



Tax Loss Carryforward Disclosure

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Abstract This study examines firms' voluntary disclosure of tax loss carryforward (TLCF) information. We measure the content and presentation of TLCF information by a disclosure score based on hand collected data from annual reports. Our identification strategy employs new proprietary data to control for overall reporting quality. We argue and find that uncertainty about the usability of TLCF is a key driver of voluntary TLCF disclosure. The disclosure score is on average 3.86 points higher for firms with a strong loss history vis-à-vis firms without such a loss history. This positive association is economically meaningful, since the sample mean for the disclosure score is 8.88 (median 7.5). We also find that the content and type of disclosure vary systematically with the signal of uncertainty. In instances of historic uncertainty, firms exhibit increased reporting on the reasons and mechanisms behind changes in TLCF. Conversely, in the case of future uncertainty, they increase disclosure related to valuation allowance information. Our study provides detailed and unique insights into TLCF disclosure, suggesting that managers enrich the information environment with voluntary disclosure that caters to expected investors' needs.

Keywords Tax loss carryforwards · Disclosure · Uncertainty · Tax footnote · Deferred taxes

JEL Classifications M41 · M48

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1 Introduction

Information about tax loss carryforwards (TLCF) is complex and difficult to comprehend, but their considerable magnitude renders them important for estimating future tax savings. For example, the mean (median) TLCF for large German firms between 2005 and 2016 is 10.4 (3.7)% of total assets.¹ The COVID-19 pandemic and the resulting financial problems for certain businesses have likely increased the amount of TLCF for many firms and consequently, their economic relevance. To assess the effect of TLCF on firms' future tax payments, financial statement users must understand how firms can use their TLCF for offsetting future profits (TLCF usability). We investigate whether firms voluntarily provide TLCF information when the TLCF usability is uncertain.

Research on TLCF-related balance sheet information, e.g., deferred tax assets or valuation allowances, finds that this information is a useful signal for future performance (Dhaliwal et al. 2013; Kumar and Visvanathan 2003), tax payments (Flagmeier 2022), and may indicate earnings management (Frank and Rego 2006; Herbohn et al. 2010, 2016; Schrand and Wong 2003). Accordingly, the literature on deferred taxes mainly provides evidence on the value relevance of these positions (e.g., Amir and Sougiannis 1999; Chang et al. 2009). Importantly, institutional circumstances and the firm's economic environment may render TLCF-related balance sheet information less useful (Badenhorst and Ferreira 2016; Flagmeier 2022; Hanna et al. 2019). In particular, investors do not seem to rely on recognized deferred tax assets under International Financial Reporting Standards (IFRS) in a German setting (Chludek 2011; Flagmeier 2022) and the TLCF items seem not to be useful to predict future performance in such settings (Dreher et al. 2024). In such accounting regimes firms may complement financial statements with voluntary guidance in the tax footnote as an alternative to communicate TLCF usability.² Thus, we explore how firms voluntarily cater to investors' TLCF information needs.

We predict that firms provide additional TLCF information when the future usability and hence the value of TLCF are uncertain. Investors perceive TLCF as valuable when they can be offset against profits in the near future (McGuire et al. 2016). Unusable TLCF indicate unfavorable earnings expectations or even further losses in the future (Amir and Sougiannis 1999). It is therefore essential for investors to assess whether TLCF can offset future taxable income. Uncertainty about the usability of TLCF can create (or increase) capital market pressures, for example affecting the liquidity of a firm's shares and hence the cost of capital.³ To mitigate

¹ This number is based on the total TLCF amount per firm-year for German DAX30 and MDAX firms, derived from deferred tax assets for TLCF and unusable TLCF.

² Using footnote disclosures to assess a firm's information dissemination is in line with evidence that financial statement users incorporate footnote information into stock prices (De Franco et al. 2011) and other studies using the footnote as the primary source of tax information (e.g., Inger et al. 2018). While major tax information such as the effective tax rate is also disclosed via other channels, e.g., press releases or conference calls (e.g., Balakrishnan et al. 2019), this does usually not apply to more complex tax-related details (Dhaliwal et al. 2013).

³ Note that uncertainty does not necessarily mean that TLCF is unlikely to be used; rather, it means that it is *not clear* whether TLCF can be used.

this threat, firms can voluntarily provide TDCF information. Anecdotal evidence from interviews with top managers of German corporations supports the notion that both recognition of deferred tax assets for TDCF and respective disclosures are a discussion point and a strategic choice in periods of high economic uncertainty. This also corresponds with interviews in Flagmeier et al. (2023) who document that tax disclosure decisions are typically made after business or recognition decisions.

The mechanism of using voluntary disclosure to reduce information asymmetry is well established in the accounting literature (e.g., Guay et al. 2016; Verrecchia 2001). However, TDCF is an economically important tax item with some unique features. First, unlike many financial accounting items, TDCF provides not only information about past events but also forward-looking information. Information in TDCF disclosure can go beyond management's earnings forecasts as, for example, details about TDCF usability reveal expectations about future taxable instead of financial income. This information aids in assessing (potential) future tax savings and can be particularly informative for investors. Second, the audience for tax information is generally very broad. In addition to outside equity investors, analysts, tax authorities, legislators and the general public are interested in a firm's tax details, potentially creating additional disclosure costs (e.g., Bozanic et al. 2017; Flagmeier et al. 2023; Müller et al. 2020; Robinson and Schmidt 2013). Third, gathering and editing the relevant TDCF information is costly, as it has to be derived from single entity tax statements (e.g., PricewaterhouseCoopers [PwC] 2012; Smith Raedy et al. 2011). Fourth, due to the complex nature of TDCF information, high processing costs occur, which may distort the investor perception of such information (Blanckespoor et al. 2020). In sum, firms have incentives to disclose more TDCF information in the case of uncertain usability, but they also face disclosure costs.

To examine whether firms disclose more TDCF information if its usability is uncertain, we derive two signals of usability uncertainty from IAS 12: historic uncertainty resulting from a firm's loss history and future uncertainty based on expected future earnings (and hence loss-offsetting options). We create a disclosure score to measure TDCF disclosures. The score captures all information about TDCF that is disclosed voluntarily in the tax footnotes, i.e., beyond the mandatory requirements under IAS 12. Each TDCF disclosure is evaluated regarding the information content and the type of information disclosed (e.g., qualitative vs. quantitative), including the way in which it is presented. This comprehensive approach allows us to distinguish between different disclosure properties and to draw granular inferences about firms' disclosure behavior. We apply the score to a sample of large German public firms between 2005 (after mandatory adoption of IFRS) and 2016, and we mainly hand-collect data from their annual reports' notes on income taxes. The institutional benefits of the German setting are reinforced by an innovative design feature of our study. We control for the general disclosure behavior of a firm based on proprietary data of the German yearly annual report competition of 'Manager Magazin'. This allows us to analyze the incremental tax reporting disclosure choice over the general disclosure policy of a firm more precisely than past studies.

We find that greater TDCF usability uncertainty is related to the voluntary disclosure of TDCF information. We find, for example, that the disclosure score is on average 3.86 points higher for firms with a strong loss history vis-à-vis firms without

such a loss history. This positive association is economically meaningful, since the sample mean for the disclosure score is 8.88 (median 7.5). The finding qualitatively holds for both signals of uncertainty, historic and future, and suggests that firms use their TDCF disclosure to guide users with TDCF information. A placebo test in which we use the annual report disclosure quality instead of the TDCF disclosure score yields mainly insignificant results, suggesting that firms' disclosure choices are TDCF specific. Our findings are further corroborated in tests with an alternative measure for uncertainty based on tax planning opportunities, derived from McGuire et al. (2016). Moreover, the results are robust to a battery of sensitivity tests, including a two-stage estimation to address endogeneity concerns and an exogenous uncertainty shock.

In additional tests, we break down the disclosure score into subcategories to explore the characteristics (content and type) of disclosure behavior. First, our findings reveal a systematic pattern in disclosure behavior related to content, contingent on the uncertainty signal. In instances of historic uncertainty, firms exhibit increased reporting on the reasons and mechanisms (e.g. effect on current year's income) behind changes in TDCF. Conversely, in the case of future uncertainty, they increase disclosure related to valuation allowance information.⁴ Further, firms provide additional unsystematic information under both uncertainty signals. Second, firms seem to apply specific disclosure types under uncertainty. Firms provide more detailed information on TDCF items and enhance visibility through the use of tables under both uncertainty signals. In summary, our results suggest that firms adjust their TDCF disclosure based on the prevailing situation, encompassing considerations of both content and ease of processing.

We contribute to the literature in several ways. First, we advance the understanding of firms' strategic tax disclosure by providing insights into firms' disclosure behavior for TDCF, an economically important tax item with the unique nature of complex forward-looking information elements. Our analyses support and extend findings of increased voluntary tax-related disclosure in the case of high information asymmetry (Balakrishnan et al. 2019; Chen et al. 2023) and, in a broader context, voluntary disclosure as a response to financial statement complexity (Guay et al. 2016). Second, we add to the research on TDCF-related items. Extending evidence that mandatory items provide signals about future tax payments (Flagmeier 2022), we document that firms complement these mandatory items with additional voluntary guidance. These findings advance the understanding of tax disclosure decisions and tax footnote heterogeneity (e.g., Kvaal and Nobes 2013; Smith Raedy et al. 2011). We document how firms cater to the expected shareholders' information needs about TDCF, contingent on the uncertainty signal, and thus we connect with Dreher et al. (2024) who investigate the predictive ability of certain disclosed TDCF information. However, our study does not delve into whether accounting for the nuanced heterogeneity in the content and type of voluntary disclosure could improve the prediction of earnings or cash flows. Third, we extend the emerging literature that performs textual analyses of tax information (e.g., Hutchens 2017; Inger et al.

⁴ While the deferred tax recognition under IAS 12 does not use the concept of valuation allowance (in contrast to US GAAP), many firms voluntarily provide valuation allowance information.

2018) by introducing a disclosure score that captures the content and type of TILCF information. Our disclosure measure allows us to model disclosure decisions more precisely and to distinguish between the content and type of disclosure to overcome limitations of current natural language processing techniques. The complexity of accounting for TILCF provides ample opportunities for voluntary disclosures. At the same time, such information is not easy to collect, present or comprehend, which provides a unique setting with an unclear cost–benefit balance. Hutchens (2017) identifies disclosure characteristics that improve analysts’ understanding of the tax footnote and emphasizes the need for more research examining how disclosure characteristics affect users’ ability to process tax information. Our findings improve the understanding of the content and type of voluntary disclosure (e.g., Chen et al. 2017; Li 2010; Loughran and McDonald 2016). In particular, it appears that firms tailor the substance of TILCF-related voluntary disclosure to meet the anticipated demand for information by providing content that is more readily understandable, such as presenting it in a tabular format. Our findings could offer valuable insights for investors in different jurisdictions that adopt IFRS, particularly those where deferred tax assets are similarly regarded as less value relevant.

