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## Article

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# Deferred Tax Assets on Tax Loss Carryforwards During Economic Shock Situations

Vanessa Flagmeier · Felix Werthebach

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**Abstract** This study examines the recognition of deferred tax assets on tax loss carryforwards (TLCF-DTA) before and during the COVID-19 pandemic. We analyze a sample of large German firms from 2017–2021, hand-collecting deferred tax and management forecast data. The recognition behavior of the average sample firm seems not to change during the pandemic, but cross-sectional tests suggest firms with unfavorable or uncertain performance expectations reduce their TLCF-DTA recognition, which is consistent with recognition based on management forecasting. However, we find this behavior is asymmetric, since firms with optimistic expectations do not increase recognition simultaneously. Furthermore, firms seem not to follow usual earnings management patterns during the pandemic. Taken together, our results provide new insights into firms' response to an economic crisis for the highly relevant and ever-increasing accounting item TLCF-DTA.

**Keywords** Deferred tax assets · Tax loss carryforwards · COVID-19 · Management forecast · Economic crisis · Conservatism

**JEL Classification** M41 · M48

## 1 Introduction

Economic shocks such as the COVID-19 pandemic usually create a high level of uncertainty in several economic areas, including accounting (e.g., Bahadar and Za-

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man 2022; Rinaldi 2022; Bonaldi et al. 2023; Li and Luo 2024; Sefried and Riepe 2023). One of the key features of this uncertainty is the difficulty of forecasting future firm performance (e.g., Chen et al. 2022). An accounting item that is highly dependent on future performance and therefore particularly affected in this context is tax loss carryforwards (TLCF). Firms reporting under International Accounting Standard (IAS) 12.34 must recognize deferred tax assets on tax loss carryforwards (TLCF-DTA) but only “to the extent that it is probable that future taxable profit will be available against which the unused tax losses [...] can be utilised”. Hence, TLCF-DTA recognition involves much uncertainty, which is further exacerbated by the shock of the pandemic. In addition to uncertainty, the relevance of TLCF increased during the pandemic, as many firms faced economic difficulties, which may have resulted in new TLCF. It is unclear but considerably relevant how firms handle the accounting treatment of large TLCF amounts, since unused TLCF are an important determinant of firms’ future after-tax income. Thus, firms’ assessments of TLCF usability (as reflected in deferred tax recognition) can provide crucial information, for example, for capital market participants (e.g., McGuire et al. 2016).

The elevated role of TLCF during the pandemic combined with increased uncertainty and the potentially high interest of shareholders in this area characterizes firms’ TLCF recognition as a highly relevant research area. This importance is in line with earlier calls for more research on loss firms and TLCF (e.g., Hanlon and Heitzman 2010, p. 129), suggesting that the topic was already underexplored before the pandemic. Hence, we analyze TLCF-DTA recognition before and during the COVID-19 pandemic in this study. Prior studies document that the uncertainty and consequently the discretion immanent in TLCF-DTA recognition can be used to communicate managements’ private information about future profitability and their accompanying uncertainty (e.g., Kumar and Visvanathan 2003; Jung and Pulliam 2006; Herbohn et al. 2010; Dhaliwal et al. 2013) or for opportunistic reporting in terms of earnings management (e.g., Schrand and Wong 2003; Frank and Rego 2006; Herbohn et al. 2010, 2016). Nevertheless, research on TLCF-DTA recognition during economic shock situations is very scarce. The few studies analyze the value relevance of deferred taxes during the 2008 financial crisis (Badenhorst and Ferreira 2016; Hanna et al. 2019) and the role of deferred taxes in the Japanese banking crisis (Skinner 2008).

Our study adds to this literature in several ways. First, rather than examining market participants’ perceptions, we investigate the recognition behaviors of firms to provide insights into the effect of an economic shock on a specific accounting practice. Second, the COVID-19 pandemic differs from other crises in that it created an immediate and massive hit to the economy, resulting in unprecedented levels of uncertainty (e.g., Graff et al. 2021; Li et al. 2022). At the same time, the expectation was that the economy would recover very quickly. This expectation is evident from growth projections from April 2020 at the onset of the pandemic, which predicted a gross domestic product (GDP) change of  $-7.0\%$  for 2020 for the German economy but  $+5.2\%$  for 2021 (International Monetary Fund 2020a). The expectation for 2021 even exceeded the prepandemic prediction for 2020, issued in January 2020 ( $+1.7\%$ , International Monetary Fund 2020b). Since TLCF-DTA recognition is highly depen-

dent on performance expectations, we are interested in analyzing how firms handle this situation of high current uncertainty combined with a rather optimistic outlook.

To investigate TDCF-DTA recognition behavior during the pandemic, we examine the period 2017 to 2021 for a balanced sample of large German public and private firms, using the consolidated financial statements which they prepared in accordance with International Financial Reporting Standards (IFRS).<sup>1</sup> Financial data are obtained from Bureau van Dijk's Dafne database, and deferred tax data are hand-collected from firms' financial statements. Germany is a suitable setting for our analysis because it is one of the largest European capital markets, and relative to other countries, the German loss-offset relief in response to the pandemic most likely had only a minor effect on large firms' TDCF positions.<sup>2</sup> This setting allows us to isolate the effects of the pandemic on the strategic recognition behaviors of firms that are not considerably affected by regulatory interventions.

First, we investigate the development of TDCF-DTA recognition over our sample period to assess potential differences in the pandemic years 2020 and 2021. Our results indicate that the ratio of TDCF for which the firm recognizes deferred tax assets relative to total TDCF does not significantly change during the pandemic for our average sample firm. Next, in cross-sectional tests, we analyze two possible drivers of firms' recognition patterns on the basis of recognition behaviors identified in the literature (e.g., Dhaliwal et al., 2013; Herbohn et al., 2010): (i) management forecasting and (ii) opportunistic reporting.

To illustrate the link between TDCF-DTA and management forecasting, we start with the connection between regulatory compliance and uncertainty. Prior studies suggest that firms increase regulatory compliance in situations of elevated uncertainty (e.g., Beck and Jung 1989; Scotchmer and Slemrod 1989; Tan and Yin 2014). In the context of this study, increased compliance with IAS 12 recognition requirements could mean that firms align their TDCF-DTA recognition more closely with

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<sup>1</sup> The results are unaffected if we exclude private firms from our sample. In Germany, firms are considered large if they are publicly listed or meet certain sales, total assets, and number of employee thresholds (Sect. 264d, 267 Para. 2, 3 HGB). According to this definition, all of the companies in our sample except for two private firms are large. A caveat of our sample is that TDCF-DTA in consolidated financial statements can result from legal entities in several different regions within and outside of Germany. Hence, even though there was no major German tax rate change during our sample period, tax rate changes in local business tax rates or foreign countries could affect the TDCF-DTA measurement. We address the issue of foreign tax rates in the sensitivity tests presented in Sect. 5.

<sup>2</sup> In Germany, loss carryback options were extended as a response to the COVID-19 shock (see Sect. 2 for details). The average TDCF level of large German firms in our sample amounts to 501 million euros in 2019, the year before the pandemic. Hence, the increase in tax loss carryback options from one million euros to five million euros in 2020 represents only 0.80% of this average amount. On the one hand, this small percentage might represent an overestimate of the amount, as it assumes that every firm can use the carryback while the rule applies only to firms with positive pre-year taxable income. On the other hand, our comparison is only a rough estimation as our data are on the group level, whereas the carryback applies to the legal entity. Although extensions of the carryback period or volume could be an effective tool to mitigate firms' liquidity issues during the pandemic (e.g., Gassen et al. 2020; Koch and Langenmayr 2020), such measures are primarily intended to support small and mid-size firms (European Commission 2021), and survey evidence indicates that this size group of firms considers these measures as useful (Heinemann-Heile et al. 2020). We conclude that the tax loss carryback extension is unlikely to substantially affect the TDCF-DTA level of large firms, but we further address this issue in the robustness tests presented in Sect. 5.

management forecasts. This behavior could result in less recognition due to uncertainty or more recognition on the basis of an optimistic outlook. We derive firms' (i.e., managers') performance expectations from management forecasts to distinguish between favorable and unfavorable expectations and a high or low level of uncertainty. These management forecast variables are interacted with an indicator for the pandemic. Using a control group of firms with mixed performance expectations, this approach follows a difference-in-differences (DiD) design. Our results indicate that firms with unfavorable performance expectations or greater uncertainty reduce their TDCF-DTA recognition during the pandemic. Interactions for firms with favorable expectations or lower uncertainty levels are insignificant. This result suggests that TDCF recognition reflects firms' performance expectations via TDCF-DTA but only for the downside case, indicating an asymmetric effect of the shock on the recognition behavior. This behavior would be consistent with conservative recognition, but additional tests suggest that conservatism does not drive TDCF-DTA recognition during the pandemic. A potential conclusion is that the elevated uncertainty during the pandemic discourages firms from increasing recognition despite optimistic forecasts. Depending on the likelihood that firms assign to their optimistic forecasts, this behavior is in line with IAS 12, which emphasizes the assessment of the "probability that taxable profit will be available" (IAS 12.36).

The second pattern is opportunistic reporting. The literature from noncrisis periods suggests that firms use TDCF-DTA recognition for income-increasing earnings management or to make a big bath and create reserves for future periods (e.g., Burgstahler et al. 2002, Schrand and Wong 2003; Frank and Rego 2006; Skinner 2008; Christensen et al. 2008). It is unclear how this evidence translates into an economic shock situation since the only study on TDCF-DTA recognition in a crisis period examines a very specific industry and setting (Skinner 2008). Recent evidence on general earnings management behavior suggests that elevated uncertainty results in increased earnings management (e.g., Yung and Root 2019; Bermpei et al. 2022). To assess whether firms use TDCF-DTA for earnings management during the COVID-19 pandemic, we distinguish between firms with small losses (incentives for income-increasing earnings management) and those with large losses (incentives for big-bath accounting) at the onset of the pandemic. The control group includes firms without such incentives. Our results indicate that firms do not apply typical earnings-management patterns in the economic shock situation. Instead, we find a lower TDCF-DTA ratio for firms with small losses. When this finding is combined with graphical evidence, the decrease for small-loss firms seems to be a continuation of prepandemic trends.

Additional tests suggest that recognition behavior is not driven by industry effects but rather is firm specific. To shed more light on these firm-specific characteristics, we estimate multinomial logit estimations to identify determinants of the change in firms' TDCF-DTA recognition in 2020 (as the first year of the pandemic). Our results corroborate the role of pessimistic management forecasts in recognition behaviors and provide new insights into the drivers of an increase in the TDCF-DTA ratio in 2020. In particular, firms with higher current earnings are more likely to increase their recognition. Combined with further tests, these results suggest that current earnings are generally relevant for TDCF-DTA recognition but that this relevance

is not altered by the pandemic. Neither a favorable *current* earnings situation nor optimistic *forecasts* seem to have an incremental effect on recognition during that period.

