equations for the derivative we are looking for. This yields

$$\left. \frac{\partial^2 \beta^\#}{\partial \bar{q}^2} \right|_{\bar{q}=\bar{q}_{\text{crit}}} = \frac{2(1 - \beta^\#)\theta}{[\alpha^\#(\bar{q}_{\text{crit}}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q}_{\text{crit}})] [(1 - \delta^\#)(1 - \bar{q}_{\text{crit}}\theta) + \delta^\#(\bar{q}_{\text{crit}} - \underline{q})]} ,$$

which is positive in an equilibrium with $\bar{q}_{\text{crit}} \in (\underline{q}, 1)$. Therefore, we have a unique minimum at \bar{q}_{crit} , which had to be shown. \square

Comparative statics

We only show the non-trivial effects, which, in addition, have not been shown in Propositions 2 and 3. Namely, these are the derivatives of $\alpha^\#$, $\delta^\#$ and $\beta^\#$ with respect to A , B , C and z , respectively. As a preliminary step, we identify how the equilibrium probability $\alpha^\#$ changes following an (exogenous) variation of δ , i.e., $\frac{\partial \alpha^\#}{\partial \delta}$. The derivative is given by

$$\frac{\partial \alpha^\#}{\partial \delta} = \frac{-(1-\bar{q}) [(1-\delta)(1-\bar{q}\theta) + \delta(\bar{q}-\underline{q})] - \left[\left(\frac{B}{z} - \delta(1-\bar{q})\right) (\bar{q}(1+\theta) - \underline{q} - 1)\right]}{[(1-\delta)(1-\bar{q}\theta) + \delta(\bar{q}-\underline{q})]^2}$$

The numerator is always negative for $\bar{q} \geq \frac{1+q}{1+\theta}$. For $\bar{q} < \frac{1+q}{1+\theta}$, we need to show that this still applies. Given that $\alpha^\# \in [0, 1]$, we know the following relation holds

$$(1-\delta)(1-\bar{q}\theta) + \delta(\bar{q}-\underline{q}) \geq \frac{B}{z} - \delta(1-\bar{q}).$$

If we insert $\frac{B}{z} - \delta(1-\bar{q})$ 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

$$-\left(\frac{B}{z} - \delta(1-\bar{q})\right) (\bar{q}\theta - \underline{q}) < 0.$$

As a second step, observe that the (exogenous) variation of α has the following effect on the equilibrium settlement probability:

$$\frac{\partial \beta^\#}{\partial \alpha} = \frac{2D}{\lambda^{CM} z} \cdot \frac{\bar{q}(1+\theta) - \underline{q} - 1}{[\alpha(\bar{q}\theta - \underline{q}) + (1-\alpha)(1-\bar{q})]^2}.$$

The direction is obviously unclear, and depends on $\bar{q} \gtrless \frac{1+q}{1+\theta}$.

Since, $\frac{\partial \delta^\#}{\partial A} < 0$, we know $\frac{\partial \alpha^\#}{\partial A} > 0$. For the derivatives with respect to C , we observe the opposite effect. Also, we know that $\frac{\partial \delta^\#}{\partial B} = 0$ and $\frac{\partial \alpha^\#}{\partial B} > 0$. The effect on $\beta^\#$ of all these parameters is ambiguous and depends on the above threshold value for \bar{q} . 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 settlement probability is implicitly defined by

$$\frac{\partial \beta^\#}{\partial z} = \frac{(1 - \bar{q})(1 - \bar{q}\theta)(1 - \beta^\#)}{[\alpha^\#(\bar{q}\theta - \underline{q}) + (1 - \alpha^\#)(1 - \bar{q})] [(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})]},$$

which is strictly positive.

Proof of Proposition 4

The proof for part a) consists of two steps. First, we determine the boundaries for the TRMS quality from the separate analysis at which the mixed strategy equilibria for both tax department types exist. Second, we identify conditions so that the boundaries indeed establish a comparable interval, i.e., an interval in which mixed strategies are played for both tax department types.