2 Setting and Hypothesis Development

2.1 Setting

Firms can communicate private information about TILCF value via the recognition of deferred taxes for TILCF. For the recognition of deferred taxes, both IAS 12 and the US-GAAP Accounting Standards Codification (ASC) 740 require taxable profit in the future.⁵ Hence, the amount of recognized deferred tax assets for TILCF is a signal of management’s earnings expectations. However, Chluddek (2011) and Flagmeier (2022) examine German firms and do not find value relevance of deferred tax assets for TILCF. In a similar setting Dreher et al. (2024) show that mandatory TILCF items do not improve predictive ability regarding future performance. These findings suggest that deferred tax assets for TILCF are not informative in certain settings and raise the question whether firms anticipate a stakeholder demand for information and use an alternative channel—the voluntary disclosure of additional, yet complex information in the notes—to reduce information asymmetries. While our setting allows an improved identification due to the potentially high demand for information, mandatory TILCF disclosure requirements may not fully address investors information needs and leave room for firms’ voluntary disclosure also in other settings. The FASB’s Proposed Accounting Standards Update on Income Taxes (FASB 2019), for example, discusses additional disclosure requirements for TILCF to enhance the information environment on this important topic.

⁵ For institutional differences in accounting for deferred tax assets under both regimes, see, e.g., Flagmeier (2022).

2.2 Hypothesis

Theoretical studies that analyze the value relevance of TILCF include De Waegenaere et al. (2003) and Sarkar (2014), both highlighting the ability of TILCF to reduce future tax payments. In line with this notion, empirical studies on US and Australian data mostly find a positive association between newly generated TILCF and stock returns (Amir and Sougiannis 1999; Chang et al. 2009; McGuire et al. 2016). Without offsetting options, the TILCF is worthless and can be interpreted as a signal for further losses in future periods (Amir and Sougiannis 1999). Investors can be assumed to be particularly interested in TILCF information when it is not obvious which of the two scenarios applies, i.e., when there is uncertainty about the usability of the TILCF. Disclosing information that goes beyond mandatory disclosures, for example, reasons for changes in the amount of TILCF or when and why the firm expects to use the TILCF, can be a way for firms to reduce this uncertainty.

Nevertheless, there are at least four reasons why firms might not disclose this information. First, gathering and editing the information is costly. Usually, firms derive tax information from single-entity tax returns, often from different jurisdictions. Aggregating this information at the group level can be a challenging task. According to researchers and practitioners, tax footnotes are very complex and costly to produce (PwC 2012; Smith Raedy et al. 2011). In particular, the recognition of deferred tax assets is a controversial issue under both IFRS and US-GAAP. According to Petree et al. (1995), the recognition of deferred tax assets is probably “the most complex and subjective area of Financial Accounting Standards Board Statement no. 109” (p. 71). Anecdotal evidence highlights the difficulties firms face in estimating the amount of TILCF for the consolidated statement. Deutsche Post DHL states in their annual report for 2011 that a “... refined method for determining unused TILCF was applied for the first time as at the current balance sheet date. The prior-period amounts were adjusted” (p. 184). The adjustment of the prior period’s unused TILCF amounts to 2.4 billion euros, which can be expressed as six percent of the firm’s total assets. This example illustrates that firms need sophisticated methods to determine the amount of TILCF at the group level, implying costs for the creation of the tax footnote.⁶

Second, the provision of detailed tax information can reveal insights into firm performance (Lenter et al. 2003) and help estimate firms’ tax returns (Kvaal and Nobes 2013). These insights can involve proprietary costs (Verrecchia 1983) and costs from stakeholder reactions, e.g. scrutiny of enforcement bodies (Bozanic et al. 2017; Flagmeier et al. 2023). In the TILCF context, sensitive information can for example be details on the TILCF amounts and expiration dates in different subsidiaries. Subsidiary level information is generally associated with proprietary costs as it could be a proxy for tax avoidance behavior if tax-haven activities are revealed (Dyregang et al. 2016). In line with this notion, we find only very few examples of

⁶ While the amount of unused TILCF is a mandatory disclosure and not counted for our voluntary disclosure score, the example indicates the general difficulties that firms have in gathering information about TILCF at the group level. Considering that this holds for mandatorily required amounts, it is likely that the difficulties are even more severe for granular additional information that firms disclose voluntarily.

firms disclosing region-specific TILCF information.⁷ Further, Bozanic et al. (2017) find that Internal Revenue Service (IRS) attention to tax positions is positively associated with TILCF, indicating that tax authorities are generally interested in this item.

Third, once certain information is disclosed voluntarily auditors and stakeholders expect such disclosures also in future years. The principle of consistency of accounting choices (IAS 8.13) renders the disclosure costly since any future deviation needs to be substantiated and might raise stakeholders' concerns. Thus, the requirement to disclose such information continuously may cause preparation and proprietary costs.

Fourth, if investors deem voluntarily disclosed TILCF information as not valuable, particularly in predicting future earnings or cash flows (as indicated by Dreher et al. 2024), the effective demand for such information may diminish. Hence, firms may refrain from responding to uncertainty signals by increasing voluntary disclosure. In fact, there might be a tendency to reduce disclosures overall, as the perceived benefits of providing additional TILCF-related information seem diminished. In sum, capital market pressure can incentivize firms to increase their disclosure in the case of uncertainty, but they also have to consider the costs. We analyze whether firms expect a net benefit and therefore increase their disclosure for uncertain TILCF, and we pose the following hypothesis:

Hypothesis 1. *The level of voluntary disclosure is positively associated with uncertainty about the usability of TILCF*

3 Research Design

3.1 Sample

To investigate the financial statement disclosure of TILCF, we employ a sample of hand-collected data from annual reports' notes on income taxes. Further firm-specific accounting information is obtained from Refinitiv's Worldscope and the IB/E/S database. Our sample comprises financial statements of listed DAX-30 and M-DAX firms over fiscal years 2005 to 2016 that are prepared in accordance with IFRS. Our sample period ends in 2016 because one of our main control variables (*AR_DISCL*: a disclosure score of the annual report content quality to control for the overall disclosure quality of a firm; for details, see the *Model* section) is no longer available after 2016. DAX-30 and M-DAX include the 80 largest and most liquid firms on the German stock market, based on free float market capitalization and exchange turnover.⁸ Moreover, the information environment (e.g., disclosure requirements,

⁷ If anything, firms report TILCF information at aggregate levels, e.g. 'Germany' and 'abroad' (e.g. the annual report of BASF 2014). A notable exception is SGL Carbon, disclosing, for example, in the annual report 2014 the TILCF amounts per country and the respective expiration periods.

⁸ We consider firms that are DAX-30 and M-DAX members on an arbitrary date: April 30, 2010. German firms listed on an EU-regulated market were required to adopt IFRS in their consolidated statements for each fiscal year beginning on or after January 1, 2005. An exception applies to firms that already used

Table 1 Sample Overview
(Years 2005–2016)

	Firms	Observations
DAX-30	30	
M-DAX	50	
	80	960
Non-IFRS		-17
Annual report availability		-38
Missing data for:		
<i>AR_DISCL</i>		-100
<i>ΔDTA_TLCF</i>		-35
Other variables		-47
<i>Total</i>	79	723

This table presents the sample selection process. The firms are selected based on the DAX-30 and M-DAX index composition on an arbitrary date (April 30, 2010)

investor relations, visibility, analyst following) is rather homogeneous for firms in these market segments in comparison to other German stock-listed firms. We exclude 17 non-IFRS observations and lose 38 observations due to a lack of availability of annual reports. Furthermore, the sample is reduced by 183 observations with missing data, resulting in a final sample of 79 firms with 723 firm-year observations. Of these 723 observations, we can infer from the collected data that at least 721 firm-years have TLCF.⁹ Our sample selection is detailed in Table 1.

3.2 Disclosure Level

To investigate the voluntary disclosure level, our measure captures all information that is provided beyond mandatory IAS 12 requirements.¹⁰ To measure disclosure, prior studies sometimes use a disclosure index (e.g., Chen et al. 2017; Chow and Wong-Boren 1987; Makhija and Patton 2004; Raffournier 1995) that compares an expected or preferred list of items to the effectively disclosed figures and aggregates the results to a score. We do not want to restrict the collected data to a predefined set of items, and we want to avoid the subjectivity involved in setting up a list of disclosures. Thus, we employ a disclosure score based on the number of *all* voluntary TLCF disclosures weighted by their quality of presentation. While all items are considered in our disclosure score, we record the content of each item

internationally accepted standards such as US-GAAP; they were allowed to postpone the adoption of IFRS until the financial year 2007 (European regulation (EC) 1606/2002). We exclude the respective US-GAAP statements from our sample.

⁹ In the tax footnotes of 721 of our 723 firm-year observations, we find either deferred tax assets recognized for TLCF or, in 23 cases where the amount is zero, other information indicating the existence of TLCF (including the total amount of TLCF for 21 observations, the nonusable TLCF for one observation, and the deferred tax effect due to unused tax losses for one observation). There are only two observations with zero deferred taxes for TLCF and without other evidence for the existence of TLCF, indicating that no TLCF exists for these two firm-years.

¹⁰ See Appendix A for the distinction between mandatory and voluntary information.

Table 2 Disclosure Subcategories: Type of Disclosure**Panel A:** Scale

Score	Type of Disclosure
0.5	Qualitative
1	Comparative
1.5	Interval
2	Quantitative
+1.5	Additional Information
+1.5	Using Table/Graph

Panel B: Examples

Score	Type of Disclosure	Examples of Disclosed Information
0.5	Qualitative	The firm has TLCF
1	Comparative	This year, the firm's TLCF are higher than in the previous year.*
1.5	Interval	The firm's TLCF are usable within the next five to ten years
2	Quantitative	This year, the firm's TLCF increased by 5 Mio EUR
3.5	Quantitative+ Additional Information	This year, the firm's TLCF increased by 5 Mio EUR, resulting primarily from restructuring in the XY subgroup

We assign a score based on the scale in panel A for every voluntary TLCF information and add up all scores for one firm-year to calculate our dependent variable *DISCL*, as shown in Fig. 1. Panel B shows examples of how the scale is applied

*This is only a hypothetical example. We did not find a disclosure in the financial statements that was classified as comparative. All other examples are (slightly modified) extracts from financial statements' notes of our sample firms. For more examples see Appendix C

and classify them into different content groups, enabling us to analyze each content category separately in additional tests. This approach provides detailed insights into firms' disclosure behavior without restricting the scope of the analysis.

We measure the quality of presentation because prior research indicates that financial statement users rely on readily available and salient information (e.g., Huang et al. 2018; Miao et al. 2016). Hirst and Hopkins (1998) find that alternative presentations of the same information affect analysts' firm valuation judgments differently. Furthermore, Atwood and Reynolds (2008) document that the pricing of realized tax benefits from TLCF is affected by its presentation in income statements. Taken together, the way in which information is presented is important for the information processing of financial statement users. It can be assumed that clearer and more salient disclosure is easier to process and thus is preferred by analysts and investors.

Hence, to measure the quality of tax disclosure, we examine the way in which an item is presented.¹¹ We apply a scale developed for the German 'Best Annual Report' competition and used by a number of prior studies, e.g., Daske (2005) and Glaum et al. (2013). Disclosed items are analyzed and scored according to their level of detail and form of disclosure, which we summarize as disclosure type.

¹¹ We emphasize that our method does not weigh the content of the disclosure. Again, we want to avoid the subjectivity of evaluating the usefulness of disclosure, which would involve judgment and make the findings hard to replicate (Healy and Palepu 2001).