Our results contribute to several strands of the literature. First, they add to the literature on deferred taxes (for an overview, see Görlitz and Dobler 2021). We extend the studies on earnings management and management forecasting via TDCF-DTA (e.g., Kumar and Visvanathan 2003; Schrand and Wong 2003; Frank and Rego 2006; Herbohn et al. 2010, 2016; Dhaliwal et al. 2013) by documenting that these patterns may be only partly applicable in an economic shock situation. In particular, our finding of asymmetric recognition in the case of unfavorable or uncertain performance expectations is consistent with a substantial level of uncertainty during the pandemic. An implication could be that the informativeness of TDCF-DTA in an economic shock situation is confined to firms with unfavorable or uncertain performance expectations. In this context, the limited information content of TDCF-DTA in a German setting is in line with prior findings. For example, Chluddek (2011) does not find value relevance for TDCF-DTA during the financial crisis period, and Flagmeier (2022) corroborates this finding for a noncrisis sample period, with the additional insight that TDCF-DTA are not value relevant, although they have predictive ability with respect to future tax payments. As a possible explanation, Flagmeier (2022) finds that TDCF-DTA are the least reliable of all deferred tax items. We extend these studies by documenting that the reliability of TDCF-DTA in a crisis period can be asymmetrically distributed and depend on firms' performance expectations. Hence, we add new insights into potential drivers of TDCF-DTA's reduced informativeness.

Second, to the best of our knowledge, we are the first to establish a link between two management signals for future profitability: TDCF-DTA and management forecasts. A lower TDCF-DTA recognition in the case of unfavorable or uncertain forecasts indicates consistent management signals in these items. This finding could be interesting for investors because comparing TDCF-DTA recognition and forecasting behavior could yield insights into the reliability of management predictions.

Third, we add to the nascent literature on firms' accounting behavior during the COVID-19 pandemic (e.g., Bahadar and Zaman 2022; Chen et al. 2022; Rinaldi 2022; Bonaldi et al. 2023; Li and Luo 2024; Sefried and Riepe 2023). The finding that recognition patterns identified in the literature are of only limited use in explaining TDCF-DTA recognition during the pandemic highlights the uniqueness of this economic shock and supports the call for more research on the accounting effects of COVID-19 (Rinaldi 2022).

## 2 Institutional Background, Literature, and Hypotheses

### 2.1 Institutional Background

Consolidated statements of all firms listed in EU-regulated markets must be prepared in accordance with IFRS for fiscal years beginning January 1, 2005 (Regulation [EC] No. 1606/2002). Private German firms have the option to apply IFRS for their consolidated statements (Sect. 315e Para. 3 HGB). In our sample, we include only

those firms that prepare their financial statements under IFRS; hence, IAS 12 is the relevant standard for deferred tax recognition. TLCF-DTA under IAS 12 are defined as the amount of income taxes recoverable in future periods with respect to the carryforward of unused tax losses or unused tax credits (IAS 12.5). Recognition shall be made to the extent that it is probable that future taxable profit will be available against which the unused tax losses can be utilized (IAS 12.34) and is subject to an annual reassessment (IAS 12.37). Thus, the estimation of future taxable profit should be the main determinant of TLCF-DTA recognition. The TLCF amount that is not expected to be usable in the future must be disclosed in the tax footnote (IAS 12.81 (e)). We provide additional information and examples on how firms report TLCF information in Appendix B (Figs. B.1, B.2, B.3, B.4, B.5 and B.6).

While deferred taxes are recognized in consolidated IFRS statements at the group level, tax losses emerge at the single entity level. Hence, for multinational firms, jurisdiction-specific tax loss offsetting rules are also relevant. In Germany, losses can be carried backward and forward. According to Sect. 10d Para. 1 of the German Income Tax Act (EStG), losses can be carried backward and offset only in the previous year and only up to one million euros. During the COVID-19 pandemic, this amount was first extended to a possible offset volume of five million euros in 2020, which allowed firms to offset losses in 2020 from the 2019 tax base. In a second step, the loss carryback was extended to ten million euros in 2021. As of fiscal year 2022, the carryback is also allowed for the two previous years (Sect. 52 Para. 18b EStG) instead of the usual carryback period of one year, which provides firms with the opportunity to carry 2022 tax losses back into the 2020 tax base. Given the limited extent of the increase in tax loss carrybacks, we do not expect this policy measure to noticeably affect the TLCF-DTA level of our average (large) sample firm. The extended carryback of 2022 tax losses to 2020 and 2021 taxable income does not affect our data, as we obtain TLCF and management forecasts from the financial statements of 2020 and 2021. Nevertheless, we perform several additional tests to control for the loss carryback extension in Sect. 5.1.

Losses can also be carried forward into the future without a time restriction. However, the yearly amount that can be offset is limited to one million euros plus 60% of the taxable income that exceeds one million euros (Sect. 10d Para. 2 EStG). This minimum taxation was implemented for fiscal reasons and ensures that even in the presence of large TLCF, a minimum amount of taxes is to be paid if the firm's taxable profit is sufficiently high in the respective year. Minimum taxation rules also exist in several other countries, e.g., Spain and Austria (EY 2024, p. 131, 1731).

## 2.2 Literature and Hypothesis Development

Prior studies identify different management objectives in TLCF-DTA recognition, exploiting discretion in the recognition decision. A number of studies document that the valuation allowance recognized under the US Generally Accepted Accounting Principles (US GAAP) provides relevant information for investors, as it is informative about future taxable income (Kumar and Visvanathan 2003), future cash flows (Legoria and Sellers 2005; Jung and Pulliam 2006), and the persistence of

accounting losses (Dhaliwal et al. 2013).<sup>3</sup> Similar results for an Australian sample suggest that unrecognized TDCF-DTA signal information about future performance (Herbohn et al. 2010) and that recognized TDCF-DTA signal future profitability under certain conditions (Herbohn et al. 2016). In a German setting, Flagmeier (2022) documents that TDCF-DTA recognition is informative about future tax payments. In summary, the literature suggests that TDCF-DTA (de)recognition provides useful information for investors stemming from the way that managers use their discretion to indicate their expectations about the future development of different performance measures.

However, the discretion inherent in forecasting could also reduce the informative value. In line with this notion, prior studies suggest that the valuation allowance can be used to smooth earnings (Schrand and Wong 2003), to meet analyst forecasts (Frank and Rego 2006), or to create a big bath (Christensen et al. 2008). Furthermore, Flagmeier (2022) finds no value relevance for TDCF-DTA, and Dreher et al. (2024) indicate that TDCF items are not useful for predicting future financial performance. Herbohn et al. (2010) and Herbohn et al. (2016) corroborate the ambiguous nature of TDCF-DTA in finding that the item is used not only for management signaling but also opportunistically for earnings management. Hence, it is *ex ante* not obvious how firms recognize TDCF-DTA, especially in a situation of high economic uncertainty.

There is scarce evidence on how recognition discretion is used during economic crises. Two studies document the detrimental effect of the 2007–2008 financial crisis on the value relevance of DTA (Badenhorst and Ferreira 2016; Hanna et al. 2019), and only one study more directly addresses the recognition of DTA during crises. Skinner (2008) investigates a sample of large Japanese banks during the Japanese banking crisis and finds evidence that banks recognize large net DTAs despite clear evidence of financial difficulties. This result is consistent with banks using DTAs to avoid falling below minimum capital thresholds, indicating an opportunistic use of DTA during a crisis. However, Skinner (2008) analyzes a specific setting in which a deferred tax recognition was newly introduced amid the crisis, which is consistent with a tool of regulatory forbearance. It remains unclear whether this recognition behavior also applies to nonfinancial industries and whether it can be extended to other economic shock periods and settings.

While some research is available on how *ex ante* accounting properties moderate the impact of an economic crisis (e.g., Lang and Maffett 2011; Cui et al. 2021) and preliminary evidence describes the effects of COVID-19 on corporate internal transparency (Ho et al. 2023), disclosure (for an overview Rinaldi 2022), and banks' loan loss accruals (Sefried and Riepe, 2023), we still know little about how the pandemic manifests in firms' accounting behaviors (Leoni et al. 2021). More generally, management behaviors during crises are not necessarily straightforward or easy to predict (Förster et al. 2022). As TDCF-DTA recognition is closely tied to managements' expectations about future taxable income, it involves much discretion and is particularly prone to uncertainty during an economic crisis (Eichholz et al. 2023).

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<sup>3</sup> The valuation allowance must be recognized to reduce DTA if it is more likely than not that there will not be sufficient future taxable income to offset the DTA (ASC 740, formerly SFAS 109). It generally applies to all DTA but in practice it is mainly recognized for TDCF-DTA (Miller and Skinner 1998).

On the basis of this literature review and the framework outlined in Dhaliwal et al. (2013), we propose that TLCF-DTA recognition could be driven by, first, managers' forward-looking private information, such as their expectations regarding future profitability and accompanying uncertainty, or, second, opportunistic reporting in terms of earnings management. On the one hand, the relation between TLCF items and future performance and market value documented in prior studies is consistent with the first possible driver (e.g., Legoria and Sellers 2005; Herbohn et al. 2010, 2016; Dhaliwal et al. 2013). TLCF-DTA recognition, which is based on managers' forward-looking private information, is in line with IAS 12 recognition guidelines. During an economic crisis, firms might intensify the incorporation of performance expectations into TLCF-DTA recognition to stick more closely to IAS 12. Such behavior would indicate a higher level of compliance with the regulation and is documented in the general tax literature, which suggests higher compliance with tax rules in situations of high uncertainty (e.g., Beck and Jung 1989; Scotchmer and Slemrod 1989; Tan and Yin 2014). On the other hand, the recognition might be driven by the second driver, earnings management. Firms might recognize TLCF-DTA opportunistically in an economic shock situation for income-increasing earnings management to mitigate the negative economic effect of the crisis or to make a big bath and create reserves for future periods. Recent earnings management studies suggest such a pattern, as they indicate increased levels of earnings management if (policy) uncertainty is high (e.g., Yung and Root 2019; Bermpei et al. 2022). The deferred tax literature provides evidence for both directions during noncrises (e.g., Burgstahler et al. 2002, Schrand and Wong 2003; Frank and Rego 2006; Skinner 2008; Christensen et al. 2008).

Although the described recognition patterns are derived from the literature and appear plausible, the pandemic might not have any effect on TLCF-DTA recognition, i.e. firms might maintain their prepandemic recognition behaviors. Furthermore, the patterns are not necessarily mutually exclusive. Herbohn et al. (2010) find that although firms use unrecognized TLCF-DTA for earnings management, such TLCF-DTA remain informative about future performance. With respect to the patterns that we analyze, it is, for example, conceivable that firms base recognition on their (negative) earnings expectations and apply big bath accounting simultaneously. Firms in a detrimental economic situation have incentives to take a big bath, but a reduction in TLCF-DTA could also be informative about their future earnings expectations. Depending on which incentives firms follow during a crisis, they might (i) reduce (increase) TLCF-DTA if private information suggests unfavorable or uncertain (favorable or less uncertain) future profitability development or (ii) increase (reduce) TLCF-DTA to pursue opportunistic goals such as income-increasing earnings management (big bath accounting). Given this tension resulting from the opposing theoretical predictions, we state our hypothesis in a nondirectional form:

**H1:** The COVID-19 pandemic has an effect on the TLCF-DTA recognition.

**Table 1** Sample Selection (Period 2017–2021)

	Observations	Firms
Consolidated financial statements prepared under IFRS	2140	428
No financial statements available	-68	
Unusual values	-42	
Industries with less than five firms	-15	
Missing values	-452	
Incomplete time series	-703	
Final sample (balanced panel)	860	172

This table presents the sample selection process for the sample period 2017–2021

The Column “Observations” indicates the number of firm-year observations, the Column “Firms” presents the number of firms in our sample

### 3 Research Design

#### 3.1 Sample Selection

We analyze a sample of large German public and private firms over the period 2017 to 2021. The sample selection process is detailed in Table 1.

