The effect of earnings management and tax aggressiveness on shareholder wealth and stock price crash risk of German companies

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Abstract

Purpose – The purpose of this paper is to examine the influence of earnings management (EM) and tax aggressiveness (TA) on shareholder wealth and on stock price crash risk (SPCR) of German companies.
Design/methodology/approach – The sample comprises 820 firm-year observations of 188 non-financial companies listed on German stock exchanges from 2008 to 2014. The authors apply generalized least square panel regression to overcome autocorrelation and heteroscedasticity problems.
Findings – EM and TA are not related in terms of affecting shareholder wealth and SPCR. EM has no impact on shareholder wealth but significantly affects SPCR. TA has a significant positive effect on shareholder wealth but no impact on SPCR. Thus, EM practices applied within German companies are non-opportunistic, as they do not affect shareholder wealth and decrease SPCR. TA practices are also non-opportunistic, as they increase shareholder wealth and do not affect SPCR.
Research limitations/implications – This study provides insights that can improve managers' accounting choices (EM vs TA) and alleviate investor concerns about the effect of managers' manipulation strategies. Considering other variables affecting TA, such as discretionary book tax differences, may add further insights into this discussion. The analysis of and comparison with other markets may shed more light on the validity and generalizability of the results.
Practical implications – This study recommends that investors must take into consideration the accounting variables to ensure better investment decisions and highlight the importance of CEO choices on market reaction.
Originality/value – The investigation of the mutual impact of EM and TA on shareholder wealth and SPCR is novel, and so too is the analysis of whether EM and TA are complementary or substitute for each other in this relationship.

Keywords Earnings management, Tax aggressiveness, Crash risk
Paper type Research paper

1. Introduction

Financial statements are the basic source of information for many stakeholders, in particular for shareholders (Freedman, 2004). In many countries such as Germany, Spain and France, these financial statements are regulated by tax systems located between the two extremes of one-book and two-book accounting. In such environments, tax accounting and financial accounting are mingled together. According to Bonsall *et al.* (2013), the stock market is a leading economic indicator for entities tracking the economy. Companies with relatively high (low) levels of accrual exhibit negative (positive) future abnormal stock returns around the time of future earnings announcements (Sloan, 1996). This finding reveals the different incidence of earnings management (EM) tactics on stock prices.

Previous accounting research has analyzed the motivations behind EM (e.g. Xie *et al.*, 2003; Neifar *et al.*, 2016) and TA (Desai and Dharmapala, 2006; Halioui *et al.*, 2016).

Other studies investigate the effect of TA on firm value (Desai and Dharmapala, 2009) and the impact of TA on stock price crash risk (SPCR) (Kim *et al.*, 2011b). However, there is a dearth of information on the connection between EM and taxation and the effect of both of them on financial variables.

EM is a deliberate intervention in the process of presenting financial information, in order to ensure personal gain (Schipper, 1989). In a company, managers have privileged information, which is communicated strategically to investors and analysts via different types of disclosure (Bonsall *et al.*, 2013). Furthermore, managers are responsible for issuing two types of statement: financial and tax. Managers use various EM tactics when reporting financial income (pre-tax) and TA behavior when reporting taxable income.

Corporate taxation consists mainly of preparing tax statements and paying tax liabilities to tax authorities. Shareholders delegate that duty to managers and usually aim at minimizing tax liabilities. However, due to information asymmetry between shareholders and managers, managers can appropriate some of the rent using TA activities. Managers verify the real taxable income before reporting it to the tax authorities. The benefits of tax evasion are not as clear as those of EM. Indeed, whereas some researchers argue that both managers and shareholders benefit from such activities, as they avoid possible penalties associated with illegal tax management practices (Hanlon and Slemrod, 2009; Chen *et al.*, 2010), others claim that the complexity and opacity of TA activities provide opportunities for managers to hide their rent-diversion activities (Desai and Dharmapala, 2006). Furthermore, if shareholders perceive the behavior of TA as a way to hide cash, a price reduction would be imposed on the shares (Steijvers and Niskanen, 2014). Similarly, Kim *et al.* (2011b) demonstrate a TA impact on stock prices because it facilitates managerial rent extraction and bad news hoarding.

In this study, we adopt the traditional theory viewing TA as a value-maximizing activity that transfers wealth from the state to corporate shareholders. Nevertheless, despite the abundance of information on EM and tax evasion as two separate factors affecting management strategies and investment decisions, little is known about the relation between them. Therefore, we investigate the effect of manager manipulation in terms of EM and TA on shareholder wealth and SPCR, that is, whether they are complementary variables or substitute for each other in terms of affecting shareholder wealth and SPCR. We choose the German context, because Germany has a tax system that is located somewhere between the one-book- and two-book accounting extremes. Moreover, Germany is one of the global leading economies and has a liquid stock market. Finally, Germany is ranked among the best countries with respect to the corruption index, indicating a solid legal system. Thus, a German sample is appropriate as we thus conduct our study on a reliable data set that is not particularly driven by managerial entrenchment and corporate fraud outliers.