Disclosure Content	Item	Disclosure Type	Value	<i>DISCL</i> score for a single TLCF item
Basic TFCF Information	0	Qualitative	0	
Changes and Effect on Income	1	Comparative	0	
Valuation Allowance Information	0	* Interval	* 0	= 3.5
Others	0	Quantitative	2	
		Additional Detail	0	
		Table	1.5	

Fig. 1 Construction of Disclosure Score *DISCL*. *Notes:* This figure presents an example for the construction of the disclosure score *DISCL*. It is an outcome of multiplying the two disclosure subcategories content and type of disclosure. The score is calculated for each voluntary TFCF item and the sum of all scores per firm-year is the dependent variable *DISCL*. Details for the subcategory content are provided in Table 3 and for the subcategory type of disclosure in Table 2

A higher score is assigned if an item is a precise number vs. an interval or qualitative information. The degree of quantification is commonly used in recent literature to assess the readability or salience of disclosure (e.g., Huang et al. 2018; Lundholm et al. 2014) and the assignment of a higher score for a higher quantification degree reflects the enhanced usefulness, in line with prior evidence on investors' limited attention and processing costs (e.g., Blankespoor et al. 2020; Miao et al. 2016). Table 2 panel A provides an overview of the scale, and panel B and Appendix C give examples of how points are assigned. We apply the scale to every voluntary TFCF item to account for disclosure type.¹² We then add the scores of the same year and firm to obtain one score for each firm-year observation. The resulting score is our dependent variable *DISCL*, as presented in Fig. 1.

¹² If mandatory items are disclosed with additional information, we classify the additional information as voluntary disclosure. For example, Merck (annual report 2014, p. 198) discloses the deferred tax assets for TFCF (mandatory) and splits it into the amount based on German TFCF and TFCF from abroad (voluntary, score: 1.5).

3.3 Uncertainty About the Usability of TLCF

The usability of TLCF depends on the availability of sufficient taxable income in future years. Our definition of uncertainty about this usability is derived from IAS 12.34: deferred tax assets “shall be recognized for the carryforward of unused tax losses [...] to the extent that it is probable that future taxable profit will be available against which the unused tax losses [...] can be utilized”. Hence, the expectation of future taxable profits is one of the key criteria to assess the value of TLCF. Another important aspect is the existence of a “history of recent losses” (IAS 12.35), which potentially increases the uncertainty about future taxable income. Firms are supposed to consider both factors in their recognition of deferred tax assets for TLCF, and we propose that investors rely on similar criteria to derive the value of TLCF. Based on these criteria, we derive two groups of indicators of TLCF usability uncertainty: future indicators related to the expectation of future income and historic indicators based on a recent history of losses.

3.3.1 Future Indicators

The future indicators of TLCF usability uncertainty measure different aspects of the ratio of TLCF to expected earnings. The best available proxy of future earnings is analysts’ earnings forecasts.¹³ For our main uncertainty measure, we compare expected earnings with the amount of usable TLCF. We investigate three possible cases: I) forecasts and carryforwards are close to each other, II) forecasts are considerably higher than carryforwards, and III) forecasts are considerably lower than carryforwards.

We expect uncertainty to be particularly high in the first case (I), when the amounts are close to each other, because minor deviations of earnings from a forecast can lead to the unexpected offsetting or non-offsetting of the TLCF. In this situation, we expect that investors demand more information about the TLCF. In contrast, if forecasts far exceed carryforwards (II), there is little doubt that the TLCF can be used, and additional disclosure is less necessary. If, on the other hand, carryforwards largely exceed forecasts (III), the prediction is less clear. Two different scenarios can apply. If the forecast is smaller than the TLCF and negative, it is very likely that the TLCF cannot be offset in the near future, and there is little uncertainty about usability. In contrast, if the forecast is smaller than the TLCF and positive, part of the TLCF is usable, but for the remaining part of the TLCF, usability is hard to predict. In this second scenario, uncertainty increases. Since our subsample of case (III) does not include any observations with a negative forecast, we are limited to testing the second scenario of case (III) and anticipating an increased demand for information regarding TLCF.

As a basis for our future indicators, we use the last mean earnings before tax (EBT) analyst forecast for year $t+1$, issued before the end of fiscal year t , provided

¹³ Investors ideally know TLCF and predictions of taxable income by entity. Absent such information consolidated earnings is the best indicator about profitability available.

by I/B/E/S.¹⁴ At this point in time, financial statement notes for period t are not available and cannot affect the forecast, reducing concerns about reverse causality.¹⁵ Moreover, this forecast is available for all observations in our sample. The amount of TLCF is not available in standard databases and must be hand-collected from tax footnotes. However, IAS 12 does not require the disclosure of this amount, and only 16% of our observations disclose it voluntarily. Thus, we calculate TLCF by grossing deferred tax assets recognized for TLCF. If the tax rate is disclosed, we divide deferred tax assets for TLCF by the tax rate that the firm uses to calculate deferred taxes; otherwise, we divide it by the (average) statutory tax rate as stated by the firm.¹⁶

Based on the forecast and the TLCF, we calculate the difference between the two amounts. For case (I), we partition the differential amount into deciles and identify the two deciles that are closest to zero (the total range of the two deciles combined is -0.628 to 0.030 Bn €). We create an indicator variable, $AEF \approx TLCF$, that has a value of 1 if the difference lies in these two deciles. We expect $AEF \approx TLCF$ to have a positive association with disclosure because uncertainty increases when forecasts are close to TLCF. For case (II), we create a second indicator variable, $AEF > TLCF$, that has a value of 1 when earnings forecasts are higher than TLCF and the difference is not included in the two deciles around zero. We expect a negative relation because less disclosure is needed when the forecast is considerably higher than the TLCF. For case (III), our third indicator variable, $AEF < TLCF$, has a value of 1 when the amount of TLCF is higher than the forecast and the difference does not lie within two deciles around zero. We expect a positive association for $AEF < TLCF$.

Another factor to consider in assessing uncertainty is the dispersion of forecasts. Large variation in forecasted earnings indicates disagreement between analysts and complicates the assessment of TLCF usability for an investor. Therefore, our fourth future indicator, $STDEV$, measures the standard deviation of the last mean EBT forecast for the following fiscal year, scaled by the absolute value of the last mean EBT forecast (AEF). We expect a positive association because higher dispersion of analyst forecasts induces uncertainty for investors and thus increases the demand for disclosure.

¹⁴ Our proxy is indicative of the actual information environment and functions more as a signal with noise for investors rather than a precise estimate. Such a simple signal may trigger investor demand for more information and may be anticipated by the firm, which is the primary focus of our analysis. Mechanically, our proxy based on consolidated accounts overstates the usability of TLCF and underestimates the inherent uncertainty, potentially biasing against our findings. To further validate the robustness of our arbitrary one-year forecast horizon, we conduct additional analyses using two-year forecasts, with results presented in Sect. 5.3, yielding similar outcomes.

¹⁵ However, if the reporting behavior within firms is relatively stable, we cannot discard the possibility that the expected disclosure in t (based on the disclosure in $t-1$) affects the uncertainty variables in t .

¹⁶ A comparison of the calculated amounts with the disclosed TLCF amounts (when they are provided) yields an average deviation of 5.79%. Despite the low deviation, we employ a number of robustness checks to test the sensitivity of our findings. If we use the amount of TLCF as disclosed in the annual report when it is available and use the calculated amount otherwise, we find qualitatively unchanged results. Further robustness tests are provided in Sect. 6.

3.3.2 Historic Indicators

The role of historic indicators is twofold. First, they indicate whether a firm has any information to disclose about TLCF. Without prior negative earnings and accordingly without TLCF, no information about this item can be disclosed. Although nearly all of our sample firms have TLCF (see Footnote 9 for details), it seems plausible that a firm has more to tell about TLCF and that this information is more relevant if the loss emerged in the recent past than if TLCF resulted from negative earnings ten years ago. Accordingly, we expect a higher level of disclosure if a firm had losses in recent years, indicating more disclosure if more information is available and if it is more relevant. Nevertheless, a firm still must decide whether to publish the information in light of the incentives and costs discussed above. Second, the historic indicators are alternative proxies for uncertainty. Hayn (1995) finds that losses are less informative about future earnings than profits are. Hence, it is harder to assess the usability of TLCF if a firm has a recent loss since future earnings are harder to predict. Based on the literature, we expect higher uncertainty and hence higher disclosure if a firm has a history of recent losses.

We use three different historic indicators. The first indicator variable, *LH_5Y*, measures whether a firm had at least one negative EBT in the past five years. The second variable, *LH_CUM*, is based on the accounting standards' definition of a loss history and is more restrictive than the first proxy: the variable has a value of 1 if a firm has a cumulative negative EBT in the current and the two previous years.¹⁷ Hence, only very large losses are considered here. The third measure, *N_LOSS*, counts the years with negative EBT in the past five years and ranges from zero to five. For all historic indicators, we expect a positive association with *DISCL* because the existence and a higher frequency of losses should increase uncertainty and hence disclosure.

3.4 Model

To analyze the association between disclosure and uncertainty, we estimate the following regression model:

$$DISCL_{it} = \beta_0 + \beta_1 UNCERTAINTY\ INDICATOR_{it} + \sum \beta\ control_{it} + \varepsilon_{it} \quad (1)$$

where firms are identified by *i* and years by *t*. Detailed variable definitions are presented in Appendix B. *UNCERTAINTY INDICATOR* represents the individual *FUTURE INDICATORS* (*AEF*≈*TLCF*, *AEF*>*TLCF*, *AEF*<*TLCF*, and *STDEV*) or one of the *HISTORIC INDICATORS* (*LH_5Y*, *LH_CUM*, or *N_LOSS*). We estimate the model separately for each of our indicators.¹⁸

¹⁷ As IAS 12 does not define a loss history, we use the US-GAAP definition of ASC 740.

¹⁸ Given that the historic indicators not only serve as alternative proxies for uncertainty but also indicate the availability and relevance of TLCF information that can be disclosed, we include one of the historic indicators in each of our *FUTURE INDICATOR* models to control for the opportunity to disclose in untabulated tests. Our inferences are not affected.

A common concern in disclosure research is that specific financial statement disclosures simply reflect a firm's overall disclosure behavior. We can address this concern in our one-country setting by employing a unique dataset. Our research design includes a proxy for the annual report disclosure quality (*AR_DISCL*). This is an important control variable, as it is a measure for the general (TLCF-unrelated) disclosure behavior of a firm. The score is based on the German yearly annual report competition of 'Manager Magazin' (the same as the scale for our dependent variable *DISCL*). For this competition, every year since 1995, the annual reports of large German listed companies are analyzed with respect to content, design, and language by an expert research group of the University of Münster. Therefore, points are assigned with a checklist including more than 300 criteria grounded in theory which has been compiled based on several surveys of fund managers, financial analysts, auditors, and private investors (Glaum et al. 2013). The criteria refer to different parts of the annual report, including reports that are mainly reflecting past events (e.g., the notes) and parts with forward-looking information, such as the management report. The experts examine whether the information is reported, in how much detail it is reported, and what kind of disclosure it is (comparative, qualitative etc.) and aggregate the assigned points to a summary score. We use the results of the 'annual report content' category for which the scores range from zero to 100 (100 denotes the highest level of content quality).¹⁹ The score is divided by 100, resulting in a score between zero and one for our variable *AR_DISCL*, with a higher score indicating higher quality of content. The advantage of using this well-established score (Daske 2005; Glaum et al. 2013) instead of, for example, the length of the annual report is that it incorporates the same disclosure characteristics for the full annual report that we study for TLCF, i.e., content and disclosure type. Further, it is a comprehensive and time-variant measure of a firm's disclosure quality, capturing potential firm-specific strategies and incentives.