First, note that $\delta^\#$ is independent of \bar{q} , and therefore does not restrict the comparable TRMS quality range. Further, since (α^*, β^*) is independent of D , and assuming that the dispute resolution costs are sufficiently small, i.e., $D < \bar{D}^\#$ (Lemma 4), $\beta^\# \in (0, 1)$ is guaranteed without restricting the comparable TRMS quality range. Lastly, note that $\alpha^*(\bar{q}) < \alpha^\#(\bar{q}) \forall \bar{q}$, so that $\alpha^* > 0$ and $\alpha^\# < 1$ determine boundaries for the TRMS quality. This is because $\frac{\partial \alpha^\#}{\partial \delta} < 0$ (see Proof in the Appendix under ‘‘Comparative statics’’) and $\alpha^\#(\bar{q})|_{\delta^\#=1} = \alpha^*(\bar{q})$. The upper bound for TRMS quality is thus $\bar{q} = (\alpha^\#)^{-1}(1) = \frac{1 - \frac{B}{z} - \delta^\# \underline{q}}{\theta(1 - \delta^\#)}$, where the second upper bound guarantees that the TRMS quality cannot be perfect. The first lower bound is derived from rearranging $\bar{q} = (\alpha^*)^{-1}(0) = 1 - \frac{B}{z}$. The second lower bound is derived from $\bar{q} = (\beta^*)^{-1}(0) = \frac{2A}{\lambda^{TMz}} + \underline{q}$, which needs to be additionally fulfilled to guarantee that a high compliance effort is not a dominated strategy in the benchmark setting.

Second, the comparable range only exists if the lower bounds are indeed smaller than the first upper bound, since the lower boundaries are always smaller than 1. If $\theta \leq 1$, the first condition $1 - \frac{B}{z} < \frac{1 - \frac{B}{z} - \delta^\# \underline{q}}{\theta(1 - \delta^\#)}$ is always satisfied, since it implies $1 - \bar{q} < (1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(1 - \underline{q})$.²⁷

²⁷For $\theta > 1$, a sufficient condition is $\delta^\# > \frac{1 - \bar{q}}{1 - \underline{q}}$, i.e., the difference between \bar{q} and \underline{q} must be sufficiently large.

The second condition requires that the tax manager's incentive to prevent unfavorable litigation outcomes in the absence of a controversy manager is sufficiently high, which we get from rearranging $\frac{2A}{\lambda^{TM_z}} + \underline{q} < \frac{1 - \frac{B}{z} - \delta^\# \underline{q}}{\theta(1 - \delta^\#)}$ for λ^{TM} .

The necessary condition for part b) to hold is exactly the requirement for the critical TRMS quality to be higher than the lower bound of the compatibility range, i.e.,

$$\bar{q}_{crit} = \frac{1 - \alpha^\#(1 - \underline{q}\theta)}{\theta} > \max \left\{ 1 - \frac{B}{z}, \frac{2A}{\lambda^{TM_z}} + \underline{q} \right\}. \quad (27)$$

To get a more intuitive idea for the parameter range in which part b) is fulfilled, note the following, considering $\frac{\partial \alpha^\#}{\partial \theta} > 0$:

$$\begin{aligned} \frac{\partial \bar{q}_{crit}}{\partial \theta} &= \frac{- \left[\frac{\partial \alpha^\#}{\partial \theta} (1 - \underline{q}\theta) - \alpha^\# \underline{q} \right] \theta - [1 - \alpha^\#(1 - \underline{q}\theta)]}{\theta^2} \\ &= \frac{- \frac{\partial \alpha^\#}{\partial \theta} (1 - \underline{q}\theta) \theta + \alpha^\# - 1}{\theta^2} < 0. \end{aligned}$$

If we show that inequality (27) holds for specific conditions and a fixed value θ_{fix} , it is obvious that these specific conditions also apply for feasible values $\theta < \theta_{fix}$.²⁸ Assume first that $1 - \frac{B}{z} > \frac{2A}{\lambda^{TM_z}} + \underline{q}$ and $\theta_{fix} = 1$. Then inequality (27) reduces to

$$1 - \alpha^\#(1 - \underline{q}) > 1 - \frac{B}{z}.$$

Inserting $\alpha^\# = \frac{\frac{B}{z} - \delta^\#(1 - \bar{q})}{(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})}$ and simplifying yields

$$\begin{aligned} \frac{B}{z} &> \frac{\frac{B}{z} - \delta^\#(1 - \bar{q})}{(1 - \delta^\#)(1 - \bar{q}\theta) + \delta^\#(\bar{q} - \underline{q})} (1 - \underline{q}) \\ \iff \frac{B}{z} &[(1 - \delta^\#)(\bar{q} - \underline{q}) + \delta^\#(1 - \bar{q})] < \delta^\#(1 - \bar{q})(1 - \underline{q}) \end{aligned}$$

²⁸It is required that θ satisfies $1 - \bar{q}\theta > 0$ and $\bar{q}\theta > \underline{q}$, which gives $\theta \in (\frac{\underline{q}}{\bar{q}}, \frac{1}{\bar{q}})$.