We use Jensen's α as a measure of shareholder wealth, and two common proxies for SPCR. The sample comprises 188 non-financial publicly traded German companies for the period of 2008–2014. Previous studies have focused on the impact of EM or TA on shareholder wealth and SPCR. However, in this paper, we study all of these variables together and we test if EM and TA are complementary or substitutes when affection shareholder wealth or SPCR.

Our findings show that EM and TA are not related regarding affecting shareholder wealth and SPCR, and that the use of EM and TA in the German context is non-opportunistic. This is because EM has no significant effect on shareholder wealth but significantly decreases SPCR, while TA increases shareholder wealth and has no impact on SPCR.

The remainder of this paper is organized as follows. Section 2 reviews the related literature and develops the research hypotheses; Section 3 specifies the German context. Section 4 describes the data and the methodology. Section 5 shows the results and Section 6 examines the robustness tests. Finally, Section 7 concludes.

2. Literature review and research hypotheses

2.1 Managerial behavior under agency and stewardship theory

According to agency theory, each individual is self-interested and there is a conflict of interest between principal and agent. Agency problems arise because of opportunistic behavior by agents who maximize their own wealth as opposed to the interests of principals. Thus, managers use opportunistic tactics such as EM (Bergstresser and Philippon, 2006; Houmes and Skantz, 2010) or TA (Desai and Dharmapala, 2006; Wilson, 2009) strategies that can affect information quality and thus decrease shareholder wealth and increase SPCR, as opportunistic behavior may be detected in the future.

By contrast, non-opportunistic managers use strategies that minimize firm risk. The traditional view of accounting information value revolves around its informational role (Ronen and Yaari, 2008), which arises from investor demand for information (Bergstresser and Philippon, 2006). According to stewardship theory, managers maximize and protect shareholder wealth and thus maximize shareholder utility. Accordingly, the purpose of accounting is to check the honesty and reliability of agents (Watts, 1977) and the role of the accounting system lies in ensuring that a firm's invested capital is maintained in such a way as to preserve the economic interests of stockholders and bondholders (Kothari *et al.*, 2010). Accounting and financial reporting are more consistent with stewardship (care of net assets) than an attempt to value the firm (Watts and Zuo, 2016). Thus, shareholders are satisfied by stewards who improve the performance of the organization, because most stakeholders see their interests as being best served if organizational wealth increases (Bessire *et al.*, 2007).

2.2 Earnings management

Accounting information plays a prominent role in investors' decisions. In general, accrual and cash components of current earnings in financial statements enable an assessment of future earnings (Sloan, 1996). According to De Jong *et al.* (2014), chief financial officers believe that EM enhances investor valuations of their companies. As a result, managers exploit EM behavior and influence investors erroneously so as to affect the stock price. Not surprisingly, managers are keen on depicting their companies positively and can gain personally from applying the various EM tactics.

In companies with overvalued equity, managers are motivated to use EM tactics that sustain the company's overvalued stock price (Jensen, 2005). In such companies, managers not only fail to correct overvalued stock prices, but also even try to extend the overvaluation by engaging in EM tactics that increase reported income (Jensen, 2005). To analyze the impact of financial reporting on stock market, Ball (2013) suggests investigating stock price responses to earnings announcements. Bar-Yosef and Prencipe (2013) document a market reaction to earnings and an EM-induced trading volume increase for non-financial Italian firms.

In general, managers acting opportunistically choose alternatives that maximize their own interests. Compensation schemes often provide incentives toward opportunistic EM behavior. Numerous studies (e.g. Bergstresser and Philippon, 2006; Houmes and Skantz, 2010) confirm that incentive-based wages motivate managers to manipulate earnings to meet performance targets or thresholds. A second opportunistic motivation for EM is the incentive to meet market expectations, as failing to do so is penalized in the stock market (Sloan, 1996). Third, changes in senior management or board members can provide incentives for EM.

Finally, EM is a measure of communication incentives (Holthausen, 1990). Managers use EM to signal firms' good performance and attract new shareholders. EM tactics aimed at overvaluing equity result in a share price increase and investors may then adjust their expectations of future performance upwards. However, such EM tactics lead to an increase

in SPCR when markets detect the real company situation. Therefore, if EM is a sign of opportunistic managerial behavior (agency theory perspective), it decreases shareholder wealth and increases SPCR. In contrast, the stewardship theory (non-opportunistic behavior) predicts shareholder wealth increasing and an SPCR-decreasing effect of EM.