Our other firm specific control variables are derived from the disclosure literature and the specific characteristics of TLCF. The first is ΔDTA_{TLCF} , denoting the change in deferred tax assets for TLCF. This item can indicate management's earnings expectations because international accounting standards allow the recognition of deferred tax assets only if sufficient future taxable income is likely to be available. However, whether a change in deferred tax assets increases or reduces the voluntary disclosure level is unclear. An increase in deferred tax assets for TLCF can, on the one hand, indicate new TLCF and hence the opportunity to disclose more information. On the other hand, an increase can indicate improved earnings expectations that result in the recognition of deferred tax assets on existing TLCF.

¹⁹ Scores for the periods 2005 to 2012 and 2014 to 2016 are obtained from 'Manager Magazin' or are provided directly by the Baetge research group. For 2013, the annual report contest was not carried out; therefore, we use data from an alternative contest, 'Investors' Darling', which is organized by the Chair of Accounting and Auditing at the Leipzig Graduate School of Management (HHL). The data are available online (ID 2020) and start in 2013. We use the scores in the 'reporting annual report' category, which also range from zero to 100. To ensure the two rankings are comparable, we examine the yearly correlation of the scores for the overlapping years 2014 to 2016. We find a positive and significant (at least at the five percent level) Spearman correlation of between 0.38 and 0.40. If we instead drop all observations for 2013 (59 observations), the results are qualitatively unchanged.

In both scenarios, it is not obvious whether or how new deferred tax assets affect uncertainty about TLCF usability and hence the voluntary disclosure level. We calculate ΔDTA_TLCF as the change in deferred tax assets for TLCF from the previous to the current year, scaled by total assets and (for ease of exposition) multiplied by 100. The second control variable indicates whether the firm has negative earnings in the current year. A current loss can increase existing TLCF and draw more attention to the topic, possibly increasing disclosure. The indicator variable *LOSS* has a value of 1 if the firm has a negative EBT in the current year and zero otherwise. Analyst following (*AN_FOL*) (e.g., Lang and Lundholm 1996) proxies for the information environment of a firm and supports governance mechanisms through information dissemination. Moreover, it may also capture whether TLCF information is publicly available beyond annual report disclosures. Furthermore, previous research indicates a significant association between the level of disclosure and firm size (*SIZE*) (Cooke 1989; Craig and Diga 1998), leverage (*LEV*) (Ismail and Chandler 2005; Meek et al. 1995), profitability (ΔEBT) (Broberg et al. 2010; Singhvi and Desai 1971), audit firm (*AUD*) (Singhvi and Desai 1971), and CEO turnover (*CEO_TO*) (Kwak et al. 2011). In addition, we control for experience with accounting regulations by measuring the number of years that have passed since the firm adopted IFRS/IAS (*IFRS_AD*).²⁰ To control for other unobserved effects, we include year and industry fixed effects (one-digit Standard Industrial Classification (SIC) code).²¹

4 Firms' Disclosure Choice

4.1 Descriptive Results

To assess disclosure, we first investigate the content of the TLCF information in annual reports' notes. We identify 15 different voluntary items. Table 3 gives an overview of the items and the frequency of these disclosures. Each item appears in several firm-years, and the column "Absolute" presents the number of observations that disclose the item. The column "Percent of Total Observations" puts this number in relation to the total number of 723 observations.

The most frequent disclosure is the effect of TLCF on tax reconciliation in 52% of all annual reports. In addition, 43% of the observations disclose the total amount of TLCF, which is comparable to 51.7% in Dreher et al. (2024, p. 11). Four other voluntary disclosures are reported in at least 30% of statements: the expiration date of total TLCF, deferred tax income/expenses recognized in the current year's income statement due to unused TLCF, valuation allowance for deferred tax assets on TLCF, and distinction between corporate tax loss and trade tax loss. To group the different items, we divide the voluntary disclosures into four subcategories. The first contains basic information about TLCF, i.e., amount and expiration date. The

²⁰ Our starting point for this variable is 1995; i.e., if a firm adopted IFRS (or IAS) before 1995, this variable understates experience with the standards. However, given that many standards changed over time, we do not expect experience in the early adoption years to bias this variable.

²¹ If we include industry \times year fixed effects instead, our results are qualitatively unchanged.

Table 3 Disclosure Subcategories: Content

		No. of Observations Disclosing the Item	
		Absolute	Percent of Total Observations (%)
<i>Basic TLCF Information</i>	Total amount of recoverable TFCF	119	16
	Expiry date of recoverable TFCF	63	9
	Total amount of TFCF (recoverable and not recoverable)	314	43
	Expiry date of total TFCF	234	32
<i>Changes and Effect on Income</i>	Explanation for changes in TFCF or deferred tax assets for TFCF	175	24
	Income/tax effect of using TFCF	106	15
	Deferred tax income/expense recognized in the current year's income statement due to unused TFCF	217	30
<i>Valuation Allowance Information*</i>	Valuation Allowance for deferred tax assets on TFCF	221	31
	Income effects of changes in TFCF valuation allowance	52	7
	TFCF for which a valuation allowance is recognized	25	3
	Amount of deferred tax assets for TFCF which have not been recognized	189	26
<i>Others</i>	Effect of TFCF on tax reconciliation	375	52
	Distinction between corporate tax loss and trade tax loss	226	31
	Reference to minimum taxation	95	13
	Other disclosures	170	24

This table presents the different voluntarily disclosed TFCF items, grouped into four content categories. The column 'Absolute' provides the number of observations that disclose the respective item, the column 'Percent of Total Observations' shows this number relative to the total number of observations (723). Each observation can disclose zero, one, or several items, hence the percentages do not add up to 100

*In contrast to US GAAP, IAS 12 does not require the disclosure of a valuation allowance but instead the amount of unusable TFCF. However, many firms voluntarily provide valuation allowance information

second category comprises items that explain why or to what extent TFCF (or the recognized deferred taxes) have changed, have been used or have affected the current fiscal year's income. The third group gives information about valuation allowances and deferred taxes that have not been recognized. Any other kind of disclosure is included in the fourth category. We further analyze the four categories by estimating our main model separately for each of the disclosure categories. Details are outlined in the subcategory regression section.

Next, we present several figures that describe our aggregate disclosure variable *DISCL*. Figure 2 shows the development of the 25th percentile, the mean, and the 75th percentile of *DISCL* over our sample period 2005 to 2016. The graph shows no clear trend but indicates that the disclosure behavior varies over time. Further, the large range between the 25th and 75th percentile is an indicator for a substantial cross-sectional dispersion of the *DISCL* variable in the respective year. To explore

the within-firm dispersion of *DISCL*, a histogram in Fig. 3 presents the frequency of each sample firm's standard deviation of the disclosure score. The bin width is one unit of the within-firm standard deviation of *DISCL*. The graph illustrates that the vast majority of firms have a standard deviation between zero and three; the average within-firm dispersion is 2.22. This finding indicates a modest change of voluntary disclosure within firms over time and corroborates our earlier argument in the hypothesis development section on the quasi-mandatory continuity of disclosure choices.

Figure 4 shows boxplots of the disclosure score *DISCL* for the three uncertainty indicators that compare the earnings forecasts and TLCF: $AEF \approx TLC$, $AEF < TLC$, and $AEF > TLC$. The figure indicates the highest disclosure score if earnings forecasts and TLCF are close ($AEF \approx TLC$) with respect to the upper adjacent value and the outside values. We expect this variable to capture a situation with high uncertainty. The lowest disclosure scores are visible for $AEF > TLC$, which we assume to signal a low level of uncertainty.

Table 4 presents summary statistics, and Table 5 presents a Spearman correlation matrix. The average voluntary disclosure score per year and firm (*DISCL*) amounts to 8.88 with a median of 7.5 and a range from 0 to 42. Approximately 18% of our observations have a difference between forecasts and carryforwards close to zero ($AEF \approx TLC$), 10% have a carryforward surplus ($AEF < TLC$) and 72% have a substantively higher forecast than TLCF ($AEF > TLC$). Approximately 8% of observations have a dominating loss in the current three-year period (*LH_CUM*), and

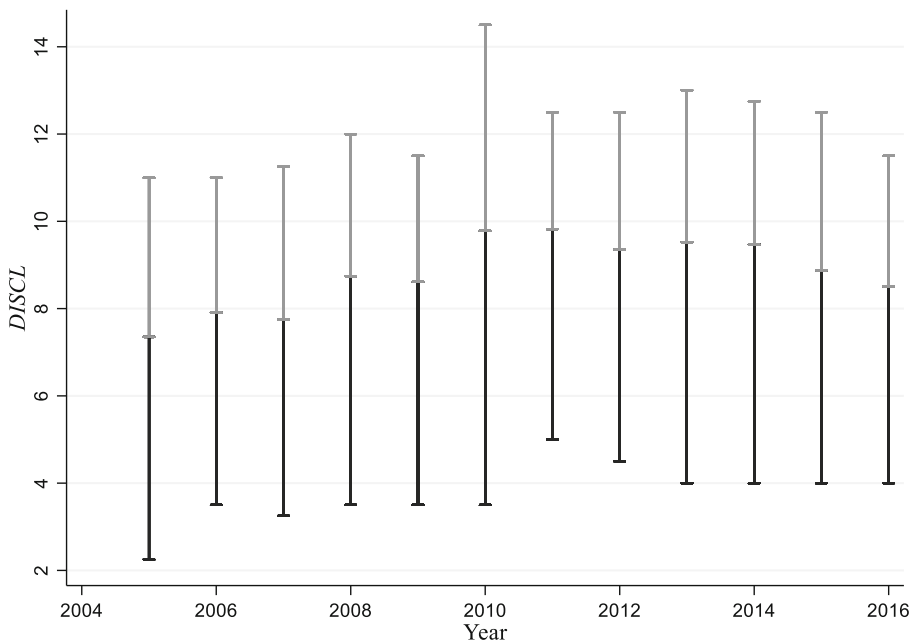


Fig. 2 Distribution of the Disclosure Score *DISCL* over Time. *Notes:* This figure presents the 75th percentile (*upper end*), mean, and 25th percentile (*lower end*) of the disclosure score *DISCL* over our sample period