Since $1 - \bar{q} < \frac{B}{z}$, we can rank the terms as follows, where it is sufficient to compare the first and third expressions

$$\begin{aligned}
(1 - \bar{q}) [(1 - \delta^\#)(\bar{q} - \underline{q}) + \delta^\#(1 - \bar{q})] &< \frac{B}{z} [(1 - \delta^\#)(\bar{q} - \underline{q}) + \delta^\#(1 - \bar{q})] \\
&< \delta^\#(1 - \bar{q})(1 - \underline{q}) \\
\iff \delta^\#(1 - \bar{q})(1 - \underline{q}) &> (1 - \bar{q}) [(1 - \delta^\#)(\bar{q} - \underline{q}) + \delta^\#(1 - \bar{q})] \\
\iff (\delta^\# - (1 - \delta^\#))(\bar{q} - \underline{q}) &> 0 \\
\iff \delta^\# > \frac{1}{2} \implies C > 2A
\end{aligned}$$

Therefore, $\theta \leq 1$ and $\delta^\# > \frac{1}{2}$ are sufficient for part b) to hold when $1 - \frac{B}{z} > \frac{2A}{\lambda^{TMz}} + \underline{q}$. Similarly, we can derive $\underline{\lambda}^{TM}$ by rearranging

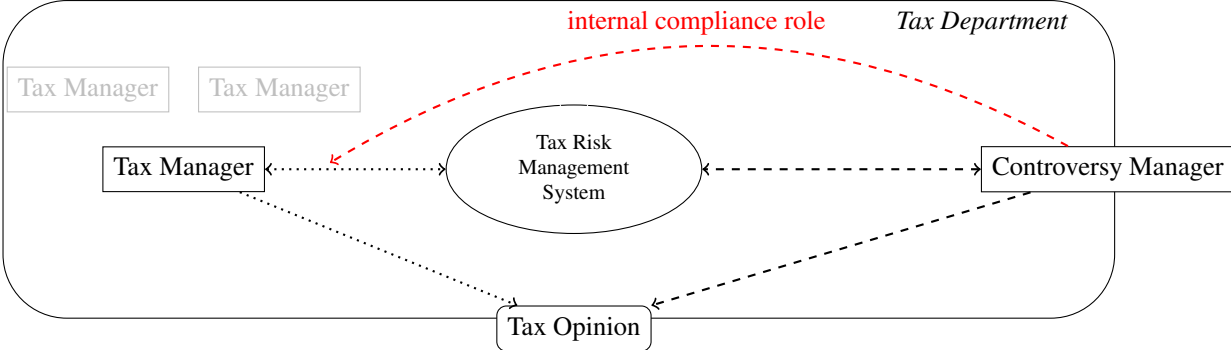
$$1 - \alpha^\#(1 - \underline{q}) > \frac{2A}{\lambda^{TMz}} + \underline{q}$$

for λ^{TM} , where $\underline{\lambda}^{TM} < \lambda^{TM}$ if Proposition (3) is fulfilled.

For the statement in c) to be true, it is sufficient to derive one parameter constellation in the comparability range which fulfills it. Note that $\frac{\partial \beta^\#}{\partial D} < 0$ and that $\frac{\partial \beta^*}{\partial D} = 0$. Further, suppose that $\bar{q}_{crit} \in (\underline{q}, 1)$. Then it is obvious that $\lim_{D \rightarrow \bar{D}^\#} \beta^\#(\bar{q}_{crit}) = 0 < \beta^*(\bar{q}_{crit})$ as long as $\frac{2A}{\lambda^{TMz}} + \underline{q} \neq \bar{q}_{crit}$.
□