Given that managers can use EM to mislead stakeholders regarding firm performance (Healy and Wahlen, 1999), EM may affect shareholder wealth as well as SPCR. Thus, we formulate the following hypothesis:

H1. EM does not affect either shareholder wealth or SPCR.

2.3 Tax aggressiveness

TA behavior is often accompanied by managerial rent diversion (Desai and Dharmapala, 2006). Nevertheless, Desai and Dharmapala (2009) find a non-significant relationship between TA and firm value. Kim *et al.* (2011b) show that TA is positively associated with SPCR for US companies. This is because TA provides tools for managers to deny bad news and overstate financial performance. Therefore, not tax management *per se*, but rather rent diversion and bad news hoarding, ultimately cause stock price crashes (Kim *et al.*, 2011b). Moreover, TA can lead to other costs which have significant financial implications (Christensen *et al.*, 2014), such as opportunity costs through a firm's ability to allocate profits that have been moved abroad. These strategies influence company decisions as to how to pay dividends, manage cash and make investments (Foley *et al.*, 2007; Blouin and Krull, 2009). TA exposes companies to various risks, including tax, political and reputational. Tax risks occur when tax authorities audit firms and force them to pay the real amount of taxes along with fines, penalties and interest. Moreover, when firms avoid taxes, they can create a public outcry, which exposes the firm to reactions from politicians (Christensen *et al.*, 2014). Reputational risks occur when these practices are detected and disclosed to the public (Christensen *et al.*, 2014). Therefore, the use of this behavior in fact increases future cash flow volatility through intensifying uncertainty (Shevlin *et al.*, 2013). Usually, tax management strategies increase shareholder wealth, as they decrease company liabilities. However, managers use their opportunistic behavior in managing taxable income by employing information asymmetry within a company, so as to benefit personally. In particular, managers can choose risky tax planning strategies that expose companies to risks of tax audits and therefore to the costs of paying additional taxes and penalties, thereby decreasing shareholder wealth. The level of tax management chosen by managers and the extent to which these management strategies aggressively maximize their own interests and expose shareholders to high SPCR are the result of opportunistic managerial behavior.

From the agency theory perspective, TA reduces corporate transparency, and even protects managerial opportunism and rent diversion (Desai and Dharmapala, 2006; Wilson, 2009). TA transactions favor opportunistic managerial behavior by providing the manager with "tools, masks, and justifications" (Desai and Dharmapala, 2006). Moreover, opportunistic leaders manage accounting results by choosing accounting policies that enable them to maximize their wealth and minimize tax burdens (Frank *et al.*, 2009; Wilson, 2009). However, these expropriations constitute possible agency costs for the company. If shareholders perceive the behavior of TA as hiding cash, a price reduction will be imposed on the shares (Steijvers and Niskanen, 2014). Therefore, according to agency theory, TA has shareholder wealth-reducing and SPCR-increasing effects.

According to Kim *et al.* (2011b), the ability of TA to increase the rate of SPCR is related to managerial rent extraction and bad-news-hoarding activities. If managers do not use rent diversion, TA will benefit shareholders and therefore, a positive relationship will arise between TA and shareholder wealth, and a negative relationship between TA and SPCR.

This interpretation follows the stewardship view of tax management practices and leads to the following hypothesis:

H2. TA does not affect either shareholder wealth or SPCR.

2.4 The interaction between EM and TA

Erickson *et al.* (2004) and Frank *et al.* (2009) analyze the possible interrelation between EM and TA, but without explaining whether these two variables are complements or substitutes when affecting another variables. Erickson *et al.* (2004) show that managers are likely to be forced to paying tax on aggressively reported income. Rego and Wilson (2008) extend this work by evaluating firms that restate their income downwards. Comparing original and restated data indicates that firms using aggressive behavior in reporting book income also report taxable income aggressively (Heltzer *et al.*, 2012; Frank *et al.*, 2009). Frank *et al.* (2009) find that managers have incentives to manage the accounting profit upwards. At the same time, they are encouraged to manage the taxable income downwards. Managers aim to minimize taxes and maximize rents. Therefore, managers use their discretion so as to optimize an already favorable position. The above-mentioned studies examine the US context and find it to be characterized by disconnection between accounting and taxation. Besides the observed dearth of empirical research on EM and TA, there is little evidence on the inter-relationships between these two variables. In general, there are three possible EM–TA relationships: use as substitutes, use as complements and use without a relationship.