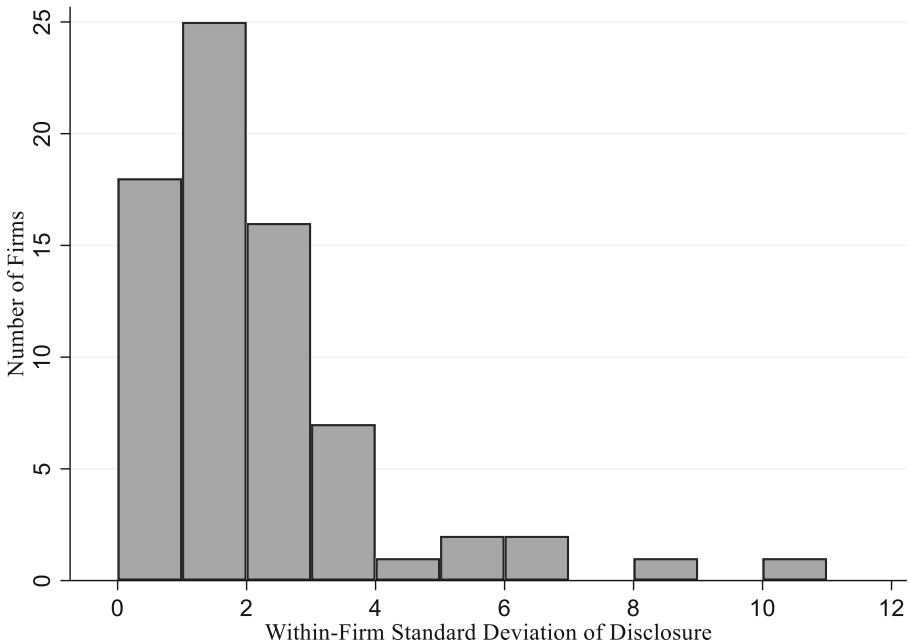


Fig. 3 Frequency of Within-Firm Standard Deviation of the Disclosure Score *DISCL*. *Notes:* This figure presents a histogram for the within-firm standard deviation of the disclosure score *DISCL*. The bin width is one unit of the within-firm standard deviation of *DISCL*

31% have at least one loss in the five previous years (*LH_5Y*). With regard to the control variables, 10% have a loss in the current year, 90% are audited by a Big 4 auditor, and the average annual report disclosure quality score is 0.59. Summary statistics are also presented for the disclosure content subcategories derived from Table 3 and the different types of disclosure as presented in Table 2. The highest average score for content is observable for *BASIC* information with 2.78 and a maximum of 16. The subcategories for disclosure type show that *QUANT* has the highest average score with 3.54, followed by *DETAIL* with 3.18.

The correlation matrix indicates a positive and significant association of *DISCL* with the uncertainty variables and a negative association with *AEF > TLCF*, which represents lower uncertainty. These correlations provide preliminary support for the hypothesized increase in *TLCF* disclosure under *TLCF* usability uncertainty.²²

²² The matrix shows some very high and significant correlations, for example, between *SIZE* and *AEF* (0.866) and between *N_LOSS* and *LH_5Y* (0.984). However, these correlations do not create multicollinearity concerns, as the respective variables are not simultaneously included in our models.

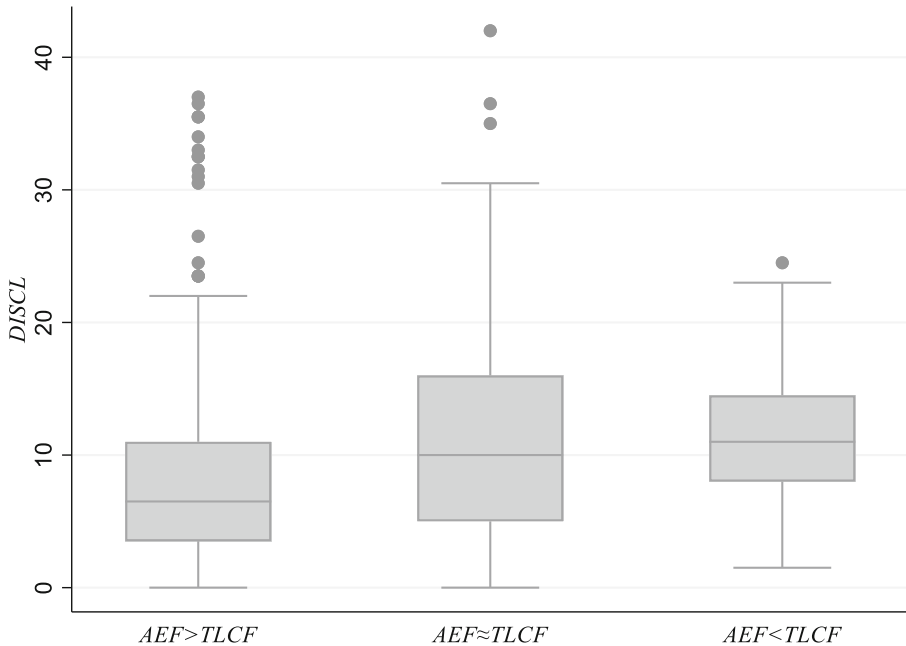


Fig. 4 Disclosure Boxplot. *Notes:* This figure presents boxplots for the disclosure score *DISCL* over the three *FUTURE INDICATOR* variables $AEF > TLCF$, $AEF \approx TLCF$, and $AEF < TLCF$

4.2 When Is Additional TLCF Information Disclosed? Disclosure Score Regression Results

We estimate a pooled cross-sectional regression with standard errors clustered by firm (reported in parentheses).²³ Panel A of Table 6 gives an overview of the results for the *FUTURE INDICATORS* in columns I–IV; panel B shows columns V–VII with the different *HISTORIC INDICATORS*. Year and industry fixed effects are included in all models but are not reported. Consistent with our expectations, $AEF \approx TLCF$ and the dispersion of earnings forecasts measured by *STDEV* have significant coefficients with a positive sign. The results indicate that firms disclose on average more information when TLCF usability is uncertain because TLCF is close to earnings forecasts or because it is harder to estimate future earnings. We expect and find a negative and significant coefficient for $AEF > TLCF$, indicating that if TLCF is expected to be offset in the following fiscal year, uncertainty is low and less disclosure is provided. We do not find significant results for $AEF < TLCF$. In columns V–VII (panel B) with the *HISTORIC INDICATORS*, we find positive and significant coefficients for all loss history variables. At this point, we cannot disentangle whether the relation between disclosure and recent losses is driven primarily by the availability

²³ If we estimate a Tobit regression instead of OLS to control for the nonnormal distribution properties of our dependent variable *DISCL*, inferences are not affected.

Table 4 Summary Statistics

	Mean	Median	Std. Dev	Min	Max	N
Uncertainty Regression Main Variables						
<i>DISCL</i>	8.88	7.50	6.76	0.00	42.00	723
<i>AEF</i> (in Bn €)	1.74	0.52	2.60	-0.25	15.90	723
<i>TLCF</i> (in Bn €)	1.26	0.22	2.48	0.00	19.00	723
<i>AEF</i> ≈ <i>TLCF</i>	0.18	0.00	0.38	0.00	1.00	723
<i>AEF</i> < <i>TLCF</i>	0.10	0.00	0.30	0.00	1.00	723
<i>AEF</i> > <i>TLCF</i>	0.72	1.00	0.45	0.00	1.00	723
<i>STDEV</i>	24.70	10.18	238.12	0.21	6268.87	723
<i>LH_CUM</i>	0.08	0.00	0.27	0.00	1.00	723
<i>LH_5Y</i>	0.31	0.00	0.46	0.00	1.00	723
<i>N_LOSS</i>	0.48	0.00	0.87	0.00	5.00	723
Control Variables						
Δ <i>DTA_TLCF</i>	0.01	0.00	0.57	-6.78	3.14	723
<i>LOSS</i>	0.10	0.00	0.29	0.00	1.00	723
<i>SIZE</i>	23.22	22.82	1.85	18.68	28.42	723
<i>AN_FOL</i>	16.51	16.00	6.24	1.00	35.00	723
Δ <i>EBT</i>	0.42	0.05	8.93	-42.32	220.91	723
<i>LEV</i>	0.23	0.22	0.15	0.00	0.75	723
<i>AUD</i>	0.90	1.00	0.30	0.00	1.00	723
<i>IFRS_AD</i>	8.62	8.00	4.31	0.00	21.00	723
<i>AR_DISCL</i>	0.59	0.59	0.09	0.33	0.85	723
<i>CEO_TO</i>	0.06	0.00	0.24	0.00	1.00	723
Disclosure Subcategories						
<i>BASIC</i>	2.78	2.00	3.43	0.00	16.00	723
<i>CH_EFF</i>	1.67	0.50	2.27	0.00	12.00	723
<i>VA</i>	1.76	0.50	2.16	0.00	10.50	723
<i>OTHERS</i>	1.78	1.50	1.70	0.00	11.50	723
<i>QUAL</i>	0.21	0.00	0.34	0.00	2.00	723
<i>QUANT</i>	3.54	4.00	3.14	0.00	16.00	723
<i>INTERVAL</i>	0.61	0.00	1.04	0.00	6.00	723
<i>DETAIL</i>	3.18	3.00	2.42	0.00	13.50	723
<i>TABLE</i>	1.34	0.00	2.02	0.00	10.50	723

This table presents descriptive statistics for the variables from Model (1) and the disclosure subcategories. The subcategories split the disclosure score *DISCL* according to the content (*BASIC*, *CH_EFF*, *VA*, *OTHERS*) and type of disclosure (*QUAL*, *QUANT*, *INTERVAL*, *DETAIL*, *TABLE*). The content subcategories are based on the Table 3, the type of disclosure is based on the scale in Table 2. The sample period is 2005–2016. Detailed variable definitions are provided in Appendix B

Table 5 Spearman Correlation Matrix

	DISCL	AEF	TLCF	AEF≈ TLCF	AEF> TLCF	AEF< TLCF	STDEV	LH_ CUM	LH_SY	N_LOSS	ΔDTA_ TLCF	LOSS	SIZE	AN_ FOL	ΔEBT	LEV	AUD	IFRS_ AD	AR_ DISCL	CEO_ TO
DISCL	1.00																			
AEF	0.190*	1.00																		
TLCF	0.267*	0.702*	1.00																	
AEF≈TLCF	0.128*	-0.336*	0.122*	1.00																
AEF>TLCF	-0.222*	0.102*	-0.434*	-0.749*	1.00															
AEF<TLCF	0.168*	0.275*	0.491*	-0.157*	-0.536*	1.00														
STDEV	0.217*	-0.107*	0.211*	0.297*	-0.387*	0.199*	1.00													
LH_CUM	0.110*	-0.181*	0.071	0.260*	-0.320*	0.146*	0.366*	1.00												
LH_SY	0.156*	-0.082*	0.212*	0.329*	-0.448*	0.249*	0.433*	0.392*	1.00											
N_LOSS	0.171*	-0.110*	0.202*	0.337*	-0.465*	0.263*	0.447*	0.452*	0.984*	1.00										
ΔDTA_TLCF	-0.049	-0.007	0.090*	0.081*	-0.100*	0.046	-0.002	0.004	-0.030	-0.038	1.00									
LOSS	0.043	-0.049	0.099*	0.167*	-0.216*	0.110*	0.282*	0.475*	0.177*	0.196*	0.090*	1.00								
SIZE	0.210*	0.866*	0.786*	-0.160*	-0.094*	0.345*	0.116*	-0.006	0.065	0.050	-0.018	0.033	1.00							
AN_FOL	0.127*	0.594*	0.428*	-0.189*	0.001	0.240*	-0.032	-0.052	-0.028	-0.033	-0.019	-0.126*	0.492*	1.00						
ΔEBT	-0.022	-0.036	-0.080*	-0.031	0.082*	-0.084*	-0.133*	-0.170*	-0.093*	-0.095*	-0.201*	-0.299*	-0.051	-0.006	1.00					
LEV	0.063	0.032	0.194*	0.121*	-0.151*	0.071	0.146*	0.123*	0.073*	0.081*	0.060	0.072	0.183*	-0.018	-0.046	1.00				
AUD	0.157*	0.254*	0.198*	0.011	-0.002	-0.011	0.103*	0.095*	0.085*	0.083*	0.028	0.045	0.235*	0.150*	-0.041	0.024	1.00			
IFRS_AD	0.116*	0.202*	0.105*	-0.030	0.059	-0.050	0.013	0.003	0.009	0.003	0.080*	-0.009	0.218*	0.218*	-0.037	-0.125*	0.184*	1.00		
AR_DISCL	0.263*	0.216*	0.140*	-0.032	-0.021	0.072	0.123*	-0.039	0.022	0.012	0.014	-0.027	0.201*	0.145*	0.007	0.086*	0.148*	-0.194*	1.00	
CEO_TO	-0.052	0.006	-0.030	0.028	0.008	-0.048	0.004	0.056	-0.013	-0.007	0.011	0.170*	0.008	-0.141*	-0.049	0.044	-0.029	-0.159*	0.093*	1.00