We start with a sample of 428 firms (2140 observations) whose consolidated financial statements are prepared in accordance with IFRS, according to Bureau van Dijk’s Dafne database. Deferred tax and management forecast data are hand-collected, reducing the sample by 68 observations due to the lack of available financial statements. We drop 42 observations with unusual values (e.g., negative TLCF-DTA) and 15 observations from industries with fewer than five firms to enable a meaningful industry comparison (one-digit SIC level). As several of our variables have missing values either in the Dafne database (248 observations) or in the financial statements (for the hand-collected data, 204 observations), we lose another 452 observations. To avoid inference confounding resulting from firms that drop out or enter the sample during our sample period, we exclude 703 observations from firms with incomplete time series. Hence, our final balanced sample includes 172 firms with 860 observations. To mitigate the effect of outliers, we winsorize all continuous variables at the 1st and 99th percentiles.

#### 3.2 Model

To test the effect of the COVID-19 pandemic on TLCF-DTA recognition ( $HI$ ), we estimate the following multiple regression model:

$$Rec\_TLCF_{i,t} = \alpha_0 + \beta_1 Post_t + \beta_n Control_{i,t} + FE_i + \varepsilon_{it} \quad (1)$$

The dependent variable  $Rec\_TLCF_{it}$  reflects the amount of TLCF for which deferred tax assets have been recognized. We calculate the amount of recognized TLCF by grossing up TLCF-DTA with the tax rate used for deferred tax recognition, both

hand-collected from the tax footnote.<sup>4</sup> If TDCF-DTA are not disclosed, we set them to zero.<sup>5</sup> Next, we add the nonusable TDCF for which no deferred tax assets have been recognized to obtain the total TDCF amount. As the nonusable TDCF portion is a mandatory disclosure according to IAS 12.81 (e), we set the item to zero if the firm does not disclose an amount.<sup>6</sup> Finally, we divide the recognized amount by the total amount to obtain our dependent variable,  $Rec\_TDCF_{it}$ . An advantage of using the ratio instead of an absolute number is that it controls for the existence and level of TDCF. To measure the effect of the COVID-19 pandemic, we include the indicator variable  $Post$ , which takes a value of 1 for the years 2020 and 2021 and 0 otherwise. The coefficient for  $Post$  indicates whether the recognition behavior differs in the two sample years affected by the pandemic relative to the prepandemic period.

To control for time-invariant firm characteristics, we include firm fixed effects in our model. Furthermore, we add a vector with (time-variant) control variables derived from the literature (e.g., Miller and Skinner 1998, Herbohn et al. 2010, Dhaliwal et al. 2013): earnings before interest, taxes, depreciation, and amortization (EBITDA) scaled by total assets ( $Earn_{it}$ ), the logarithm of the number of employees ( $Size_{it}$ ), the number of years since the foundation of the company ( $Age_{it}$ ), the growth in sales relative to the previous year ( $Sales\_grow_{it}$ ) and an indicator of whether the firm is audited by a Big 4 auditor ( $Big4_{it}$ ). While the construction of our dependent variable controls to a certain extent for TDCF level, we also include the total TDCF amount (explained above) scaled by total assets ( $TDCF_{it}$ ) as another control variable. We expect a negative association because firms are more likely to recognize TDCF-DTA on a high fraction of TDCFs if the total amount is smaller. We cluster standard errors by firm (Peterson 2009). All of the variable definitions are stated in Table A.1 in Appendix A.

## 4 Results

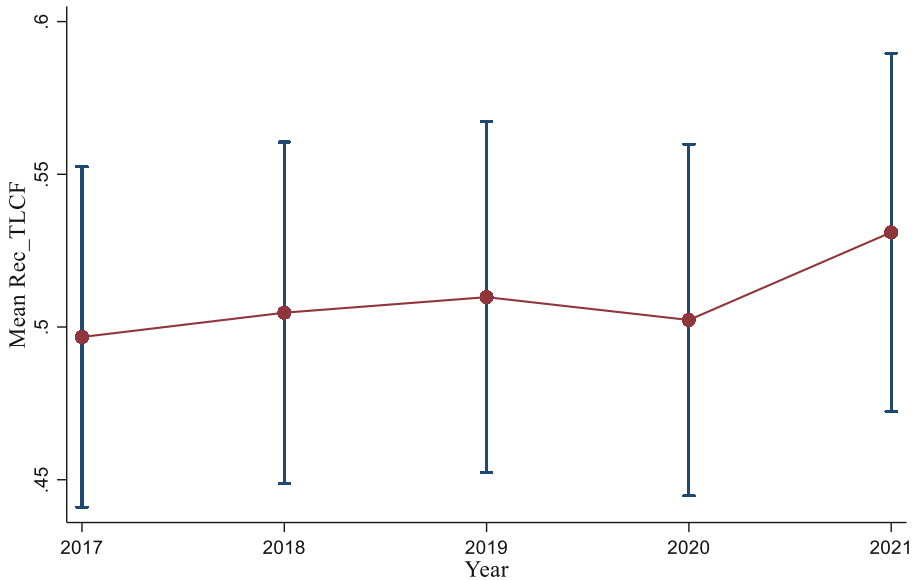
### 4.1 Graphical Evidence

We start our analysis with a graphical examination of the development of the average recognized TDCF ratio,  $Rec\_TDCF$ , over time. Figure 1 shows the development over our sample period, including the 95% confidence intervals.

<sup>4</sup> To obtain more insights into how and which TDCF information firms disclose, we present additional details and examples of tax footnotes in Appendix B.

<sup>5</sup> If we drop the five observations for which we use zero for the replacement, our results are unaffected. To further assess the accuracy of this approach, we compare the amount of recognized TDCF obtained from the tax footnote in 418 cases in which firms disclose it voluntarily with our calculated number. We find a significant ( $p$ -value < 0.01) Spearman correlation of 0.90 between the two numbers, indicating that our calculated variable is highly accurate.

<sup>6</sup> In some rare cases, firms do not disclose nonusable TDCF, instead disclosing nonrecognized TDCF-DTA. In these cases, we gross up the amount with the respective tax rate to obtain the amount of nonusable TDCF.



**Fig. 1** Average fraction of recognized TILCF (*Rec\_TILCF*) over time with confidence intervals. This figure shows the development of the yearly mean for the recognized fraction of TILCF (*Rec\_TILCF*) including the 95% confidence intervals over time. All variables are defined in Table A.1 in Appendix A

The figure shows an increase from 49.7% in 2017 to 51% in 2019. In the first COVID-19 year, 2020, the average ratio drops to 50.2%. The second pandemic year, 2021, shows an increase to 53.1%. If we apply the change from 2019 to 2020 (2020 to 2021) of  $-0.8$  ( $+2.9$ ) percentage points to the average TILCF level of 520 million euros, we see a change in the recognized portion of  $-4.16$  ( $+15.08$ ) million euros. These amounts represent the average effect on the firms' profits or losses due to the (de)recognition of deferred tax assets.

As we examine a balanced sample, these changes are not caused by variations in the sample composition. Instead, the decline in 2020 could be consistent with different recognition patterns. It could indicate management expectations if it is caused by deteriorated performance predictions. It could also indicate income-decreasing earnings management. The increase in 2021 possibly suggests a combination of improved performance expectations and high accumulated TILCF levels, particularly resulting from the prior year.

## 4.2 Summary Statistics and Correlation Matrix

The summary statistics are presented in Table 2. Our sample firms recognize on average deferred tax assets for 51% of their TILCF (*Rec\_TILCF*). The total unscaled TILCF amount (*TILCF* unscaled) ranges from 80,997 euros to 9012 million euros, with a mean of 520.963 million euros.

The correlation matrix in Table 3 does not show a significant association between *Rec\_TILCF* and *Post\_TILCF*. *TILCF* has a negative and significant association with

**Table 2** Summary Statistics

	Mean	Median	Std. Dev	Min	Max	N
<i>Rec_TLCF</i>	0.509	0.458	0.379	0.000	1.000	860
<i>Earn</i>	0.096	0.101	0.094	-0.400	0.371	860
<i>Size</i>	7.719	7.594	2.100	1.946	12.560	860
<i>Age</i>	3.541	3.332	0.896	0.693	5.313	860
<i>Sales_grow</i>	0.089	0.046	0.329	-0.637	2.844	860
<i>Big4</i>	0.657	1	0.475	0	1	860
<i>TTLCF</i>	0.356	0.067	1.119	0.000	7.615	860
<i>TTLCF</i> unscaled (€M)	520.963	45.767	1424.022	0.081	9012.348	860
<i>Cross-Sectional Indicators</i>						
<i>Forecast_Optimistic</i>	0.314	0	0.464	0	1	860
<i>Forecast_Pessimistic</i>	0.326	0	0.469	0	1	860
<i>Forecast_Many</i>	0.076	0	0.264	0	1	860
<i>Forecast_Few</i>	0.192	0	0.394	0	1	860
<i>EM_Small_Loss</i>	0.110	0	0.314	0	1	860
<i>EM_Large_Loss</i>	0.116	0	0.321	0	1	860

This table presents descriptive statistics for the main variables over the sample period 2017–2021

*Rec\_TLCF*, which is consistent with a lower ratio of recognized TLCF-DTA if the underlying TLCF are higher. Furthermore, the table shows a significantly positive correlation between *Rec\_TLCF* and *Earn* and a negative correlation with *Age* and *Big4*, indicating a higher recognized TLCF percentage for firms with higher earnings, younger firms and firms not audited by a Big4 auditor.

### 4.3 Regression Results

Table 4 presents the regression results for our tests of *H1*. The t-statistics are reported below the coefficients in parentheses. Column (1) shows the results for the estimation with only *Post* as the explanatory variable, and the negative adjusted  $R^2$  suggests that *Post* does not have any explanatory power. After the control variables are added in Column (2), the adjusted  $R^2$  increases to 0.101, but the coefficient for *Post* remains insignificant. Columns (3) and (4) show the results for the estimations with firm fixed effects. The enormous increase in the adjusted  $R^2$  to 0.779 (0.789) combined with the consistently insignificant coefficient for *Post* indicates that the TLCF-DTA recognition behavior is driven primarily by firm-specific factors and does not differ between the prepandemic and pandemic periods for the average firm. When the differences between the development in the years 2020 and 2021 indicated by Fig. 1 are considered, a possible explanation for the insignificant average effect might be the joint comparison of the years 2020 and 2021 to the prepandemic period. If we split the *Post* variable into the separate years 2020 and 2021 in untabulated tests, we find a negative coefficient for 2020 and a positive coefficient for 2021. However, both coefficients are insignificant, supporting the inference that there is, on average, no significant change compared to the prepandemic period.