First, using EM and TA as substitutes means that managers manipulate one tactic as a tool for practicing the other, e.g., they minimize financial income to minimize taxable income. In this case, they use EM as a substitute of TA. Second, the inverse relationship suggests a use as complements, i.e., managers raise tax accounts for the sake of increasing their own profits at the expense of those of shareholders. In this case, the two management tactics reduce shareholder wealth and are used in a complementary manner to serve manager interests. Third, we consider whether EM and TA are independent, i.e., managers use these tactics randomly for no specific (personal) gain. In this case, managers act non-opportunistic.

Connecting this discussion with agency and stewardship theories, we hypothesize that EM and TA being substitute means using them to promote shareholder interests. Using EM and TA as complementary, they help to maximize managers' personal benefits. No relationship would indicate a non-opportunistic implementation of these tactics.

Based on the above discussion, we formulate the following hypothesis:

H3. EM and TA are not related when affecting shareholder wealth and SPCR.

3. German context specification

A set of laws and legal texts indicates Germany's efforts to protect investors in stock markets. Thus, the specific German context regarding corporate governance (CG) and tax system provides a solid framework for our analysis.

Since 1949, Germany has introduced new regulations to induce a more market-based and deregulated financial system. Four principal acts form the basis of German stock market regulation. The 1990 First Financial Market Promotion Act (Erstes Finanzmarktförderungsgesetz) constitutes the initiating set of laws dedicated to promoting investor protection (Bradley and Sundaram, 2003). The Second Financial Market Promotion Act (1994) improved such protection by permitting money market funds. This act extended the legal forms for venture capital funds through an Amendment to the Investment Company Act, forbidding insider trading and establishing a Federal Supervisory Office for

Securities Trading (Detzer *et al.*, 2013). The 1998 Third Financial Market Promotion Act developed supervision, improved transparency and restricted cross-governance among the largest firms and increased shareholder interests (Jackson and Moerkes, 2005). Subsequently, the 2002 Fourth Promotion Act established a new supervisor for financial services referred to as the Federal Financial Supervisory Authority, aimed at integrating the fragmented supervisory institutions in the German financial market. This revision eliminated investment restrictions and improved the competitive positions of small- and medium-sized companies in relation to large investment companies (Detzer *et al.*, 2013).

Moreover, a series of laws changed CG and the financial market in Germany. The Law on the Improvement of Investor Protection in 2004 increased constraints on insider trading and introduced more appropriate measures to prevent market malpractices. Köhler (2010) discusses how the introduction of the International Financial Accounting Standards in Law on the Introduction of International Accounting Standards and on the Protection of the Quality of Audits increased auditor independence. Moreover, the Law on the Control of Financial Statements supported the Financial Reporting Enforcement Panel as an independent authority for investigating financial statements and taking specific steps to implement necessary updates on accounting irregularity. The 2005 Law on Corporate Integrity and Modernization of the Right of Rescission set up the business judgment rule and ameliorated the interests of minor shareholders by enabling minority shareholders to make liability claims against management board and advisory board members (Köhler, 2010). The Law on Capital Market Test Cases (2005) consolidated the high level of shareholder protection through German regulation. It allowed group litigation (class action) and introduced the right of test case litigation to assess whether market information had been falsely provided.

Furthermore, several regulations highlight the increased investor protection in Germany. Under the Transparency Directive Implementation Law for listed firms, management boards have to approve balance sheets, and initiate notification rules for new share ownership. Moreover, the German CG Code aims to close a gap in previous legislation, so as to empower supervisory boards and to limit incentives for bankers to focus on short-term profits (Köhler, 2010). The German CG Code required management boards to target sustainable value creation in the interests of the enterprise and its various stakeholders (Detzer *et al.*, 2013). This code additionally comprises strategies regulating the cooperation of management boards and supervisory boards, as well as simple supervisory board regulation.

The German tax system has undergone major modifications since 2000, by abolishing capital gains tax on the sale of shares by firms (Schaede, 2000). This allows German financial institutions and companies to sell shares from other companies and other property without an excessive tax burden.

In summary, the German tax system lies somewhere between the two extremes of one-book accounting and two-book accounting. Tax accounting and financial accounting are intertwined, but accounting profits and taxable profits are quite different.

4. Research methodology

4.1 Sample and data

We use a sample of non-financial, publicly listed German companies. For each company, we match financial data from Thomson Reuters Datastream, accounting data from Worldscope and CG variables from Thomson ONE. We collect information manually on auditors of each company from annual reports. The observation period covers seven years from 2008 to 2014. We exclude from our sample stocks with missing data and illiquid stocks identified by at least 26 weeks of zero returns within one year. Our final sample comprises annual end-of-year data of 820 firm-year observations for 188 different companies.