This table presents Spearman correlation coefficients. All variables are defined in Appendix B

* Denotes significance at 5% level

Table 6 OLS Regression Estimates (Dependent Variable: *DISCL*)

Pred	Panel A: Future Uncertainty Indicators			Panel B: Historic Uncertainty Indicators			
	I	II	III	IV	V	VI	VII
<i>AEF</i> ≈ <i>TLCF</i> +	2.807** (1.154)						
<i>AEF</i> > <i>TLCF</i> -		-2.410** (0.987)					
<i>AEF</i> < <i>TLCF</i> +			0.873 (1.593)				
<i>STDEV</i> +				0.001** (0.000)			
<i>LH_CUM</i> +					3.862** (1.866)		
<i>LH_5Y</i> +						1.570* (0.850)	
<i>N_LOSS</i> +							1.195*** (0.398)
Δ <i>DTA_TLFC</i>	-0.735** (0.365)	-0.715** (0.347)	-0.587 (0.402)	-0.574 (0.411)	-0.444 (0.432)	-0.516 (0.401)	-0.329 (0.382)
<i>LOSS</i>	-0.036 (0.978)	-0.211 (0.977)	0.436 (1.059)	0.496 (1.060)	-1.118 (1.138)	0.196 (1.042)	-0.285 (1.072)
<i>SIZE</i>	1.138*** (0.461)	0.964** (0.458)	0.963* (0.492)	1.021** (0.467)	1.099** (0.474)	0.984** (0.459)	1.066** (0.456)
<i>AN_FOL</i>	-0.258* (0.135)	-0.264* (0.138)	-0.277* (0.144)	-0.277* (0.144)	-0.279** (0.137)	-0.261* (0.139)	-0.271* (0.138)
Δ <i>EBT</i>	0.015 (0.018)	0.019 (0.020)	0.017 (0.021)	0.015 (0.021)	0.019 (0.022)	0.019 (0.021)	0.019 (0.021)
<i>LEV</i>	-4.154 (3.733)	-3.859 (3.694)	-2.969 (3.767)	-3.139 (3.729)	-3.691 (3.722)	-3.171 (3.688)	-3.446 (3.594)

Table 6 (Continued)

Pred	Panel A: Future Uncertainty Indicators			Panel B: Historic Uncertainty Indicators			
	I	II	III	IV	V	VI	VII
<i>AUD</i>	0.416 (1.366)	0.716 (1.304)	0.804 (1.332)	0.707 (1.411)	0.403 (1.385)	0.535 (1.403)	0.388 (1.376)
<i>IFRS_AD</i>	0.057 (0.219)	0.111 (0.214)	0.087 (0.212)	0.064 (0.221)	0.073 (0.219)	0.073 (0.217)	0.070 (0.216)
<i>AR_DISCL</i>	19.788*** (6.136)	19.163*** (6.104)	19.030*** (6.158)	19.072*** (6.265)	19.296*** (6.127)	19.668*** (6.191)	20.174*** (6.091)
<i>CEO_TO</i>	-1.267 (1.087)	-1.129 (1.080)	-1.281 (1.131)	-1.316 (1.102)	-1.347 (1.110)	-1.222 (1.072)	-1.298 (1.095)
<i>N</i>	723	723	723	723	723	723	723
Adj. R ²	0.191	0.191	0.170	0.170	0.185	0.179	0.190

***, **, * denote significance at the 1, 5, and 10% levels, respectively, in two-tailed tests. All variables are defined in Appendix B. Standard errors clustered by firm in parentheses. Year and industry indicators are included but not reported. The dependent variable is *DISCL*. Panel A presents models with future uncertainty indicators, panel B models with historic uncertainty indicators

of TILCF information or by uncertainty about future earnings. To control for the availability of information, we estimate a selection model in the robustness section.

Regarding the magnitude of the documented relations, firms' disclosure score is on average 2.8 points higher if their earnings forecasts and TILCF are close to each other ($AEF \approx TILCF = 1$). This difference can, for example, result from an additional quantitative (2 points) and a qualitative item (0.5). Mind that the sample mean for the disclosure score *DISCL* is 8.88 (median 7.5). Observations with a cumulative loss history (*LH_CUM*) have, on average, a disclosure score nearly four points higher than the score of firm-years without a cumulative loss history, which can, for example, indicate additional quantitative information (2 points) presented in a table (1.5 points) and an additional qualitative item (0.5 points). For our control variables, we find significant coefficients for *SIZE* (positive) and *AN_FOL* (negative), in line with higher disclosure scores for larger firms with fewer analysts following them. With respect to the control variable *AR_DISCL*, we find a strong positive relation with *DISCL*, as expected. This finding suggests related disclosure behavior in the tax footnote and the overall annual report, yet incremental TILCF disclosure is significantly associated with uncertainty.

To further address the concern that tax disclosures mirror the overall disclosure strategy of a firm, we employ a placebo test and substitute our TILCF disclosure score *DISCL* with our control *AR_DISCL* as the dependent variable and rerun the baseline model. If firms increase their overall disclosure in the case of uncertainty, we should find similar results for the uncertainty variables as in our baseline model. The results for the different model specifications are reported in the online Appendix (Table OA15). The findings support the positive association between *DISCL* and *AR_DISCL*. However, the remaining results differ considerably from our baseline findings. The *HISTORIC INDICATORS* have negative coefficients (contrary to our baseline model), weakly significant only for *N_LOSS*. Among the *FUTURE INDICATORS*, *STDEV* is the only variable that has the same (positive) sign as in our main regression and a significant coefficient.²⁴ This finding seems plausible because the standard deviation of earnings forecasts *STDEV* is our least specific and rather generic uncertainty measure, while the other variables measure uncertainty very closely tied to TILCF. Our findings thus align with the results of Chen et al. (2002), indicating that the overall disclosure quality increases in the case of uncertain future earnings but also suggesting that this does not hold in the case of TILCF-specific uncertainty. This result corroborates our baseline finding that firms provide specific voluntary tax disclosures where they anticipate investors' need for additional information.

²⁴ If we exclude *DISCL* from the placebo test, we find the same insignificant coefficients for all variables but the standard deviation.

4.3 What Kind of Information Is Disclosed?

4.3.1 Content

Next, we aim to shed light on the nature of disclosed information, i.e., content and type. In Table 3, we identify four categories of disclosed items: 1) *Basic TLCF Information*, 2) information about *Changes and Effect on Income*, 3) *Valuation Allowance Information*, and 4) *Other* information. To analyze for which type of information our main results are most pronounced, we repeat our basic regressions for subcategories 1) to 4).²⁵ Table 7, columns I to IV, shows the aggregated estimation results. Each coefficient is from a separate estimation of the basic Model (1) with the respective disclosure subscore as the dependent variable. Full estimation results for all models are available in the online Appendix (Tables OA1–OA4).

The dependent variable in column I is the disclosure score for *Basic TLCF Information*. We do not find a significant relation of the score with most future or historic uncertainty indicators. Only *STDEV* has a significant coefficient but with a negative sign, reverse to our main results. This finding suggests that the disclosure of essential TCF information is basically unrelated to uncertainty about TCF usability. Column II presents the results for *Changes and Effect on Income*. We see a strong significant positive association for the *HISTORIC INDICATORS*, while among the coefficients of the *FUTURE INDICATORS* only *AEF > TCF* is weakly significant. Hence, in the case of recent losses, firms seem to report more information about how and why TCF and the respective deferred taxes have changed and affected the current year's income. The findings for the disclosure category *Valuation Allowance Information* are shown in column III. The results are opposite to those in column II: two of the *FUTURE INDICATORS* have significant coefficients with the expected sign, while the *HISTORIC INDICATORS* have insignificant coefficients. This finding indicates that the results for the forward-looking uncertainty proxies are associated mainly with valuation allowance information. When uncertainty about TCF usability increases, firms must adjust the amount of recognized deferred tax assets and voluntarily report the respective valuation allowance activities in the tax footnote. Column IV shows results for the category *Others*. Coefficients for all *FUTURE* and *HISTORIC INDICATORS* are significant with the expected sign. The category includes diverse and unsystematic disclosed items, for example, the effect of TCF on the tax reconciliation and a residual category *Other disclosures* with items that do not fit in any of the other categories (see Table 3 for details). The results indicate that firms further complement our identified voluntary items with additional individual information under uncertainty.

In sum, evidence from the disclosure content subcategories suggests four conclusions. First, in the case of forward-looking uncertainty, firms primarily provide valuation allowance details. Second, in the case of recent losses, firms mainly provide information about TCF changes and the effect on the current year's income. Third, providing basic TCF information seems to be unrelated to both types of

²⁵ We exclude *AEF < TCF* from this set of tests because it applies to only ten percent of our observations (see Table 4) and we do not find a significant relation with our aggregated disclosure score.