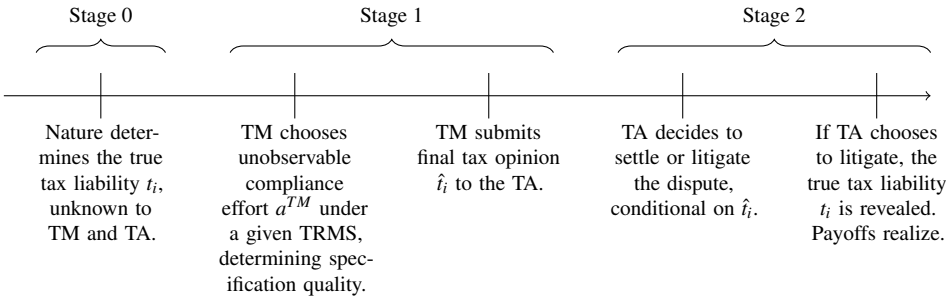
Figures and Tables

Figure 1: Firm’s decision-making structure in tax disputes



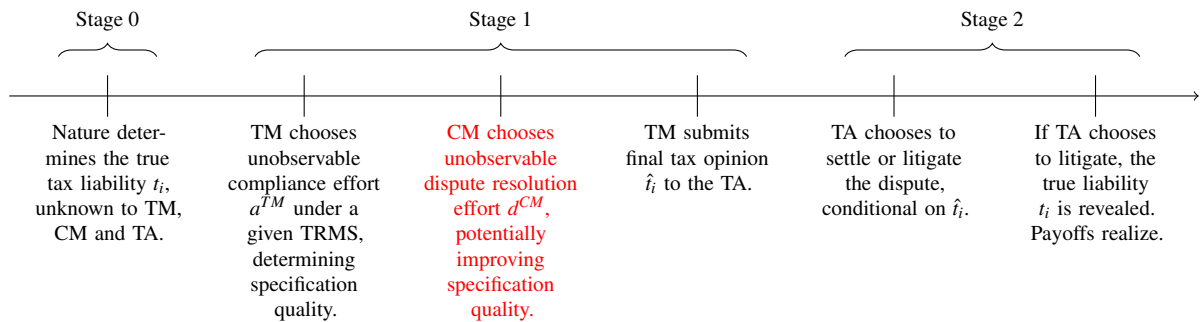
The solid rectangles and ellipses within the tax department depict features that are observable for the tax authority, i.e., TRMS (quality) and the tax department’s structure with one tax manager (of many) and one potentially involved controversy manager. The dotted lines illustrate that the tax manager’s compliance effort affects the probability for a correct tax opinion. The black dashed lines depict that the controversy manager can additionally increase the probability for a correct tax opinion with her expertise. The red dashed line highlights the controversy manager’s internal compliance role, i.e., her ability to identify noncompliant effort and initiate the necessary actions indicated by the TRMS to resolve disputes. This setting abstracts from principal-agent conflicts and hierarchical aspects of the relationship between the tax manager and controversy manager other than the controversy manager’s responsibility for tax disputes and her internal compliance role.

Figure 2: Timeline of the game between the tax manager (TM) and the tax authority (TA) with a given TRMS.



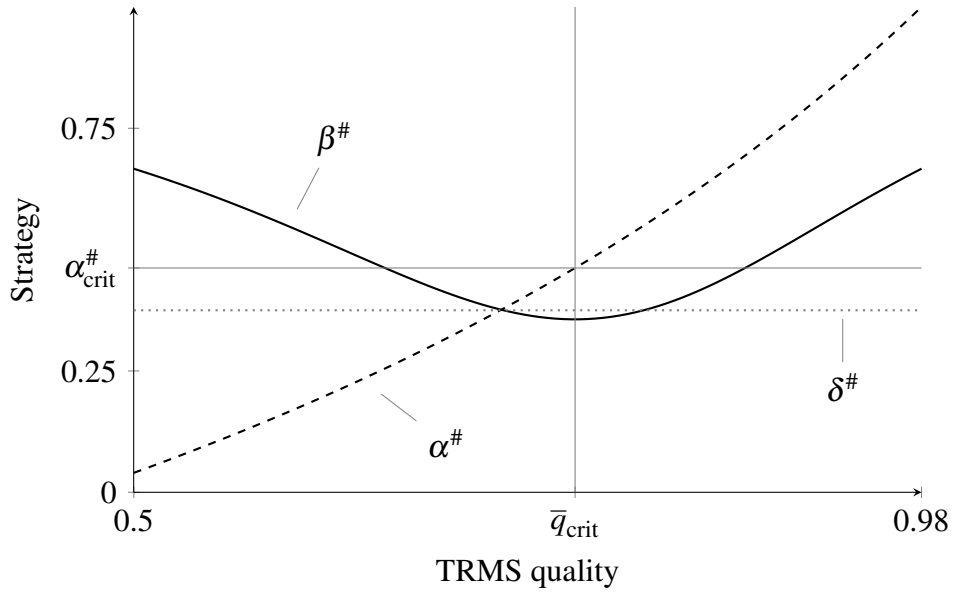
This figure illustrates the sequence of events without a controversy manager. The players' actions are conditional on a given tax dispute, which occurs after the firm's pre-audit tax risk management procedure has occurred, the tax return has been filed, and the tax authority has challenged an uncertain tax position in the tax return. Two interpretations of the true tax liability (stage 0) are possible. First, the true tax liability may remain unchanged throughout the overall interaction of the firm and the tax authority, including the firm's pre-audit tax risk management procedure, tax return submission, and dispute resolution. Second, the probability distribution for the true tax liability may change after the tax authority challenges the tax manager's initial assessment, as the information provided in the tax audit changes the material facts a court can exploit for adjudication.