**Table 3** Correlation Matrix

	1	2	3	4	5	6	7	8
1 <i>Rec_TLCF</i>	1							
2 <i>Post</i>	0.012	1						
3 <i>Earn</i>	0.088*	-0.022	1					
4 <i>Size</i>	0.050	0.014	0.158*	1				
5 <i>Age</i>	-0.109*	0.072*	0.099*	0.243*	1			
6 <i>Sales_grow</i>	0.022	-0.071*	0.209*	-0.054	-0.098*	1		
7 <i>Big 4</i>	-0.102*	-0.035	-0.023	0.395*	0.096*	-0.010	1	
8 <i>TTLCF</i>	-0.315*	-0.031	-0.283*	-0.302*	-0.094*	-0.069*	-0.141*	1

This table presents spearman correlation coefficients for all relevant variables

All variables are defined in Table A.1 in Appendix A

\* indicates significance at the 5% level

**Table 4** Main Regression Results

	(1)	(2)	(3)	(4)
	<i>Rec_TLCF</i>	<i>Rec_TLCF</i>	<i>Rec_TLCF</i>	<i>Rec_TLCF</i>
<i>Post</i>	0.013 (0.773)	0.016 (0.943)	0.013 (0.773)	-0.004 (-0.236)
<i>Earn</i>		-0.171 (-0.695)		0.233* (1.690)
<i>Size</i>		0.006 (0.440)		-0.069 (-1.194)
<i>Age</i>		-0.059** (-2.064)		0.211* (1.695)
<i>Sales_grow</i>		-0.055 (-1.364)		-0.055*** (-2.871)
<i>Big4</i>		-0.078 (-1.510)		-0.003 (-0.125)
<i>TTLCF</i>		-0.100*** (-5.853)		-0.065*** (-2.903)
Firm FE included	No	No	Yes	Yes
Observations	860	860	860	860
Adjusted $R^2$	-0.001	0.101	0.779	0.789

This table presents regression results for the dependent variable *Rec\_TLCF*

All variables are defined in Table A.1 in Appendix A

Standard errors are clustered by firm, t-statistics are presented in parentheses

Firm fixed effects are included but not reported

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

In support of the insights from the correlation matrix and our predictions, the total TLCF level (*TTLCF*) has a negative and significant association with *Rec\_TLCF*. This direction appears plausible, as firms with very high *TTLCF* levels likely expect to offset a lower fraction of the total amount relative to firms with low *TTLCF* levels. With respect to the remaining control variables, we find significant coefficients for *Earn* (+), *Age* (+) and *Sales\_grow* (-) in Column (4), suggesting a higher recognized TLCF-DTA level for firms with higher earnings, for older firms, and for firms with less sales growth.

This finding does not support *H1* and indicates that, on average, the pandemic did not alter firms' TLCF-DTA recognition patterns. To examine possible cross-sectional differences, in the following section, we separately assess the two potential drivers of TLCF-DTA recognition, management forecasting and opportunistic behavior.

## 4.4 Cross-sectional Tests

### 4.4.1 Management Forecasting

The first driver postulates that managers base their TLCF-DTA recognition decisions on private information about a firm's future performance. We obtain managements' expectations about future performance from management forecasts. Therefore, we hand-collect forecasts from the management report, in which German firms are required to explain their estimated business development in the next reporting period. Management forecasts are a common instrument for the disclosure of private, future-oriented financial and nonfinancial information to capital market participants (e.g., Healy and Palepu 2001; Cao et al. 2017).<sup>7</sup> While uncertainty could alter management forecast practices (Kim et al. 2021; Kitagawa 2021; Chang et al. 2022), we assume that the pandemic did not systematically change the forecast properties, building on a recent survey by Call et al. (2024, Table 12), which indicates that 71% of the surveyed managers did not change their overall forecast policy as a result of the pandemic.

Our sample firms forecast the following items: sales; earnings before interest and taxes (EBIT); EBITDA; and net income.<sup>8</sup> Firms report either one or several of the respective items. On the basis of the collected information, we analyze two properties of management forecasts: the direction and the number of forecasts.

The direction of forecasts is an indicator of managers' expectations regarding future performance. It could either be optimistic, stable, or pessimistic, depending on whether the forecasted item is higher, unchanged, or lower relative to the current value. We create the indicator variable *Forecast\_Optimistic*, which is 1 if at least one forecasted item is higher than its current value and no forecasted item is lower than its current value and 0 otherwise. *Forecast\_Pessimistic* is 1 if at least one forecasted item is lower than its current value and if no forecasted item is higher than its current value and 0 otherwise. The base category captures forecasts that are equal to the current value and observations with mixed forecasts (optimistic for at least one item and pessimistic for at least one item) and serves as a control group.<sup>9</sup>

<sup>7</sup> The literature often uses management forecasting as a proxy for voluntary disclosures (e.g., Ajinkya et al. 2005; Cao et al. 2017). This proxy is reasonable, because in many countries (e.g., the United States), management forecasting is not mandatory but is used as a tool to communicate with market participants (Beyer et al. 2010). However, according to Sect. 289 Para. 1 HGB, management forecasts are mandatory for firms based in Germany. This fact supports our choice of a German sample, as it ensures the availability of management forecasts for all sample firms.

<sup>8</sup> Some firms report different variables than those stated above. For example, real-estate companies tend to forecast funds from operations (FFO) as a key profit indicator. Others estimate earnings before interest, taxes, and amortization (EBITA) or operating income before depreciation and amortization (OIBDA). We assign these variables either to EBIT or to EBITDA for two main reasons: first, there is no substantial difference in calculation of the performance indicators and, second, the number of firms who uses them is very small. While we would prefer to use only one of the forecasted performance items for our measures, doing so would result in a substantial reduction of our sample size due to the large variation in the forecasted items (the most frequently forecasted item is sales, appearing in 422 of our 860 observations). Hence, we consider all of the forecasted items for our variable construction.

<sup>9</sup> If a point forecast is provided, we directly compare it to the current value. In the case of an interval forecast, we take the average of the upper and lower value and compare it to the current value. For qualitative

Importantly, we assign firms to the optimistic, base, or pessimistic category on the basis of their management forecast in the year 2020 (as the first pandemic year) because this procedure allows us to compare three fixed portfolios of firms over our sample period. We assume that managers base their TLCF-DTA recognition on performance expectations if they reduce (increase) recognition in the case of pessimistic (optimistic) forecasts.<sup>10</sup>

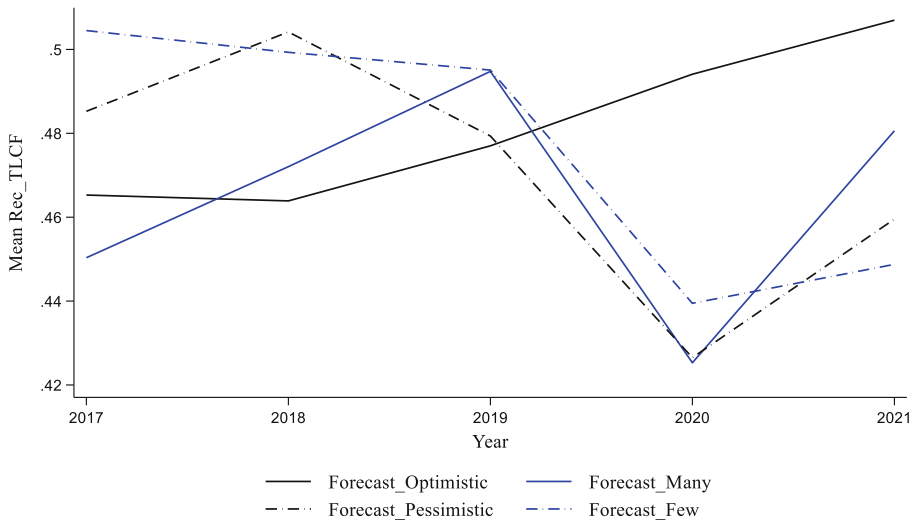
For the second management forecast property, we count the number of different forecasted items in the year 2020. While one forecast is mandatory according to Sect. 289 Para. 1 HGB, additional forecasts are voluntary. Hence, we assume that managers bear the disclosure risk (e.g., of falling short of one of the forecasts) only if sufficient information is available to build credible expectations (Clarkson et al. 2008; Müller et al. 2020). Thus, a greater number of forecasts could indicate that managers have more or more precise information about expected future performance. Fewer forecasts suggest greater uncertainty about the future. The number in our sample ranges from zero (despite being a mandatory disclosure, we were not able to find a forecast for all observations) to four, with a median of two forecasted items. As 73% of the observations issue two forecasts in 2020, we use this as the control group and create the indicator variable *Forecast\_Many* (*Forecast\_Few*) if a firm reports forecasts for more (less) than two items. The classification is again based on the management forecast in the year 2020. A decrease (increase) in recognition in the case of few (many) forecasts suggests the signaling of performance expectations. While the number of forecasts could be indicative of uncertainty, we would like to add the caveat that there might also be other drivers such as proprietary cost aspects.

Figure 2 divides the sample into different management forecasting categories: *Forecast\_Optimistic*, *Forecast\_Pessimistic*, *Forecast\_Many*, and *Forecast\_Few*. In the precrisis period, 2017–2019, the *Forecast\_Pessimistic* and *Forecast\_Few* groups are at a higher level with a generally decreasing trend, whereas the *Forecast\_Optimistic* and *Forecast\_Many* groups follow an increasing trend. The year 2020 shows a clear distinction in recognition behavior: the average ratio for the *Forecast\_Optimistic* group continues to increase, whereas the trends of the other three categories decrease. In 2021, these categories rebound but remain below their 2019 averages. This visual finding suggests that the recognition behavior in 2020 reflects management expectations because firms with optimistic forecasts increase *Rec\_TLCF*, whereas firms with pessimistic forecasts decrease the ratio. The absence of such a pattern for *Forecast\_Many* and *Forecast\_Few* could indicate that the number of forecasts is less informative about managements' earnings expectations than the forecast direction is. The summary statistics for the cross-sectional indicators in Table 2 show that, in the year 2020, 31 (33) percent of our sample firms issued an

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forecasts, we classify the forecast as optimistic (pessimistic) if it predicts an increasing (decreasing) value of the item.

<sup>10</sup> Although the pandemic introduced a considerable level of uncertainty that renders an increase in TLCF-DTA unlikely, the growth projections from the onset of the pandemic indicate a quick economic recovery to levels even higher than they were before the shock (International Monetary Fund 2020a, b). Hence, firms for which the TLCF levels increased in the first pandemic year but which have optimistic economic expectations would have to increase their TLCF-DTA ratios in accordance with IAS 12.



**Fig. 2** Average *Rec\_TLCF* over time—Management Forecasting split. This figure documents the development for the mean *Rec\_TLCF* over time per signaling category. The categories are defined based on the direction (black lines) or number (blue lines) of management forecasts in the year 2020. All variables are defined in Table A.1 in Appendix A

optimistic (pessimistic) forecast, and 7.6 (19.2) percent issued more (less) than two forecasts.

To assess potential differences between the forecasting groups, we compare the means and medians for the dependent and control variables for all of the groups in Panel A of Table 5 with t-tests and Wilcoxon rank sum tests. Firms in the *Forecast\_Optimistic* group are significantly larger and older, are more often audited by a Big4 auditor and have a lower average *TTLCF*. For the number of forecasts, we find different group characteristics. Firms with many forecasts are significantly younger and have a higher level of *TTLCF*. In line with the graphical evidence, this comparison suggests that the two categories capture different forecasting constructs.