Table 7 Aggregated Results for Disclosure Subcategories (Dependent Variable: Disclosure Subcategory)

Pred	Content			Type of Disclosure					IX Table
	I Basic Information	II Changes and Effect on Income	III Valuation Allowance Information	IV Others	V Qualitative Informa- tion	VI Quantitative Informa- tion	VII Interval In- formation	VIII Additional Detail	
<i>AEF</i> ≈ <i>TLCF</i>	+ -0.244 (0.607)	0.679 (0.512)	0.774** (0.346)	1.171** (0.446)	0.045 (0.059)	0.708 (0.619)	0.117 (0.198)	1.335*** (0.389)	0.602* (0.341)
<i>AEF</i> > <i>TLCF</i>	- 0.403 (0.567)	-0.689* (0.388)	-0.482 (0.344)	-1.296*** (0.395)	-0.063 (0.057)	-0.475 (0.499)	-0.114 (0.209)	-1.277*** (0.348)	-0.483 (0.304)
<i>STDEV</i>	+ -0.001** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000** (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000** (0.000)	0.001*** (0.000)
<i>LH_CUM</i>	+ 0.920 (0.844)	1.675** (0.634)	0.149 (0.463)	0.818** (0.339)	-0.018 (0.042)	1.347 (0.838)	0.172 (0.172)	1.226** (0.568)	1.135* (0.618)
<i>LH_5Y</i>	+ -0.032 (0.503)	0.697*** (0.258)	0.047 (0.267)	0.671*** (0.238)	0.018 (0.035)	0.473 (0.360)	0.073 (0.166)	0.726** (0.350)	0.281 (0.272)
<i>N_LOSS</i>	+ 0.293 (0.249)	0.550*** (0.129)	-0.031 (0.116)	0.328** (0.154)	0.010 (0.018)	0.414** (0.168)	0.054 (0.083)	0.438** (0.183)	0.279* (0.154)

***, **, * denote significance at the 1, 5, and 10% levels, respectively, in two-tailed tests

All variables are defined in Appendix B. Standards errors clustered by firm in parentheses. The results are aggregated, each cell from a separate estimation (54 in total). The dependent variable is the respective subcategory variable. Each model includes one of the uncertainty variables and additionally all control variables from Table 6 as well as year and industry indicators. Detailed results are provided in the online Appendix (Tables OA1–OA9)

uncertainty. Fourth, firms report additional unsystematic information under uncertainty. These findings appear intuitive and corroborate the choice of our disclosure measures. At the same time, they provide granular and novel insights into firms' tax disclosure behavior. Firms cater to the anticipated information needs of financial statement users by providing more explanations and guidance when TDCF usability is uncertain. Regarding the content of the voluntary disclosure, firms stick closely to the criteria set by IAS 12 for the recognition of TDCF-DTA. This finding is related to evidence that firms mainly use objective accounting standard criteria when setting a *mandatory* TDCF item, the US-GAAP valuation allowance (Dhaliwal et al. 2013; Goldman et al. 2022). We extend this research by identifying different uncertainty signals as explaining the content of *voluntary* TDCF disclosure.²⁶

4.3.2 Type of Disclosure

We document the choice of disclosure type in columns V to IX of Table 7 (online Appendix Tables OA5–OA9). The categories are based on the construction of the disclosure score (Table 2) and reflect the type and presentation of information. We find that *Quantitative Information*, *Qualitative* and *Interval Information* hardly exhibits any statistically significant association, indicating that firms seem not to use these disclosure types to reduce uncertainty. In contrast, providing *Additional Detail* appears to be a frequently used disclosure choice when TDCF uncertainty is high, as this category has significant coefficients with the expected signs for all *FUTURE* and *HISTORIC INDICATORS*. Highlighting information in *Tables* also shows significant associations with four uncertainty indicators. Taken together, under uncertainty, firms explain additional details, and enhance the processing of stakeholders by making this information visible in tables. These findings add to prior evidence on firms' strategic use of certain presentation formats for tax disclosure (e.g., Chychyla et al. 2022), documenting how firms apply these disclosure choices to mitigate TDCF-related uncertainty.

4.4 Cross-Sectional Tax Avoidance Test

To provide further support for the relation between uncertainty and TDCF disclosure, we derive another indicator of uncertainty about TDCF usability from prior literature and use it in a cross-sectional test: firms' tax avoidance behavior (McGuire et al. 2016). To assess the future usability of TDCF, firms should consider expected future taxable income and also take into account their own ability to generate such income via tax planning activities (IAS 12.29 (b)). Hence, if a firm is active in tax planning, this could reduce uncertainty about TDCF usability as it indicates that, if necessary, the firm can create taxable income to offset TDCF. In line with this notion, McGuire et al. (2016) find that investors positively value TDCFs when firms have high levels and high variability of prior tax avoidance. We split our sample into firms with high

²⁶ Please recall that, while the valuation allowance is a mandatory item under US-GAAP, no valuation allowance exists under IFRS (instead, firms have to disclose the non-usable TDCF). Hence, any information related to the valuation allowance reported under IFRS is a voluntary additional information.

Table 8 Cross-sectional Tests for Tax Planning Subsamples (Dependent Variable: *DISCL*)

	Pred	I High Tax Plan- ning (<i>CETR5</i> < <i>median</i>)	II Low Tax Plan- ning (<i>CETR5</i> >= <i>median</i>)	III High Tax Planning (<i>CVCETR5</i> > <i>median</i>)	IV Low Tax Planning (<i>CVCETR5</i> <= <i>median</i>)
<i>AEF</i> ≈ <i>TLCF</i>	+	2.094 (1.452)	3.985*** (1.330)	1.232 (1.333)	5.386** (2.091)
<i>AEF</i> > <i>TLCF</i>	-	-3.072** (1.209)	-2.213* (1.223)	-1.154 (1.263)	-3.918** (1.585)
<i>STDEV</i>	+	-0.000 (0.003)	0.002*** (0.001)	0.000 (0.001)	0.231* (0.128)
<i>LH_CUM</i>	+	2.867 (1.841)	7.313*** (2.729)	3.032 (1.943)	17.262** (6.502)
<i>LH_5Y</i>	+	1.265 (1.180)	2.316** (1.042)	-0.976 (1.132)	5.756* (3.297)
<i>N_LOSS</i>	+	1.363** (0.536)	1.804*** (0.646)	0.792 (0.636)	5.756* (3.297)
<i>N</i>		352	359	331	339

***, **, * denote significance at the 1, 5, and 10% levels, respectively, in two-tailed tests

Variables are defined in Appendix B. Standard errors clustered by firm in parentheses. Year and industry indicators are included but not reported. The results are aggregated, each cell from a separate estimation (24 in total). The dependent variable is *DISCL*. *CETR5* is the five-year cash ETR and *CVCETR5* the coefficient of variation of the five-year cash ETR. Each model includes one of the uncertainty variables and additionally all control variables from Table 6 as well as year and industry indicators. Detailed results are provided in the online Appendix (OA10–OA13)

and low tax planning activities. Assuming that tax planning reduces uncertainty about *TLCF* usability, we expect higher uncertainty and disclosure for firms with low tax planning activities.

Building on McGuire et al. (2016), we use two measures of firms' prior tax planning activities: the level and variability of the five-year cash ETR. The five-year cash ETR (*CETR5*) is calculated as the sum of taxes paid divided by pre-tax income less discontinued operations and extraordinary items over the five-year period *t-5* to *t-1* (Kerr 2019; McGuire et al. 2016). The variability (*CVCETR5*) is the coefficient of variation, calculated as the standard deviation of annual cash ETRs divided by the absolute value of the mean of annual cash ETRs for the five-year period *t-5* to *t-1* (McGuire et al. 2013; McGuire et al. 2016). We assign firms into low and high tax planning samples based on yearly median splits for *CETR5* and *CVCETR5*. Results are presented in Table 8.

Again, results are aggregated and show only the uncertainty coefficients. Detailed results for all 24 estimations are available in the online Appendix (Tables OA10–OA13). Columns I and II show the sample split into high (I) and low (II) tax planning firm-years based on *CETR5*. While only two out of six uncertainty variables show significant coefficients in column I, all coefficients are significant in column II. Further, the coefficients' size is considerably higher for almost all variables in column II. Results for high (III) and low (IV) tax planning based on the variability of the five-year cash ETR (*CVCETR5*) present an even more pronounced

pattern: they show no significant coefficients for the high tax planning sample, but all uncertainty variables have significant coefficients with much higher magnitudes for the low tax planning sample firms. Taken together, results indicate that the association between uncertainty and voluntary TILCF disclosure is more pronounced if firms are less active in tax planning. This finding is in line with McGuire et al. (2016) and our expectation that active tax planners are able to create taxable income to offset TILCF if necessary, reducing uncertainty and the need for more disclosure.

5 Sensitivity Analyses

5.1 Exogenous Uncertainty Shock

To validate our baseline results, we examine the European sovereign debt crisis as an exogenous shock to uncertainty. The financial sector was hit severely by charges on Greek debt, and concerns emerged about whether the euro zone would prevail (Rooney 2011; Viñals 2011). This situation created high uncertainty about future earnings, particularly for the financial industry. 2011 was characterized by large write-offs on debt that hit profits for several financial institutions. To avoid the direct effect of current negative earnings on TILCF disclosure, we examine disclosure in 2012.²⁷ The advantage of the year 2012 is that while there was a high uncertainty about future earnings (Laurent and Slater 2012), current operating earnings in German Financial Institutions were positive.²⁸ To examine whether firms in the industries finance, insurance, and real estate increase TILCF disclosure in 2012, we include an interaction of a year-2012 indicator and a finance-industry indicator in our baseline model (1). The results for the interaction variable show positive and significant coefficients (tabulated in the online Appendix Table OA16). The remaining results for our other uncertainty indicators and control variables are qualitatively unchanged. This finding indicates that firms which face an exogenous rise in uncertainty about future earnings (and hence TILCF usability) increase TILCF disclosure, corroborating our baseline results and mitigating endogeneity concerns.

5.2 Disclosure Score

Next, we analyze the robustness of our disclosure score. First, we use the number of reported items as a quantitative measure instead of the disclosure index *DISCL*, i.e., we do not apply the scale to the disclosed items. The results are presented in the online Appendix Table OA17 and do not change qualitatively. This finding mitigates potential concerns about the effect of the application of our disclosure

²⁷ If current earnings are also affected, it is again more difficult to disentangle an increase in disclosure due to higher current TILCF and an increase due to higher uncertainty about the future usability of TILCF (which we aim to identify). Similar identification problems characterize other potential exogenous shocks, such as the financial crisis 2007/2008 or the COVID-19 pandemic.

²⁸ We inspect EBT for all of our sample firms in the financial industry in the year 2012 and find no firm with a pretax loss.

scale on the results. On the one hand, it could also indicate that the number of disclosures is the driving force of the observed main effect. On the other hand, results of our subcategory tests indicate that firms apply specific types of disclosure under uncertainty.

Second, we vary the weights assigned to the disclosed items in untabulated tests. While the scoring in our main results is based on the German ‘Best Annual Report’ competition which has been used in prior research (e.g., Daske 2005; Glaum et al. 2013), we test robustness of our results to a modified weighting. For example, we assign an incremental score of 1 point instead of 1.5 points for additional information (*DETAIL*) and the disclosure in a table or graph (*TABLE*). Applying the adjusted weights, results of our disclosure regressions and all respective subcategory estimations are qualitatively unchanged.

5.3 Forecasting Horizon

We examine the robustness of our future uncertainty indicators with respect to the forecasting horizon. Anecdotal evidence indicates that firms often use forecasting horizons of more than one year to assess T_{LCF} usability.²⁹ We use the forecast for only one year in our main tests for the following two reasons. First, we expect to obtain the most precise forecast for $t+1$, while forecasts for later years are much noisier. Second, the availability of analyst forecasts beyond $t+2$ is limited and would further reduce our already modest sample size. However, in this robustness test, we repeat our main tests by using the sum of the forecasts for $t+1$ and $t+2$ to create the uncertainty proxies. Our sample is reduced by nine observations. We can no longer estimate the model with $AEF < T_{LCF}$ because under this classification, there is no case in which T_{LCF} is considerably higher than the cumulated forecast. Untabulated tests show that the results for the remaining two uncertainty variables, $AEF \approx T_{LCF}$ and $AEF > T_{LCF}$, have the same sign and are both significant at the one-percent level, suggesting that our findings are robust to this modification.