Figure 3: Timeline of the game in the presence of a controversy manager (CM) with a given TRMS.



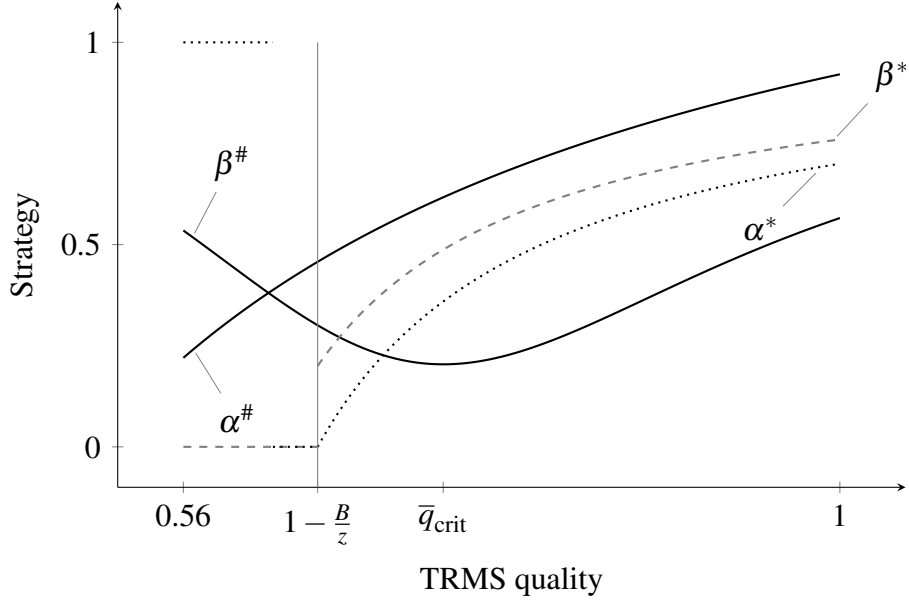
This figure illustrates the sequence of events with a controversy manager. The players' actions are conditional on a given tax dispute, which occurs after the firm's pre-audit tax risk management procedure has occurred, the tax return has been filed, and the tax authority has challenged an uncertain tax position in the tax return. Two interpretations of the true tax liability (stage 0) are possible. First, the true tax liability may remain unchanged throughout the overall interaction of the firm and the tax authority, including the firm's pre-audit tax risk management procedure, tax return submission, and dispute resolution. Second, the probability distribution for the true tax liability may change after the tax authority challenges the tax manager's initial assessment, as the information provided in the tax audit changes the material facts a court can exploit for adjudication.

Figure 4: Equilibrium with a controversy manager for varying TRMS quality levels



This figure illustrates the players' strategies as a function of the TRMS quality. The dashed line indicates the tax manager's probability of choosing a low compliance effort; the dotted line shows the controversy manager's probability of choosing a low dispute resolution effort. The solid line depicts the tax authority's settlement probability. $\bar{q}_{crit} \approx 0.77$ denotes the critical TRMS quality level that separates the direction of the tax authority's reaction to a changing TRMS quality. Parameters are chosen with $\theta = 1, q = 0.5, \lambda^{CM} = 2.5, A = 2.5, B = 2, C = 4, D = 2, z = 10$, and $B \leq \bar{B}^{\#}$ restricting the TRMS quality range, i.e., $\bar{q} \leq 0.98$.