4.2 Dependent variables

We measure shareholder wealth with Jensen (1968) α, which indicates the abnormal return a stock generates above the expected return in the capital asset pricing model. We calculate the average Jensen's α of each company for each year, based on weekly returns. Furthermore, we apply two measures to determine SPCR. First, we calculate the down-to-up volatility (DUVOL) following Chen *et al.* (2001). A higher value of DUVOL indicates a more left-skewed distribution. Our second measure for SPCR is negative conditional skewness (NCSKEW) following Kim *et al.* (2011a, b). An increase in NCSKEW corresponds to higher SPCR, i.e., a more negative-skewed stock return distribution. Definitions of all variables are provided in Table I (dependent variables) and Table II (independent variables).

4.3 Independent variables

In our paper, we follow Kothari *et al.* (2005) to measure EM as the value of discretionary accruals (residuals). We calculate industry-year discretionary accruals to measure EM and eliminate observations of industries with less than 15 observations in each industry group. Our second independent variable is TA (TAX_AGRE), which we measure by means of the total effective tax rate (ETR), as the ratio of total income tax expenses to pre-tax book income (Chen *et al.*, 2010):

$$\mathrm{ETR}_{i,t} = \frac{\text{Total current income tax expense}_{i,t}}{\text{Pretax book income}_{i,t}}.$$

A higher ETR reflects a lower TA level.

4.4 Control variables

We use CG variables (ownership concentration and BIG4) and company characteristics variables as control variables[1].

4.4.1 Firm-specific characteristics variables. To capture well-documented factors affecting shareholder wealth and SPCR, we use nine control variables: firm size (SIZE_{t-1}), the ratio of the market value of equity to the book value of equity (MTB_{t-1}), leverage (LEV_{t-1}), firm performance (ROA_{t-1}), the one-year lagged negative conditional skewness (NSKEW_{t-1}), the standard deviation of the company-specific weekly return over the last fiscal year (SIGMA_{t-1}), the average company-specific weekly return over the last fiscal year (RET_{t-1}) and dummy variables for the years (YEAR_t) and for the industrial sector (SECTOR_t). Consistent with Hutton *et al.* (2009), Kim *et al.* (2011a, b) and An and Zhang (2013), we expect a positive relationship between ROA_t, RET_{t-1}, NSKEW_{t-1}, SIGMA_{t-1} and SPCR, and a negative relationship between SIZE_{t-1}, LEV_{t-1}, MTB_{t-1} and SPCR.

4.4.2 Corporate governance variables. Concentrated ownership is observed to be a salient feature of the German system (Lehmann and Weigand, 2000). High ownership concentration provides large investors with sufficient incentives and power to discipline management, and thus to limit opportunistic managerial behavior (Edwards and Nibler, 2000). This improves firm performance by decreasing monitoring costs (Shleifer and Vishny, 1986) and therefore increases shareholder wealth and decreases SPCR.

Robin and Zhang (2015) highlight the informational role of auditors, which yields decreasing agency costs (Watts and Zimmerman, 1983), thus increasing firm value (Jensen and Meckling, 1976), decreasing malfeasance by managers, improving operating decisions and decreasing expropriation. High audit quality is a tool with which to enhance investor interests. High-quality auditors (in particular industry specialization) reduce SPCR, because of their information intermediary and CG roles (Robin and Zhang, 2015). Thus, investors can benefit directly from high-quality auditors by reducing tail risk. Our expectation is that BIG4 audit firms have a shareholder wealth-increasing and SPCR-decreasing effect.

Table I.
Dependent variables measurement

Variables	Abbreviation	Measurement	Authors
Shareholder wealth	$JENSEN_t$	Average Jensen's α of each company for each year based on weekly returns and the calendar-time portfolio approach: $r_{i,w} - r_{f,w} = a_{i,t} 1_n + \beta \times (r_{m,w} - r_{f,w}) + \epsilon_{i,w}$, where $r_{i,w}$ is the weekly return of company i; $r_{m,w}$ the actual weekly performance of the DAX (market return); $r_{f,w}$ the weekly risk-free return (1-year yield on German Bunds); 1_n represents a vector with n ones; $\alpha_{i,t}$ the average abnormal return (Jensen's α) of company i in year t	Jensen (1968)
Stock crash	$DUVOL_t$	For each firm year, we calculate the standard deviations of firm-specific weekly returns during the up (down) weeks when the firm-specific weekly returns are above (below) its annual mean. DUVOL is the log of the ratio of the standard deviation on down weeks to the standard deviation on up weeks. The convention is that a higher value of DUVOL suggests a more left-skewed distribution	Chen *et al.* (2001), An and Zhang (2013)
	$NCSKEW_t$	$\text{NCSKEW}_{i,t} = -\left[n(n-1)^{3/2} \sum_{\tau=1}^{n} \left(W_{i,\tau,t} - \overline{W}_{i,t}\right)^3\right] / \left[(n-1)(n-2)\left(\sum_{\tau=1}^{n} \left(W_{i,\tau,t} - \overline{W}_{i,t}\right)^2\right)^{3/2}\right]$, where $W_{i,t}$ is the company-specific weekly return; $\overline{W}_{i,t}$ the average company-specific weekly return in the fiscal year; n the number of observations in the respective fiscal year t The approach to scale the third moment by the cubed standard deviation is a standard normalization employed for skewness in statistics that enables a comparison across returns with different variances	Kim *et al.* (2011a, b)