5.4 Other Tests

In the online supplement, we further examine the robustness of our results. In particular, we address potential sample selection concerns estimating (i) a Heckman (1979) selection model.³⁰ The first step specifies a probit regression and models the

²⁹ Examples for a longer forecasting horizon are Klöckner & Co. SE with three years (annual report 2010, p. 154) and Rhön-Klinikum AG with five years (annual report 2012, p. 146).

³⁰ Another possible remedy for correlated omitted variables is firm-fixed effects (Amir et al. 2016). However, firm-fixed effects are only useful if the omitted variable is time invariant. Furthermore, firm-fixed effects models have limited power if the variables of interest have little variation over time (Prabhala and Li 2008) and can in this case even eliminate the variation of interest (Breuer and deHaan 2023; Roberts and Whited 2013). We believe that firm-fixed effects are not a suitable remedy in our setting because we assume the omitted variable to be time variant (the availability of T_{LCF} information changes over time, e.g., depending on the emergence of new losses or the offsetting of existing losses) and because much of the variation in our data probably comes from the cross-section. This is in line with Breuer and deHaan (2023, p. 32), stating that “disclosure choices are sticky in theory and practice, so cross-sectional research designs may be more appropriate in many voluntary disclosure settings”. Estimating our models with

availability of TLCF information. The second equation is our main model including the inverse Mills ratio from the first stage and models the relation between the level of disclosure and uncertainty. In sum, except for *STDEV*, the results of the selection model corroborate our baseline findings (Table OA14).

To control for the effect of outliers, we (ii) winsorize all continuous variables above the 99th percentile and below the 1st percentile or (iii) exclude bank, insurance, and financial firms from our sample (SIC Code 60-67). To examine the robustness to the effect of the financial crisis (iv), we drop the crisis years 2008 and 2009 from our sample. Finally, we (v) include different additional variables controlling for the materiality of TLCF, internationalization of the firm, and market-based uncertainty measures. Throughout these modifications our results remain robust. If we estimate our models without any control variables, $AEF \approx TLCF$ and LH_CUM have insignificant coefficients but the remaining results are unaffected.

6 Conclusion

This study provides a comprehensive analysis of the determinants of firms' voluntary TLCF disclosures using data hand-collected from tax footnotes. We analyze when and how firms report additional TLCF information in a German setting characterized by a high demand for voluntary TLCF disclosure due to a lack of confidence in deferred tax assets on TLCF (Chludek 2011; Flagmeier 2022). We examine different future and historic signals for uncertainty about the usability of TLCF and find a strong positive association between disclosure and uncertainty. Disaggregating our disclosure score indicates that firms disclose information on changes and the effect on income if uncertainty is created by (historic) losses and disclose valuation allowance-related information if uncertainty is based on (future) forecasts. The type of disclosure is focused on additional details and information is reported in tables. Our findings are robust to our controlling for the availability of TLCF information in a selection model and to several other sensitivity tests. Furthermore, our research design assures that the disclosure inference we draw are tax specific and do not simply stem from the overall disclosure policy of a firm.

We contribute to the tax disclosure literature with a comprehensive textual analysis of a unique TLCF disclosure dataset and an innovative identification strategy to control for the overall reporting quality of a firm. TLCF information can be highly useful in estimating a firm's future net income, and it is important to understand whether firms' disclosure is helpful in this regard. Our findings indicate strategic disclosure behavior that mainly caters to investors' need for additional information regarding the type of disclosure. With regard to content, firms' disclosure depends on the signal of uncertainty about TLCF usability. Our results provide valuable insights for regulators, investors, and firms across various jurisdictions adopting IFRS, especially those where deferred tax assets are similarly perceived as less informative. Our study also outlines the complexity of TLCF information and calls for

firm- and year-fixed effects yields a (positive) significant coefficient only for *STDEV*, in line with reduced statistical power due to low within-firm variation for the other variables.

future research on how firms could further improve the informativeness of their tax disclosures.

7 Appendix

7.1 Appendix A

7.1.1 Differentiation in Mandatory IAS 12 and Voluntary Disclosures

We identify six mandatory IAS 12 disclosures concerning TILCF:

- the amount of deferred tax assets recognized in the balance sheet for unused TILCF (IAS 12.81 (g) (i))
- the amount of the benefit from a previously unrecognized TILCF of a prior period that is used to reduce deferred tax expense (IAS 12.80 (f))
- the amount of the benefit from a previously unrecognized TILCF of a prior period that is used to reduce current tax expense (IAS 12.80 (e))
- the amount of unused TILCF for which no deferred tax asset is recognized in the balance sheet (IAS 12.81 (e))
- the expiration date of unused TILCF for which no deferred tax asset is recognized in the balance sheet (IAS 12.81 (e))
- the amount and nature of evidence supporting the recognition of a deferred tax asset when the entity has suffered a loss in the current or preceding period (IAS 12.82 (b))

One item cannot clearly be classified as voluntary or mandatory: the amount of deferred tax income or expense recognized in the income statement due to unused TILCF (IAS 12.81 (g) (ii)). The classification is ambiguous due to the additional remark that this disclosure is only necessary if it is not apparent from changes in the amounts recognized in the balance sheet. Thus, the firm can choose whether it states the amount separately or leaves it to the reader to derive it from the balance sheet. Due to this discretion, we classify this item as voluntary. Repeating our analysis with this item classified as mandatory does not affect our main results. Furthermore, every disclosure beyond the six required items is considered voluntary.

7.2 Appendix B

Table B1 Variable Description

Variable	Exp. sign	Description
Uncertainty variables		
AEF_{it}		Last mean analyst EBT forecast for $t+1$, issued before fiscal year end t
$TLCF_{it}$		TLCF: deferred tax assets for TLCF/tax rate (disclosed tax rate if available, otherwise statutory tax rate)
<i>FUTURE UNCERTAINTY INDICATORS</i>		
$AEF \approx TLCF_{it}$	+	Indicator variable: 1 if difference between AEF_{it} and $TLCF_{it}$ is in the two deciles around zero, 0 otherwise
$AEF < TLCF_{it}$?	Indicator variable: 1 if $AEF_{it} < TLCF_{it}$ and $AEF_{it} \approx TLCF_{it} = 0$, 0 otherwise
$AEF > TLCF_{it}$	-	Indicator variable: 1 if $AEF_{it} > TLCF_{it}$ and $AEF_{it} \approx TLCF_{it} = 0$, 0 otherwise
$STDEV_{it}$	+	Percentage standard deviation of AEF_{it} : (standard deviation of AEF_{it}/AEF_{it}) * 100
<i>HISTORIC UNCERTAINTY INDICATORS</i>		
LH_CUM_{it}	+	Indicator variable: 1 if firm reported a cumulative negative EBT in the current and two previous years, 0 otherwise
LH_5Y_{it}	+	Indicator variable: 1 if firm reported at least one negative EBT in the five previous years, 0 otherwise
N_LOSS_{it}	+	Frequency of negative EBT in the five previous years
Disclosure variables		
$DISCL_{it}$		Voluntary TLCF disclosure score, based on the scale in Table 2
$BASIC_{it}$		Disclosure score for <i>Basic TLCF Information</i> , see Table 3 for details
CH_EFF_{it}		Disclosure score for <i>Changes and Effect on Income</i> , see Table 3 for details
VA_{it}		Disclosure score for <i>Valuation Allowance Information</i> , see Table 3 for details
$OTHERS_{it}$		Disclosure score for <i>Other Information</i> , see Table 3 for details
$QUAL_{it}$		Disclosure score for <i>Qualitative Information</i> , see Table 2 for details
$QUANT_{it}$		Disclosure score for <i>Quantitative Information</i> , see Table 2 for details
$INTERVAL_{it}$		Disclosure score for <i>Interval Information</i> , see Table 2 for details
$DETAIL_{it}$		Disclosure score for <i>Additional Detail</i> , see Table 2 for details
$TABLE_{it}$		Disclosure score for information in <i>Tables</i> , see Table 2 for details
Control variables		
ΔDTA_TLCF_{it}		Change in deferred tax assets for TLCF from previous to current year, scaled by total assets, multiplied by 100
$LOSS_{it}$		Indicator variable: 1 if EBT in current year is negative, 0 otherwise
$SIZE_{it}$		Natural logarithm of total assets
AN_FOL_{it}		Number of analysts following the firm in the 11th month of the fiscal year
ΔEBT_{it}		Percentage change in EBT from previous to current year
LEV_{it}		Debt/total assets
AUD_{it}		Indicator variable: 1 if firm is audited by Big 4 (Deloitte, Ernst and Young, KPMG, PWC), 0 otherwise
$IFRS_AD_{it}$		Number of years since the firm adopted IAS/IFRS
AR_DISCL_{it}		Disclosure score of annual report content quality
CEO_TO_{it}		Indicator variable: 1 if CEO changed from previous to current year, 0 otherwise

Table B1 (Continued)

Variable	Exp. sign	Description
Tax planning variables		
<i>CETR5</i>		Five-year cash ETR: sum of taxes paid divided by pre-tax income less discontinued operations and extraordinary items over the five-year period <i>t-5</i> to <i>t-1</i>
<i>CVCETR5</i>		Coefficient of variation of cash ETRs: standard deviation of annual cash ETRs divided by the absolute value of the mean of annual cash ETRs for the five-year period <i>t-5</i> to <i>t-1</i>

7.3 Appendix C

Table C1 Disclosure Examples from Tax Footnotes

Examples of Disclosed Information	Score	Explanation
The actual existing and unused accumulated tax loss carryforwards of the Group amounted to € 156 million and € 47 million for the years ending December 31, 2006 and 2005, respectively. The increase of € 109 million results for the most part from the acquisition of Reebok and mainly relates to the effects of the acquisition on Reebok's U.S. tax position. (Adidas, annual report 2006, p. 175)	3.5	The first sentence is not counted because the unused TLCHF are a mandatory disclosure. The number of the increase is a quantitative information and gets 2 points. The explanation of the increase is additional information and scores 1.5 points
The change in the valuation allowance on deferred tax assets relating to tax losses available for carryforward and temporary differences resulted in a tax expense of € 3 million (2011: expense of € 6 million). (BMW, annual report 2012, p. 102)	1.5	Income effects of changes in the valuation allowance are a voluntary disclosure. The amount includes effects from temporary differences and hence gives an interval of possible values for TLCHF (between zero and 3 million, depending on the amount for temporary differences). Interval disclosures get a score of 1.5 points
The decrease in tax loss carryforwards is mainly due to the utilization of losses in Germany and the United States. (Linde, annual report 2009, p. 131)	0.5	This is a qualitative information and gets a score of 0.5 points

We assign a score based on the scale in Table 2 panel A for every voluntary TLCHF information. The differentiation between mandatory and voluntary items is illustrated in Appendix A. All examples are extracts from financial statements' notes of our sample firms

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Data Availability Data are available from the sources cited in the text.

Conflict of interest V. Flagmeier and J. Müller declare that they have no competing interests.

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