To analyze the different forecasting patterns with a difference-in-differences regression, we extend Model (Eq. 1) by adding an interaction between the respective category indicator variable (*Pattern*) and the *Post* indicator, as follows:

$$Rec\_TLCF_{i,t} = \alpha_0 + \beta_1 Post_t + \beta_2 Post_t \times Pattern_i + \beta_n Control_{i,t} + FE_i + \varepsilon_{it} \quad (2)$$

We include the same control variables and fixed effect as in the main model. Table 6 shows the estimation results. First, we interact the crisis year indicator *Post* with the forecast direction indicators *Forecast\_Optimistic* and *Forecast\_Pessimistic*. Neutral forecasts are the base group to which the other categories are compared. In the second split, we include interactions with *Forecast\_Many* and *Forecast\_Few*, using firms with two forecasts as the base group. The noninteracting indicators are subsumed by the firm fixed effects, as they are time invariant (we assign firms to categories on the basis of their 2020 forecast properties). The interaction term  $Post_t \times$



**Table 6** Cross-Sectional Tests Management Forecasting and Earnings Management

	(1)	(2)	(3)
	<i>Rec_TLCF</i>	<i>Rec_TLCF</i>	<i>Rec_TLCF</i>
<i>Post</i>	0.029 (1.091)	0.015 (0.696)	-0.004 (-0.197)
<i>Post</i> × <i>Forecast_Optimistic</i>	-0.009 (-0.238)		
<i>Post</i> × <i>Forecast_Pessimistic</i>	<b>-0.095** (-2.355)</b>		
<i>Post</i> × <i>Forecast_Many</i>		-0.058 (-1.186)	
<i>Post</i> × <i>Forecast_Few</i>		<b>-0.085** (-2.055)</b>	
<i>Post</i> × <i>EM_Small_Loss</i>			<b>-0.082** (-2.577)</b>
<i>Post</i> × <i>EM_Large_Loss</i>			0.061 (1.250)
<i>Earn</i>	0.258* (1.967)	0.225 (1.587)	0.269** (2.016)
<i>Size</i>	-0.070 (-1.214)	-0.050 (-0.873)	-0.075 (-1.315)
<i>Age</i>	0.216* (1.733)	0.212 (1.636)	0.230* (1.862)
<i>Sales_grow</i>	-0.055*** (-3.040)	-0.054*** (-2.817)	-0.056*** (-2.948)
<i>Big4</i>	-0.001 (-0.030)	-0.005 (-0.199)	-0.005 (-0.185)
<i>TTLCF</i>	-0.065*** (-2.963)	-0.066*** (-2.977)	-0.067*** (-2.986)
Firm FE included	Yes	Yes	Yes
Observations	860	860	860
Adjusted R <sup>2</sup>	0.792	0.791	0.788
F-tests (Prob > F):			
<i>Post</i> + <i>Post</i> × <i>Forecast_Optimistic</i> = 0	0.472		
<i>Post</i> + <i>Post</i> × <i>Forecast_Pessimistic</i> = 0	0.046		
<i>Post</i> + <i>Post</i> × <i>Forecast_Many</i> = 0		0.363	
<i>Post</i> + <i>Post</i> × <i>Forecast_Few</i> = 0		0.065	
<i>Post</i> + <i>Post</i> × <i>EM_Small_Loss</i> = 0			0.004
<i>Post</i> + <i>Post</i> × <i>EM_Large_Loss</i> = 0			0.226

This table presents regression results for the dependent variable *Rec\_TLCF*. Column (1) shows results for interactions with the first signaling indicators (*Forecast\_Optimistic*, *Forecast\_Pessimistic*), classified based on the forecast direction in 2020. Column (2) presents results for interactions with the second signaling category (*Forecast\_Many*, *Forecast\_Few*), classified based on the number of forecasts in 2020. Column (3) shows results for interactions with the first earnings management variable (*EM\_Small\_Loss*) based on avoiding negative net income in 2020 and the second earnings management variable (*EM\_Large\_Loss*), indicating big bath accounting in 2020. All variables are defined in Table A.1 in Appendix A. Standard errors are clustered by firm, t-statistics are presented in parentheses. Firm fixed effects are included but not reported. \*\*\*, \*\*, and \* indicate significance at 1%, 5%, and 10% levels, respectively, in two-tailed tests.

*Pattern<sub>i</sub>* captures whether the pattern is more pronounced during the pandemic than it was during the prepandemic period and relative to the control group, following a DiD design. The results for the forecast direction interactions are presented in Column (1), and those for the number of forecast interactions are presented in Column (2) of Table 6.

In both columns, the *Post* indicator has insignificant coefficients, similar to the main results. This finding indicates that the base group continues to exhibit no systematic recognition pattern during the pandemic. The interactions with the indicator for unfavorable or uncertain performance expectations (*Forecast\_Pessimistic* and *Forecast\_Few*) have negative and significant coefficients, whereas the interactions for favorable or less uncertain performance expectations (*Forecast\_Optimistic* and *Forecast\_Many*) have negative but insignificant coefficients. These findings suggest that firms base their TLCF-DTA recognition on performance expectations (in line with IAS 12 requirements) but only in the case of unfavorable or uncertain predictions. F-tests for the overall effect (sum of *Post* and interaction) are presented at the bottom of the table and suggest that the sum is significantly different from zero for *Forecast\_Pessimistic* and *Forecast\_Few*, in line with the interaction coefficients. In terms of economic significance, the coefficient for  $Post \times Forecast\_Pessimistic$  of  $-0.095$  represents 18.67% of the mean *Rec\_TLCF*. If we express this in monetary terms, our sample firms have an average recognized TLCF-DTA level of 265 million euros, which would show an incremental decline of 49 million euros for firms with pessimistic forecasts in the pandemic period.

A possible explanation for our asymmetric findings could be that firms with favorable or less uncertain earnings expectations do not systematically increase their recognition ratio because they are already close to the maximum possible recognition rate (near 100%). However, this explanation would be inconsistent with the summary statistics in Table 5, suggesting average recognition levels between 46.5 and 48.1% for these forecast groups and no significant differences in the average *Rec\_TLCF* between firms with favorable (less uncertain) and unfavorable (uncertain) forecasts. Alternatively, asymmetric forecasting behavior might suggest conservative recognition behavior. We explore this possibility in additional tests (Sect. 4.5). Finally, a potential explanation could be that the high level of uncertainty about future development discourages firms from increasing recognition despite optimistic forecasts. Considering the realization likelihood of optimistic forecasts in TLCF-DTA recognition is in line with IAS 12, which emphasizes the importance of “assessing the probability that taxable profit will be available” (IAS 12.36).

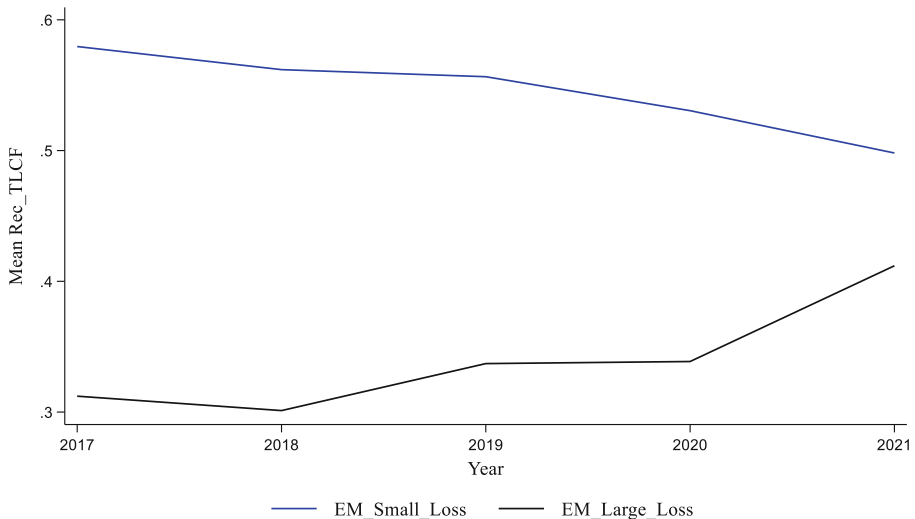
#### 4.4.2 Earnings Management

Next, we test opportunistic behavior as a second possible recognition pattern. We investigate the management of earnings in two directions: income-increasing and income-decreasing earnings management. Income-increasing earnings management can be used to meet or beat different targets, for example, positive earnings (e.g., Burgstahler and Dichev 1997; Frank and Rego 2006; Jacob and Jorgensen 2007), analyst forecasts (e.g., Burgstahler and Eames 2006; Herbohn et al. 2010), or prior year earnings (e.g., Degeorge et al. 1999). As COVID-19 created an unanticipated economic shock, prior year earnings or forecasts are less likely to be relevant earnings management targets in the year 2020. Hence, we focus on positive earnings as a possible target during the pandemic. We follow the studies on earnings management around targets (e.g., Frank and Rego 2006) and first calculate net income before TLCF-DTA by deducting the change in TLCF-DTA from net income. We

divide the firms with negative net income before TLCF-DTA into terciles and create the indicator variable *EM\_Small\_Loss*, which is equal to 1 for firms in the highest tercile (closer to zero). This group of firms has incentives to increase the recognized TLCF ratio during the crisis to avoid or reduce a loss.

Alternatively, firms might use the economic shock for big bath accounting or to create a cookie jar reserve for the future (e.g., Christensen et al. 2008). To assess whether firms that already had negative net income before TLCF-DTA extend the loss with TLCF-DTA (de)recognition, we create the indicator variable *EM\_Large\_Loss*. It equals 1 for firms in the lowest tercile of negative net income before TLCF-DTA in the year 2020. Hence, the control group for this test is firms that have neither a small nor a large loss (i.e., with a medium loss or positive net income before TLCF-DTA). A smaller recognized ratio for firms that are already in the lowest income group could indicate the creation of a reserve for the future. At the same time, it could also be consistent with management forecasting because highly negative net income often accompanies pessimistic earnings expectations. Hence, this second earnings management measure should be interpreted with caution.

The division for the different earnings management categories is presented in Fig. 3. The group with negative net income before TLCF-DTA just below zero (*EM\_Small\_Loss*) has a higher recognized ratio and decreases over the sample period. The *EM\_Large\_Loss* group shows some volatility in the precrisis period, rather stable development in 2020 and an increase in 2021. This development is inconsistent with typical earnings management patterns, as firms just below zero would increase the ratio to avoid a loss, and firms with very low income would further reduce the ratio to take a big bath. Hence, the visual inspection indicates that firms



**Fig. 3** Average *Rec\_TLCF* over time—Earnings management split. This figure documents the development for the mean *Rec\_TLCF* over time per earnings management category. The categories are defined based on incentives to avoid negative net income (*blue lines*) or to take a big bath (*black lines*) in the year 2020. All variables are defined in Table A.1 in Appendix A

do not apply typical earnings management patterns to TILCF-DTA recognition in an economic shock situation.

The summary statistics in Table 2 show that we identify incentives for income-increasing earnings management (*EM\_Small\_Loss*) for 11% and incentives for big bath earnings management (*EM\_Large\_Loss*) for 11.6% of the sample firms in 2020. Panel B of Table 5 presents the mean and median comparisons for the two earnings management groups. Firms with incentives for income-increasing earnings management in 2020 (*EM\_Small\_Loss*) have a significantly higher TILCF recognition level, are smaller and younger, and are less often audited by a Big 4 firm than *EM\_Large\_Loss* firms. A higher recognition level could be consistent with *EM\_Small\_Loss* firms using a higher *Rec\_TILCF* to avoid or reduce a loss and/or *EM\_Large\_Loss* firms reducing the *Rec\_TILCF* level due to big bath behavior.

For the earnings management regression, we modify Model (Eq. 2) and include the interactions of *Post* with the two earnings management patterns:

$$Rec\_TILCF_{i,t} = \alpha_0 + \beta_1 Post_t + \beta_2 Post_t \times EM\_Small\_Loss_i + \beta_3 Post_t \times EM\_Large\_Loss_i + \beta_n Control_{i,t} + FE_i + \varepsilon_{it} \quad (3)$$

The results are presented in Column (3) of Table 6. The base group is non-earnings management firms. The interaction of crisis years *Post* and *EM\_Small\_Loss* has a significantly negative coefficient, and the interaction with *EM\_Large\_Loss* has a positive but insignificant coefficient. This result suggests that firms with net income before TILCF-DTA just below zero incrementally reduce their *Rec\_TILCF* level, which is inconsistent with income-increasing earnings management to avoid a loss. The results are supported by F-tests, which show a significant overall effect only for *EM\_Small\_Loss*.