Notes: This table contains the four different dependent variables we use in our panel regressions. We provide the name of the variable, its abbreviation in the models, its measurement and a reference paper

Table II.
Independent and control variables measurement

Variables	Abbreviation	Measurement	Authors
Panel A: independent variables			
Earnings management	EAR_MAN_t	Year-industry value of discretionary accruals ε_{it}: $TAC_{i,t}/TA_{i,t} = \alpha_0[1/TA_{i,t-1}] + \alpha_1[(\Delta REV_{i,t} - \Delta REC_{i,t})/TA_{i,t-1}] + \alpha_2[PPE_{i,t}/TA_{i,t-1}] + \alpha_3 ROA_{i,t-1} + \varepsilon_{i,t}$, where $TAC_{i,t} = EBXI_{i,t} - CFO_{i,t}$ are total accruals; $EBXI_{i,t}$ the earnings before extraordinary items and discontinued operations; $CFO_{i,t}$ the cash flow from continuing operations; $TA_{i,t-1}$ the book value of total assets of company i at the end of year $t-1$; $\Delta REV_{i,t}$ the difference of the sales revenues of company i in year t and in year $t-1$; $\Delta AR_{i,t}$ the change in account receivables; $PPE_{i,t}$ the gross property, plant and equipment of company i at the end of year t; $ROA_{i,t-1}$ the performance of the company measured by the return on asset in year $t-1$; $\varepsilon_{i,t}$ the discretionary accruals	Kothari *et al.* (2005)
Tax aggressiveness	TAX_AGRE_t	The effective tax rate $ETR_{i,t} =$ (Total current income tax expense$_{i,t}$)/(pre-tax book income$_{i,t}$)	Chen *et al.* (2010)
Panel B: control variables			
Ownership concentration	$Major_{t-1}$	Percentage of major shareholders	Beasley (1996)
BIG 4	$BIG4_{t-1}$	Dichotomous variable equal 1 if the audit firm is Deloitte Touche Tohmatsu or Ernst and Young or KPMG or PricewaterhouseCoopers and 0 otherwise	Francis and Yu (2009)
Firm size	$SIZE_{t-1}$	Natural logarithm of the market value of equity at the end of the year $t-1$	An and Zhang (2013)
Market to book ratio	MTB_{t-1}	The lagged ratio of the market value of equity to the book value of equity	An and Zhang (2013)
Leverage	LEV_{t-1}	Lagged ratio book value of all liabilities by the total assets	An and Zhang (2013)
Firm performance	ROA_{t-1}	Lagged ratio of return on assets with ROA_t = Net income/Total assets	An and Zhang (2013)
	$NCSKEW_{t-1}$	Lagged value of the negative conditional skewness NCSKEW	An and Zhang (2013)
	$SIGMA_{t-1}$	Standard deviation of the firm-specific weekly return over last fiscal year	An and Zhang (2013)
	RET_{t-1}	Average firm-specific weekly return over last fiscal year	An and Zhang (2013)

Notes: This table contains the independent variables and the control variables we use in our panel regressions. We provide the name of the variable, its abbreviation in the models, its measurement and a reference paper