Figure 5: Equilibrium strategies in both tax department types for a specific dispute environment



This figure illustrates the players' equilibrium strategies, conditional on the tax department type as a function of the TRMS quality. The dashed line indicates the tax authority's settlement probability β^* , and the dotted line depicts the tax manager's low compliance probability α^* without a controversy manager. The solid lines depict the respective probabilities $\beta^\#$ and $\alpha^\#$ with a controversy manager. \bar{q}_{crit} denotes the critical TRMS quality level that separates the direction of the tax authority's reaction to a changing TRMS quality with a controversy manager. The parameters are chosen with $\theta = 0.9, \underline{q} = 0.5, \lambda^{CM} = 2.5, \lambda^{TM} = 2.5, A = 1.5, B = 3.5, C = 5, D = 2, z = 10$, implying $\delta^\# = 0.7 \forall \bar{q}$ and requiring $\bar{q} > 0.56$. For $\bar{q} \leq 1 - \frac{B}{z}$, the mixed strategy equilibrium effects are not comparable for the same dispute environment. Then the players choose pure strategies in the setting without a controversy manager, with $(\alpha^*, \beta^*) = (0, 0)$ for $\bar{q} \in (0.62, 0.65)$ and $(\alpha^*, \beta^*) = (1, 0)$ for $\bar{q} \in (0.56, 0.62)$.

Table 1: Comparative statics in a tax department with a TRMS and a controversy manager

Variable	Meaning	Noncompliance	Settlement	Non-resolution
		$\alpha^\#$	$\beta^\#$	$\delta^\#$
θ	CM's expertise level	+	+	0
\bar{q}	TRMS quality	+	-/+	0
\underline{q}	Downside specification quality	+	-	0
λ^{CM}	CM's reputational costs from unfavorable litigation outcomes	0	+	0
z	Value in dispute	-	+	0
A	TM's compliance costs	+	-/+	-
B	TA's litigation costs	+	-/+	0
C	TM's personal costs	-	+/-	+
D	CM's dispute resolution costs	0	-	0

This table indicates how an increase in the exogenous variables on the left-hand side affects the equilibrium strategies of the tax manager (TM), tax authority (TA), and controversy manager (CM).

Table A1: List of Symbols

A	Tax manager's costs of a high compliance effort
B	Tax authority's litigation costs
C	Tax manager's personal costs
D	Controversy manager's costs of a high dispute resolution effort
a^{TM}, a_L, a_H	Tax manager's compliance effort (low or high)
b^{TA}, b_{set}, b_{lit}	Tax authority's dispute resolution strategy (settle or litigate)
d^{CM}, d_L, d_H	Controversy manager's dispute resolution effort (low or high)
i, j	Indices for low or high
K^{TM}, K^{CM}, K^{TA}	Players' cost functions
p	Probability for a low true tax liability
\bar{q}	Quality of the firm's TRMS
q	Downside specification quality
t_i, t_L, t_H	Firm's true tax liability (low or high)
$\hat{t}_i, \hat{t}_L, \hat{t}_H$	Specified final tax opinion (low or high)
u^{TM}, u^{CM}, u^{TA}	Players' utility functions
z	Value in dispute
α	Probability for a low compliance effort
β	Probability for settling the dispute
δ	Probability for a low dispute resolution effort
θ	Degree of controversy manager's expertise
$\lambda^{TM}, \lambda^{CM}$	Scaling factor for the tax and controversy manager's reputational costs from unfavorable litigation outcomes
π	Penalty factor

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Herausgeber: Kay Blaufus, Jochen Hundsdoerfer,
Martin Jacob, Dirk Kieseewetter, Rolf J. König,
Lutz Kruschwitz, Andreas Löffler, Ralf Maiterth,
Heiko Müller, Jens Müller, Rainer Niemann,
Deborah Schanz, Sebastian Schanz, Caren Sureth-
Sloane, Corinna Treisch

Kontaktadresse:

Prof. Dr. Dr. h.c. Dr. h.c. Caren Sureth-Sloane,
Universität Paderborn, Fakultät für
Wirtschaftswissenschaften,
Warburger Str. 100, 33098 Paderborn,
www.arqus.info, Email: info@arqus.info

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