We perform three untabulated tests to assess this unexpected recognition behavior.

(I) A possible explanation could be differences in loss histories. Firms with small losses might have less recent experience with TILCF-DTA recognition; therefore, they might be more careful. Our tests do not support this notion, as we do not find significant differences in the number of historic losses for firms with small and large losses.

(II) Industry differences could be an alternative explanation. Fifty-eight percent of the firms in the *EM\_Small\_Loss* group are from the finance, insurance and real estate industry. Given the peculiarities of this industry, the result might be driven by industry instead of by loss size. We drop this industry from our sample (340 observations) and repeat the earnings management tests. We continue to find a significantly negative coefficient for the *Post* × *EM\_Small\_Loss* interaction. Hence, industry specifics do not seem to explain our results.

(III) We address the German tax loss carryback extension in our sensitivity tests and conclude that it most likely does not affect TILCF-DTA in our sample of large firms. As the descriptive evidence in Table 5, Panel B suggests, *EM\_Small\_Loss* firms are significantly smaller than *EM\_Large\_Loss* firms are. Although they are still large relative to SMEs that potentially benefit from the extension, we want to verify that the extended carryback options do not drive our results. Hence, we exclude all *EM\_Small\_Loss* firms with positive net income in 2019 (as an approximation for the

potential to carry back losses) from our sample. After dropping 55 observations, we still find a negative interaction coefficient, indicating that the effect does not result from the carryback extension.

Absent a plausible explanation from all of these tests, we interpret the regression results in conjunction with the graphical evidence in Fig. 3 and the descriptive statistics in Table 5 Panel B. The firms in the *EM\_Small\_Loss* group appear to gradually reduce their significantly higher *Rec\_TLCF* levels over our sample period. As these firms are smaller, younger and considerably less often audited by Big 4 firms, the high *Rec\_TLCF* levels might result from extensive recognition in the past. The highly uncertain pandemic situation might be seen as an opportunity to accelerate the downsizing of this position. Hence, these firms continue and intensify their *Rec\_TLCF* reducing trend during the crisis years and seem not to pursue specific earnings management goals. Firms in the lowest negative income tercile do not show significantly different recognition behaviors during the pandemic and seem not to apply big bath accounting.

## 4.5 Additional Tests

To further explore TLCF recognition during the pandemic, we perform three additional tests. First, we analyze conservatism as a potential explanation for the observed recognition pattern. Second, we examine the role of a firm's industry affiliation in TLCF recognition behavior. Third, we investigate the change in recognition behaviors from 2019 to 2020 in more detail and distinguish among different groups of firms to shed light on potential determinants of the recognition pattern due to the pandemic.

### 4.5.1 Conservatism

Our cross-sectional results suggest that firms follow a management forecasting pattern in TLCF recognition during the crisis but that this pattern applies only to unfavorable or uncertain management forecasts. Such recognition behavior might be explained by a common convention in Continental European accounting: conservatism. Following the objective of creditor protection, conservatism involves a systematic understatement of assets and overstatement of liabilities via the late recognition of revenues and early recognition of expenses (Haller and Eierle 2004; Hellman 2008). Penman and Zhang (2020) provide theoretical evidence that the degree of accounting conservatism increases with uncertainty about firms' future earnings. In line with this notion, Hellman (2008) describes conservatism as "an accounting tool for dealing with uncertainty" (p. 96) and identifies the TLCF-DTA recognition as one practical example of how to apply temporary conservatism under IFRS. If (some) firms' conservatism level increases during the pandemic, they might be more inclined to derecognize TLCF-DTA (early recognition of expenses) or delay the recognition of TLCF-DTA (delayed recognition of revenues). If at the same time these firms cannot offset TLCF during the pandemic, the conservative behavior would reduce the ratio of TLCF, for which TLCF-DTA have been recognized, to total TLCF (*Rec\_TLCF*).

Hence, we investigate whether firms' TLCF-DTA recognition behavior during the COVID-19 pandemic varies with their conservatism levels.

As most conservatism measures involve capital market measures, we test conservatism for a subsample of public firms.<sup>11</sup> We apply the approach of Khan and Watts (2009) for a firm-year measure of conservatism. Therefore, we calculate the asymmetric timeliness of bad news, estimated as the C\_Score, in line with Khan and Watts (2009). As conservatism increases in the C\_Score, we divide it in the year 2020 into terciles and create indicator variables for firms in the highest tercile (*Conservatism\_High*) and another indicator for firms in the lowest tercile, which we classify as weakly conservative (*Conservatism\_Low*). Firms in the remaining tercile constitute the control group with a medium level of conservatism. We expect firms with a high (low) level of conservatism to reduce (increase) the TLCD-DTA recognition if the recognition is moderated by conservatism.

We adjust Model (Eq. 3) to include the conservatism variables in our difference-in-differences regression:

$$Rec\_TLCF_{i,t} = \alpha_0 + \beta_1 Post_t + \beta_2 Post_t \times Conservatism\_High_i + \beta_3 Post_t \times Conservatism\_Low_i + \beta_n Control_{i,t} + FE_i + \varepsilon_{it} \quad (4)$$

Table 7, Column (1) presents the conservatism splits. The conservatism interactions do not show a systematic pattern, as both interaction coefficients are insignificant and do not support the prediction that the recognition behavior during the crisis varies with conservatism. In untabulated tests, we find that the conservatism level generally increases during the pandemic (we find a significantly positive coefficient for *Post* when the C\_Score is used as the dependent variable) but that this increase seems to be unrelated to TLCF-DTA recognition. Taken together, the results indicate that conservatism does not seem to explain the asymmetric management forecasting results of the cross-sectional tests.

#### 4.5.2 Industry Tests

In a second test, we examine whether TLCF-DTA recognition varies systematically with a firm's industry. Therefore, we identify industries that suffered and those that benefited economically from the COVID-19 shock by relying on survey data from the German Business Panel (GBP) (University of Mannheim 2022). The GBP periodically surveys executives and key decision-makers in German firms. We use data from the first GBP survey wave, which was collected between July and October 2020 and yielded 10,174 complete survey responses (Bischof et al. 2023).<sup>12</sup> The survey questions directly address how firms are affected by COVID-19. For our

<sup>11</sup> If instead we use conservatism measures that are also applicable to private firms (for example, a measure for financial conservatism from Bigelli et al. (2014) or an accrual-based measure from Givoly and Hayn (2002) and Ahmed and Duellman (2013)), our results are qualitatively unchanged relative to the findings when using the Khan and Watts (2009) measure.

<sup>12</sup> We refer to Bischof et al. (2023) for the representativeness of and further details on the survey.

**Table 7** Additional Tests Conservatism and Industry Uncertainty

	(1)	(2)
	<i>Rec_TLCF</i>	<i>Rec_TLCF</i>
<i>Post</i>	-0.009 (-0.254)	-0.016 (-0.619)
<i>Post</i> × <i>Conservatism_High</i>	-0.040 (-0.888)	
<i>Post</i> × <i>Conservatism_Low</i>	-0.003 (-0.074)	
<i>Post</i> × <i>Uncertainty_High</i>		0.026 (0.676)
<i>Post</i> × <i>Uncertainty_Low</i>		0.010 (0.251)
<i>Earn</i>	0.046 (0.342)	0.237* (1.738)
<i>Size</i>	-0.104* (-1.777)	-0.071 (-1.220)
<i>Age</i>	0.017** (1.983)	0.217* (1.753)
<i>Sales_grow</i>	-0.032 (-1.303)	-0.056*** (-2.946)
<i>Big4</i>	-0.003 (-0.100)	-0.002 (-0.085)
<i>TTLCF</i>	-0.054** (-2.340)	-0.066*** (-2.896)
Firm FE included	Yes	Yes
Observations	690	860
Adjusted <i>R</i> <sup>2</sup>	0.795	0.788
F-tests (Prob > F):		
<i>Post</i> + <i>Post</i> × <i>Conservatism_High</i> = 0	0.139	
<i>Post</i> + <i>Post</i> × <i>Conservatism_Low</i> = 0	0.688	
<i>Post</i> + <i>Post</i> × <i>Uncertainty_High</i> = 0		0.763
<i>Post</i> + <i>Post</i> × <i>Uncertainty_Low</i> = 0		0.828

This table presents regression results for the dependent variable *Rec\_TLCF*

Column (1) shows results for interactions with the conservatism indicators (*Conservatism\_High*, *Conservatism\_Low*), classified based on the conservatism level in 2020

Column (2) shows results for interactions with the indicator for industries with high (*Uncertainty\_High*) and low uncertainty (*Uncertainty\_Low*) in 2020, based on survey data from the German Business Panel

All other variables are defined in Table A.1 in Appendix A

Standard errors are clustered by firm, t-statistics are presented in parentheses

Firm fixed effects are included but not reported

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

sample split, we draw on responses to the question “How great is the uncertainty resulting from the Corona crisis for the business of your company?” (survey data item ‘*cun8*’). The survey data are anonymized but indicate the firms’ industry according to the “Klassifikation der Wirtschaftszweige”—“WZ 2008”—from the German Federal Statistical Office. We calculate the average uncertainty per four-digit WZ industry and merge it with our TLCF data. Next, we split industry-level uncertainty into terciles to identify industries with low, medium, and high uncertainty levels and interact the uncertainty indicator with our pandemic variable. Firms in industries with a medium level of uncertainty constitute the control group. We interact the indicators

**Table 8** Multinomial Logistic Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Controls only		Management Forecasting I		Management Forecasting II		Earnings Management	
	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase
<i>Forecast_Optimistic</i>			0.862 (1.57)	0.670 (1.22)				
<i>Forecast_Pessimistic</i>			<b>1.036** (2.00)</b>	0.263 (0.48)				
<i>Forecast_Many</i>					0.913 (1.00)	0.851 (0.91)		
<i>Forecast_Few</i>					0.613 (1.13)	0.108 (0.18)		
<i>EM_Small_Loss</i>							0.001 (0.00)	-0.137 (-0.17)
<i>EM_Large_Loss</i>							0.847 (0.72)	0.777 (0.64)
<i>Earn</i>	2.439 (0.78)	<b>6.012* (1.82)</b>	2.128 (0.66)	<b>6.245* (1.87)</b>	2.607 (0.83)	<b>6.276* (1.89)</b>	2.656 (0.84)	<b>6.150* (1.85)</b>
<i>Size</i>	<b>0.206* (1.69)</b>	0.164 (1.29)	<b>0.211* (1.69)</b>	0.165 (1.28)	<b>0.224* (1.82)</b>	0.164 (1.27)	0.197 (1.58)	0.153 (1.17)
<i>Age</i>	0.009 (1.62)	0.007 (1.31)	0.008 (1.52)	0.006 (1.16)	0.009 (1.65)	0.007 (1.37)	0.008 (1.45)	0.006 (1.18)
<i>Sales_grow</i>	0.608 (0.90)	-0.629 (-0.70)	0.676 (0.91)	-0.530 (-0.58)	0.485 (0.71)	-0.703 (-0.77)	0.627 (0.92)	-0.629 (-0.69)
<i>Big4</i>	0.632 (1.34)	<b>1.164** (2.31)</b>	0.669 (1.39)	<b>1.199** (2.36)</b>	0.615 (1.29)	<b>1.152** (2.27)</b>	0.636 (1.31)	<b>1.143** (2.21)</b>
<i>TTLFCF</i>	<b>11.230*** (3.23)</b>	<b>11.597*** (3.34)</b>	<b>11.813*** (3.23)</b>	<b>12.205*** (3.33)</b>	<b>11.271*** (3.17)</b>	<b>11.608*** (3.27)</b>	<b>10.966*** (3.09)</b>	<b>11.334*** (3.19)</b>
<i>Area under ROC</i>	0.664	0.649	0.679	0.673	0.675	0.653	0.656	0.651
Observations	172		172		172		172	
Mcfadden Pseudo R <sup>2</sup>	0.124		0.141		0.132		0.126	