4.5 Models

To analyze the influence of EM and TA on shareholder wealth (Model (1)) and on SPCR (Model (2)), we adopt the following baseline models:

$$\begin{aligned}\text{SHAREHOLDER\_WEALTH}_{it} = {} & \beta_0 + \beta_1 \text{EAR\_MAN}_{i,t} + \beta_2 \text{TAX\_AGRE}_{i,t} + \beta_3 \text{MAJOR}_{i,t-1} \\ & + \beta_4 \text{BIG4}_{i,t-1} + \beta_5 \text{NSKEW}_{i,t-1} + \beta_6 \text{SIGMA}_{i,t-1} + \beta_7 \text{RET}_{i,t-1} \\ & + \beta_8 \text{ROA}_{i,t-1} + \beta_9 \text{MTB}_{i,t-1} + \beta_{10} \text{LEV}_{i,t-1} + \beta_{11} \text{SIZE}_{i,t-1} \\ & + \beta_{12} \text{YEAR}_{i,t} + \beta_{13} \text{SECTOR}_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

$$\begin{aligned}\text{CRASH\_RISK}_{i,t} = {} & v_0 + v_1 \text{EAR\_MAN}_{i,t} + v_2 \text{TAX\_AGRE}_{i,t} + v_3 \text{MAJOR}_{i,t-1} + v_4 \text{BIG4}_{i,t-1} \\ & + v_5 \text{NSKEW}_{i,t-1} + v_6 \text{SIGMA}_{i,t-1} + v_7 \text{RET}_{i,t-1} + v_8 \text{ROA}_{i,t-1} + v_9 \text{MTB}_{i,t-1} \\ & + v_{10} \text{LEV}_{i,t-1} + v_{11} \text{SIZE}_{i,t-1} + v_{12} \text{YEAR}_{i,t} + v_{13} \text{SECTOR}_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{2}$$

5. Empirical results

5.1 Descriptive analysis

Table III contains summary statistics (average values, standard deviations, 25th percentiles, median values, 75th percentiles, kurtosis and skewness) of the variables used in our regressions.

The average annual Jensen's α of the companies in our sample, compared with the German stock index DAX30 over the entire observation period, is 0.1250. The median values of Jensen's α are close to 0 during the entire observation period. Our two proxies for SPCR display similar patterns. NCSKEW and DUVOL exhibit positive average values in 2008 and 2014, and negative values in other years indicating a high crash risk during 2008 and lower crash risks in the later years. These findings are consistent with An and Zhang (2013).

Table IV contains descriptive statistics of the independent and control variables for the entire observation period.

The average value of discretionary accruals, using the Kothari *et al.* (2005) model, is −0.0534 and has a standard deviation of 0.949. The average of the TA level measured by the ETR is 0.2349. The average percentage of major shareholders in a company is 34.48 percent. In total, 50 percent of the firms in our sample have major shareholders that hold at least 29.70 percent of the stocks of the company. The study also reveals that 60.92 percent of the firms in our sample are audited by BIG4 auditors.

Moreover, we calculate Pearson correlation coefficients to check for the existence of multicollinearity between the independent and control variables. Table V shows that the correlation coefficients between all variables are less than the 0.811 threshold proposed by Kennedy (1985).

We also apply the variance inflation factors (VIF) test to evaluate correlations between variables. All variables exhibit VIF values below the threshold value 5 (Kline, 1998), and thus show no indication of multicollinearity within our variables (Table VI).

5.2 Multivariable analysis

To verify the correctness of our estimation approach, we check the normality of residuals, heteroscedasticity and autocorrelation problems prior to the application of panel data in each of our regressions. Table VII summarizes the required tests.

The results of the Hausman specification test suggest using fixed effects models. Moreover, the residual normality test supports the assumption of the normality of residuals. Finally, the Wooldridge test, based on the Fisher statistic, strongly rejects the null hypothesis of no serial correlation for our models. Therefore, we apply the Wald modified test based on χ^2-statistics to test for the existence of an inter-individual heteroskedasticity problem.