This table presents results for four multinomial logistic regression estimations

The dependent variable captures the nature of the change in *Rec\_TLFCF* from 2019–2020 with the categories *Decrease*, *Increase* and *No\_Change*

*No\_Change* is the base outcome

Results for the first estimation which includes only the control variables are presented in Column (1) and (2)

Columns (3) to (8) show results for the cross-sectional indicators

All independent variables are defined in Table A.1 in Appendix A

Standard errors are clustered by firm, z-statistics are presented in parentheses

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

The area under the Receiver Operating Curve (ROC) results from the comparison of the predicted values for the outcome *Increase* or *Decrease* and the true state of the observation

for high uncertainty (*Uncertainty\_High*) and low uncertainty (*Uncertainty\_Low*) with our *Post* indicator as follows:

$$\begin{aligned} Rec\_TLCF_{i,t} = & \alpha_0 + \beta_1 Post_t + \beta_2 Post_t \times Uncertainty\_High_i + \beta_3 Post_t \\ & \times Uncertainty\_Low_i + \beta_n Control_{i,t} + FE_i + \varepsilon_{it} \end{aligned} \quad (5)$$

If the recognition pattern is driven by industry-related uncertainty, we would expect a negative coefficient for the interaction with *Uncertainty\_High* and either no negative or a positive coefficient for the interaction with *Uncertainty\_Low*. The results in Column (2) of Table 7 show insignificant interactions for both interactions.<sup>13</sup> This finding suggests that the effect of COVID-19 on TLCF-DTA recognition is firm-specific rather than industry-specific.

#### 4.5.3 Multinomial Logit Model

To explore this rather firm-specific recognition behavior during the pandemic in more detail, we reduce our sample to the year 2020 (as the first year of the pandemic) and split the sample into firms with (i) an increase in *Rec\_TLCF*, (ii) a decrease in *Rec\_TLCF*, and (iii) no change in *Rec\_TLCF* relative to 2019. To identify determinants of the recognition behavior, we estimate multinomial logistic regressions with the three categories as the dependent variable. In the first step, we use only the control variables from Model (Eq. 1) as the independent variables. Next, we add our cross-sectional indicators for management forecasting and earnings management. The results are presented in Table 8.

The first two columns show the results for the estimation with the control variables. The categories *Decrease* and *Increase* are each compared to the base category *No-Change*. The findings show that larger firms have higher multinomial log odds for reducing *Rec\_TLCF* in 2020, whereas firms with higher earnings or with a Big 4 auditor are more likely to increase *Rec\_TLCF*. The latter finding is remarkable, since our results thus far do not suggest increasing *Rec\_TLCF* during the pandemic. However, it appears plausible that firms with higher current earnings (measured via the ratio of EBITDA to total assets) are more optimistic about using TLCF in the future and increase the recognition. This notion is also supported by the positive and mainly significant coefficient for the earnings control variable (*Earn*) in Tables 4, 6, and 7, which seems not to be reflected in more optimistic forecasts (see the insignificant results in Table 6, Column (1)). In untabulated tests, we further explore the interplay of current profitability and the forecast direction. We find that the interactions between *Post* and different properties of current earnings (sign, development, level) are not significantly related to *Rec\_TLCF*. Furthermore, the results for

<sup>13</sup> As an alternative industry test, we split our sample into firms in the pharmaceutical industry (SIC code 283), in digital industries (SIC code 737) and all other industries because the two selected industries were particularly affected by the pandemic. Untabulated results for the interactions of the two industry indicators, with the *Post* indicator show insignificant coefficients for both interaction terms, in line with the results based on the GBP split.

*Forecast\_Optimistic* remain insignificant even if we exclude firms with a loss or if we condition the variable on a positive sign for EBITDA. We conclude that (1) the current profitability level is relevant for TLCF-DTA recognition but that (2) this relevance is not significantly altered by COVID-19 and that (3) optimistic forecasts are not related to recognition during the pandemic, even if they are combined with positive profitability.

The results in Table 8 further show that a greater total TLCF amount increases the likelihood of changing *Rec\_TLCF* in both directions relative to the *No\_Change* group. These inferences for the control variables are mainly consistent throughout all of the estimations. Columns (3) to (8) show the results for the estimations with the cross-sectional indicator variables. We find a significant coefficient only for *Forecast\_Pessimistic*, suggesting that firms with pessimistic forecasts are more likely to reduce *Rec\_TLCF*. This result corroborates our findings in Table 6 that recognition behavior is linked to management forecasts but only for the downside case of pessimistic expectations. For all of the estimations, the area under the Receiver Operating Curve (ROC) compares the predicted values with the true state of the observation. The observed values around or above 0.65 indicate a moderate fit. Taken together, the results of the multinomial tests support the findings from our cross-sectional tests and provide additional insights into the determinants of increasing *Rec\_TLCF* during the pandemic.

## 5 Sensitivity Tests

### 5.1 Tax Loss Carryback Extension

We perform several additional and robustness tests to examine the sensitivity of our findings. First, we address the German regulatory extension of tax loss carryback amounts as a response to the COVID-19 shock. We argue that the magnitude of the extension from one million euros to five million euros in 2020 is unlikely to affect many of our large sample firms, most of which have considerable TLCF amounts. To test this argument empirically, we identify all firms for which the tax loss carryback extension could result in a substantial reduction in total TLCF. We exclude these firms because an increase in the tax loss carryback amount, which reduces total TLCF could affect the ratio of recognized TLCF-DTA irrespective of expectations about future TLCF usability. We exclude all observations with total TLCF equal to or below different thresholds in the year 2019—in particular, 12, 20, or 40 million euros—because, for these cases, the loss carryback extension by four million euros could mean reductions in TLCF by up to 33%, 20%, or 10%, respectively.<sup>14</sup> This possibility applies to 47, 68, or 86 firms at the 12, 20, or 40 million thresholds, respectively. To keep the sample balanced, we drop an additional

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<sup>14</sup> On the one hand, even if the firm has TLCF of 20 million euros, it cannot necessarily use the full carryback amount of five million euros in 2020, because doing so requires positive pre-year taxable income and depends on the tax jurisdiction in which the TLCF emerged. On the other hand, our data are at the group level and might underestimate the magnitude as the carryback option applies to the single entity. However, according to the German Business Panel that assesses the aggregate COVID-19 influence on German firms,

188, 272, or 344 observations. For the remaining 625, 520, or 430 observations with higher TDCF amounts in 2019, we find qualitatively unchanged results for the main estimation of Model (1), as in Table 4 Column (4), i.e., an insignificant coefficient for *Post*. Regarding the cross-sectional tests, we find the most robust evidence for the first forecast split, indicating a negative interaction between *Post* and *Forecast\_Pessimistic* even after a substantial reduction in the sample size. The remaining interactions show weaker results.

In 2021, the tax loss carryback was further extended from 5–10 million euros. As this carryback is also allowed only for the previous tax period, it is relevant only for firms with a loss in 2021 and nonnegative income in 2020. We identify eight such firms (based on earnings before taxes) and exclude their related 40 observations from our sample. When controlled for the 2021 extension in this way, our results are qualitatively unchanged. In sum, these results support our assumption that the tax loss carryback extensions do not drive our inferences.

## 5.2 Other Tests

Finally, we perform several other sensitivity tests. As our sample covers public and private firms, we test the sensitivity of our findings to excluding private firms. Dropping 120 observations from private firm years does not affect our main and cross-sectional results qualitatively.

Next, we introduce additional control variables that measure corporate governance, ownership structure and international activity. These variables are not included in the main tests because they are available only for our subsample of public firms. After dropping private firms and other observations with missing data for the new control variables, we introduce the following variables for a subsample of 690 public firm-years: institutional ownership (percentage of institutional owners), closely held shares (shares held by insiders), and international assets (logarithm of one plus the amount of international assets held by the firm). While the coefficients for closely held shares and international assets are insignificant in all of the specifications, we find highly significant and positive coefficients for institutional ownership. This result is consistent with a higher recognized TDCF-DTA ratio if the firm has more institutional owners. Including these additional control variables does not affect the inferences for our variables of interest.

To further address the complexity in TDCF-DTA recognition for multinational firms due to different tax loss offsetting rules and tax rates in different jurisdictions, we analyze a subsample of public firms with low levels of foreign assets (Kager and Niemann, 2013). Therefore, we drop all firms with more than 30% of international assets and repeat our tests for the remaining sample of 545 observations.<sup>15</sup> We continue to find qualitatively unchanged results for all of our main and cross-sectional tests.

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only 48 of 1104 firms declared that they had claimed an immediate tax loss carryback in 2020 (University of Mannheim 2022). This evidence supports the procedure and the results of our robustness test.

<sup>15</sup> Kager and Niemann (2013) use a threshold of 20%. As we analyze a single-country setting and a balanced sample, this threshold would leave us with a very small sample size. Hence, we use 30% instead.

Moreover, we control for the current earnings situations of firms. TLCF-DTA recognition behaviors might be different if firms ‘only’ reassess prior TLCF levels relative to new TLCF that emerged in the current year. While the earnings variable *Earn* in our main estimations partly addresses this issue, we include a loss indicator variable in additional tests. Our results do not change qualitatively, and the loss indicator is insignificant in all estimations.

## 6 Conclusion

Analyzing a panel of large German firms over the period from 2017–2021, we find no systematic changes in the recognized TLCF-DTA ratio of our average sample firm during the pandemic, but we identify cross-sectional differences. Our results suggest that firms with pessimistic or few management forecasts reduce the ratio and, hence, TLCF-DTA recognition behavior appears consistent with firms’ performance expectations. However, we do not observe altered recognition for favorable performance expectations. Additional tests suggest that this asymmetric recognition pattern cannot be explained with conservatism. Furthermore, recognition seems to be driven primarily by firm-specific characteristics. The results of the multinomial regression estimations indicate that the current earnings situation and auditor are among these firm-specific factors.

Our study is subject to a few limitations. First, we analyze group-level TLCF-DTA, while the TLCF amount is mainly determined on a domestic basis. TLCF-DTA in consolidated financial statements could result from legal entities in several different regions within and outside of Germany. Germany’s tax rate did not change significantly during our sample period, but changes in TLCF-DTA could also be due to changes in local business tax rates or in foreign countries. The results from our sensitivity tests in Sect. 5 mitigate the concern with respect to foreign tax rates, but we cannot fully rule out that tax rate changes affect our results. The same applies to the increase in tax loss carryback options from one million euros to five million euros in 2020. On the basis of the average TLCF level of our sample firms, the effect of the increase should be negligible, and robustness tests suggest that the extended carryback option does not affect our results. However, without exact data from firms’ tax returns, we can make only rough estimations to control for possible effects of the carryback option. Furthermore, the peculiarities of our single-country setting could limit the generalizability of our results. As Germany is well known for having a traditionally conservative environment, asymmetric recognition during the pandemic might be explained by country-specific conservatism. However, additional tests (Sect. 4.5.1.) indicate that conservatism does not drive TLCF-DTA recognition during the pandemic, thus mitigating this concern. Finally, the necessary hand-collection of data and the loss of observations due to missing items result in a sample of only 860 observations for 172 firms. This relatively small sample size might limit the power of our tests.

## 7 Appendix

### 7.1 Appendix A

**Table A.1** Variable Definitions

Variable	Definition
<i>Rec_TLCF</i>	TLCF for which TDCF-DTA are recognized (TLCF-DTA/tax rate used for deferred tax recognition), divided by total amount of TDCF
<i>Post</i>	Indicator variable, 1 for years 2020 and 2021, 0 otherwise
<i>Control Variables</i>	
<i>Earn</i>	EBITDA (earnings before interest, tax, depreciation and amortization), scaled by total assets
<i>Size</i>	Natural logarithm of number of employees
<i>Age</i>	Natural logarithm of number of years since foundation of the company
<i>Sales_grow</i>	$Sales_t$ minus $sales_{t-1}$ , divided by $sales_{t-1}$
<i>Big4</i>	Indicator variable, 1 if the firm is audited by one of the four big audit firms (Price-waterhouseCoopers, KPMG, Ernst & Young, Deloitte), 0 otherwise
<i>TTLCF</i>	Total amount of TDCF (TLCF-DTA/tax rate used for deferred tax recognition + TDCF that are not expected to be usable), scaled by total assets
<i>Interaction Variables</i>	
<i>Forecast_Optimistic</i>	Indicator variable, 1 if at least one management forecast is higher and no management forecast is lower than the current item (sales, EBIT, EBITDA, net income) in the year 2020, 0 otherwise
<i>Forecast_Pessimistic</i>	Indicator variable, 1 if at least one management forecast is lower and no management forecast is higher than the current item (sales, EBIT, EBITDA, net income) in the year 2020, 0 otherwise
<i>Forecast_Many</i>	Indicator variable, 1 if firm issued more than two forecasts in the year 2020, 0 otherwise
<i>Forecast_Few</i>	Indicator variable, 1 if firm issued less than two forecasts in the year 2020, 0 otherwise
<i>EM_Small_Loss</i>	Indicator variable, 1 if net income before the change in TDCF-DTA is in the highest tercile below zero in the year 2020, 0 otherwise
<i>EM_Large_Loss</i>	Indicator variable, 1 if net income before the change in TDCF-DTA is in the lowest tercile below zero in the year 2020, 0 otherwise
<i>Conservatism_High</i>	Indicator variable, 1 if C_Score based on Khan and Watts (2009) is in highest tercile in the year 2020, 0 otherwise
<i>Conservatism_Low</i>	Indicator variable, 1 if C_Score based on Khan and Watts (2009) is in lowest tercile in the year 2020, 0 otherwise
<i>Uncertainty_High</i>	Indicator variable, 1 if industry-level uncertainty based on German Business Panel data is in highest tercile in the year 2020, 0 otherwise
<i>Uncertainty_Low</i>	Indicator variable, 1 if industry-level uncertainty based on German Business Panel data is in lowest tercile in the year 2020, 0 otherwise

## 7.2 Appendix B

### 7.2.1 TLCF-DTA Recognition Under IAS 12—Details and Examples

In this Appendix, we provide details on the TLCF items that firms report in the tax footnote and show several examples from annual reports of our sample firms. We hand-collected the following items from the tax footnote for our analysis (Tab. B.1).

Items I.–III. are mandatory disclosures under IAS 12 and IV. is a voluntary information reported only by a subset of firms. IAS 12 requires the recognition of

**Table B.1** Overview of hand-collected TLCF information from the tax footnote, the regulation on which the disclosure is based, and how we use the information in our analysis

Collected Information	Disclosure Regulation	Application in Analysis
I. Recognized deferred tax assets for TLCF (TLCF-DTA)	IAS 12.34	Calculation of <i>Rec_TLCF</i> and <i>TTLCF</i>
II. TLCF for which no deferred tax asset is recognized	IAS 12.81 (e)	Calculation of <i>Rec_TLCF</i> and <i>TTLCF</i>
III. Tax rate used for the deferred tax recognition	IAS 12.47	Calculation of <i>Rec_TLCF</i> and <i>TTLCF</i>
IV. TLCF for which deferred tax assets are recognized	Voluntary	Assessing accuracy of calculated <i>TTLCF</i> (Footnote 6)

**Fig. B.1** Excerpt from Deutz Group 2019 annual report, p. 131

The following table shows the breakdown of deferred tax assets and liabilities:

€ million	Dec. 31, 2019		Dec. 31, 2018	
	Assets	Liabilities	Assets	Liabilities
Intangible assets	0.0	41.4	0.0	41.5
Property, plant and equipment	1.5	11.5	1.7	1.2
Inventories	9.3	0.0	7.8	0.0
Receivables and other assets	3.2	0.8	6.7	0.0
Pensions	22.8	0.0	21.5	0.0
Other liabilities	25.2	2.7	12.7	2.7
Tax loss carryforwards	62.2	0.0	70.4	0.0
<b>Deferred taxes (gross)</b>	<b>124.2</b>	<b>56.4</b>	<b>120.8</b>	<b>45.4</b>
Netting	55.6	55.6	44.9	44.9
<b>Deferred taxes (net)</b>	<b>68.6</b>	<b>0.8</b>	<b>75.9</b>	<b>0.5</b>

**Fig. B.2** Excerpt from Deutz Group 2019 annual report, p. 131

Loss carryforwards on which deferred taxes have not been recognized		
€ million	Dec. 31, 2019	Dec. 31, 2018
Corporation tax/solidarity surcharge	633.0	636.4
Trade tax	724.1	730.7

The following deferred tax assets and deferred tax liabilities were attributable to differences in the recognition and measurement of individual line items on the balance sheet and to losses carried forward:

€ million	Deferred tax assets		Deferred tax liabilities		Deferred tax expense (-)/ tax income (+) reported in the income statement	
	Dec. 31, 2019	Dec. 31, 2018	Dec. 31, 2019	Dec. 31, 2018	2019	2018
Intangible assets	73.4	64.3	20.9	19.2	8.1	-2.3
Property, plant, and equipment	5.6	5.4	71.0	62.5	-8.3	-7.6
Inventories	24.4	20.7	40.1	22.1	-14.3	1.9
Other assets	28.0	29.1	19.0	30.3	51.1	-7.3
Pensions and similar obligations	118.0	95.9	14.4	13.5	3.7	-2.4
Provisions	22.4	23.6	5.6	5.9	-0.9	1.3
Liabilities	30.0	26.3	12.7	25.8	-22.4	-3.0
Tax loss carryforwards	5.4	10.3	-	-	-4.9	-12.9
<b>Total before offsetting</b>	<b>307.2</b>	<b>275.6</b>	<b>183.7</b>	<b>179.3</b>	<b>12.1</b>	<b>-32.3</b>
Offsetting	-121.5	-86.8	-121.5	-86.8	-	-
<b>Total</b>	<b>185.7</b>	<b>188.8</b>	<b>62.2</b>	<b>92.5</b>	<b>12.1</b>	<b>-32.3</b>

**Fig. B.3** Excerpt from Heraeus Holding GmbH 2019 annual report, p. 67

Tax loss carryforwards as of December 31, 2019 amounted to €321.8 million (2018: €329.9 million). Deferred tax assets were recognized for €32.4 million of the total tax loss carryforwards (2018: €59.3 million). Loss carryforwards of €36.9 million (2018: €8.9 million) are subject to a time limit, with utilization of €1.5 million restricted to the next three years (2018: no restriction). There is no statutory expiration date for loss carryforwards of €284.9 million (2018: €321.0 million). No deferred tax assets were recognized for tax loss carryforwards of €289.4 million (2018: €270.6 million) or for temporary differences arising on measurements for tax purposes in the amount of €64.4 million (2018: €71.3 million).

**Fig. B.4** Excerpt from Heraeus Holding GmbH 2019 annual report, p. 67

The parameters for calculating the expected tax rate of 30.7% in 2021 are an average trade tax (14.9% given an average multiplier of 425%) and corporation tax including the solidarity surcharge (15.8%). The parameters are unchanged compared with 2020.

**Fig. B.5** Excerpt from Fielmann Group 2021 annual report, p. 143

deferred tax assets ‘to the extent that it is probable that future taxable profit will be available against which the unused tax losses’ can be utilized (IAS 12.34). Hence, the recognition is limited to those deferred taxes that are expected to reverse in the future. The TDCF amount for which no deferred tax asset is recognized must be disclosed (IAS 12.81 (e)). Many firms provide additional voluntary information on TDCF beyond the required items (Flagmeier and Müller 2024).

The following examples from the annual reports of Deutz Group and Heraeus Holding GmbH for the year 2019 (Figs. B.1, B.2, B.3, and B.4) illustrate how firms report items I., II. and the voluntary information IV. in the tax footnote.

From the annual report 2019 of Deutz Group, we obtain information on TDCF-DTA (I.) (62.2 million euros) from the first table. The TDCF for which no deferred

**Fig. B.6** Excerpt from BMW Group 2020 annual report, p. 211

Deferred taxes are determined on the basis of tax rates which are currently applicable or expected to apply in the relevant national jurisdictions when the amounts are recovered. After taking account of an average municipal trade tax multiplier rate (Hebesatz) of 428,0 (2019: 428,0), the underlying income tax rate for Germany was as follows:

in %	2020	2019
Corporate tax rate	15.0	15.0
Solidarity surcharge	5.5	5.5
Corporate tax rate including solidarity surcharge	15.8	15.8
Municipal trade tax rate	15.0	15.0
<b>German income tax rate</b>	<b>30.8</b>	<b>30.8</b>

Deferred taxes for non-German entities are calculated on the basis of the relevant country-specific tax rates. These ranged in the financial year 2020 between 9.0% and 40.0% (2019: between 9.0% and 40.0%).

tax assets have been recognized (II.) are split into corporate tax and trade tax and visible in the second table ( $633 + 724.1 = 1357.1$  million euros).

The second example from the Heraeus Holding GmbH annual report 2019 provides information on TILCF-DTA (I.) (5.4 million euros), the TILCF for which no deferred tax assets have been recognized (II.) (289.4 million euros), and the TILCF for which deferred tax assets are recognized (IV.) (32.4 million euros).

Another important aspect is the tax rate that firms use for the deferred tax recognition (III.). According to IAS 12.47, DTA should be recognized with the tax rate that is expected to apply in the period when the DTA is realized. The tax footnote information on the tax rate is very heterogenous across firms. We present two examples from the annual reports of Fielmann Group 2021 and BMW Group 2020 (Figs. B.5 and B.6).

The Fielmann Group 2021 example shows that firms often explain the different elements of the tax rate, in particular, the percentage resulting from trade tax and corporate tax. The excerpt from the annual report 2020 of BMW Group shows similar information for Germany and additional information on non-German entities. In such cases, we use the German tax rate to calculate our measures. Robustness tests in Sect. 5.2 address potential issues arising from international tax rate differentials.

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**Availability of Data and Materials** Part of the data that support the findings of this study are available from Bureau van Dijk's Dafne Database but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Additional hand-collected data used during the current study is available from the corresponding author on reasonable request.

**Conflict of interest** V. Flagmeier and F. Werthebach declare that they have no competing interests.

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