Year	Average	SD	P25	P75	Kurtosis	Skewness	Median
Model 1: panel Jensen's α							
All	0.1250	0.4371	−0.1205	0.2707	19.0530	2.6765	0.0638
2008	−0.0803	0.4312	−0.3342	0.0600	16.2228	2.6909	−0.1420
2009	0.3337	0.5484	−0.0089	0.5229	11.6868	2.2380	0.1776
2010	0.3007	0.5128	0.0289	0.4331	25.2675	3.4443	0.2089
2011	−0.0112	0.2509	−0.1593	0.1450	4.0596	0.4379	−0.0304
2012	0.0653	0.2612	−0.1083	0.1983	4.5269	0.4942	0.0683
2013	0.1562	0.3882	−0.0583	0.2668	9.8070	2.1299	0.0579
2014	−0.0032	0.0945	−0.0849	0.0784	1.0118	0.0049	−0.0045
Model 2: panel stock price crash risk							
Model 2a: DUVOL							
All	−0.1269	0.3586	−0.3529	0.1032	3.2666	−0.3187	−0.0984
2008	0.0608	0.3097	−0.1716	0.2735	3.0189	−0.0375	0.0580
2009	−0.2363	0.3495	−0.4591	0.0105	2.6768	−0.2983	−0.2114
2010	−0.2039	0.3678	−0.4363	0.0669	3.2697	−0.4597	−0.1984
2011	−0.0495	0.3081	−0.2107	0.1554	3.1431	−0.2320	−0.0648
2012	−0.1866	0.3497	−0.4093	0.0357	3.4426	−0.1222	−0.1712
2013	−0.1523	0.3808	−0.4330	0.0768	3.1990	−0.3299	−0.0937
2014	0.0766	0.1100	−0.0153	0.1686	1.2573	−0.1653	0.0884
Model 2b: NCSKEW							
All	−0.2525	0.7829	−0.6327	0.2039	4.7324	−0.5956	−0.1666
2008	0.1186	0.7353	−0.2776	0.5775	5.2734	−0.1596	0.0840
2009	−0.4414	0.6974	−0.8502	−0.0012	3.8214	−0.4590	−0.3714
2010	−0.4022	0.7753	−0.7573	0.1066	5.1116	−1.1705	−0.2968
2011	−0.1232	0.7250	−0.4719	0.3291	5.2571	−0.6810	−0.1279
2012	−0.3628	0.7437	−0.7074	0.0722	4.2187	−0.4261	−0.2558
2013	−0.3145	0.8790	−0.7805	0.1601	4.3435	−0.7349	−0.1589
2014	0.1431	0.1976	−0.0153	0.3016	1.5087	−0.3938	0.1864

Notes: This table reports upon summary statistics of the dependent variables Jensen's α (Model 1) and three proxies for stock crash (Model 2). We use two measures for stock crash, first measured by the down-to-up volatility (Model 2a = DUVOL), and second measured by the negative conditional skewness (Model 2b = NCSKEW) over the entire observation period (All) as well as for each single year

Table III.
Descriptive statistics of dependent variables

Panel A: continuous variables

Variables	Mean	SD	P25	P75	Kurtosis	Median	Skewness
EAR_MAN	−0.0534	0.9490	−0.0506	0.2652	39.0421	0.0407	−3.3417
TAX_AGRE	0.2349	1.2439	0.1737	0.3248	257.1060	0.2813	7.8581
MAJOR	0.3448	0.2649	0.0994	0.5254	2.1917	0.2970	0.5271
NSKEW	−0.2339	0.7632	−0.5990	0.2264	5.0538	−0.1352	−0.6794
SIGMA	0.3749	0.1470	0.2669	0.4570	3.7893	0.3477	0.9154
RET	0.0811	0.4657	−0.2180	0.3313	12.1167	0.0348	1.6356
ROA	0.0409	0.1516	0.0271	0.0839	110.8416	0.0528	−7.9115
MTB	1.9969	2.8212	1.0200	2.3500	116.2633	1.5100	−1.3568
LEV	0.5182	0.2715	0.3800	0.6625	223.3610	0.5425	9.9655
SIZE	2.4042	1.0263	1.6069	3.1250	2.5179	2.2555	0.4695

Panel B: binary variables

Variable	Modalities	Percentage
BIG 4	0	38.08
	1	60.92

Notes: This table reports upon summary statistics of the independent and control variables over the entire observation period. In Panel A, we show mean, standard deviation, the 25th percentile (P25), median, 75th percentile, kurtosis and skewness for each continuous independent and control variable. Panel B contains information on the binary BIG 4 variable. BIG 4 is an indicator variable which equals 1 if the auditor of a firm in a certain year is one of the four big auditing companies (Deloitte & Touche, E&Y, KMPG and PricewaterhouseCooper) and 0 otherwise

Table IV.
Descriptive statistics of independent and control variables

Table V. Correlation matrix of independent and control variables

	EAR_MAN	TAX_AGRE	MAJOR	BIG 4	NSKEW	SIGMA	RET	ROA	MTB	LEV	SIZE
EAR_MAN	1										
TAX_AGRE	−0.0166	1									
MAJOR	0.1035***	−0.0393	1								
BIG 4	−0.1256***	0.0338	−0.1213***	1							
NSKEW	−0.0190	0.0383	−0.0580*	0.1825***	1						
SIGMA	0.0363	−0.0147	−0.0771**	−0.1217***	−0.1673***	1					
RET	0.0108	−0.0167	−0.0254	0.0471	−0.2274***	−0.0551*	1				
ROA	0.0893***	0.0367	−0.0128	0.0431	0.1412***	−0.2098***	0.1031***	1			
MTB	−0.0215	0.0205	−0.0117	−0.0268	0.0566*	0.0068	−0.1440***	0.2211***	1		
LEV	−0.2024***	0.0388	0.0053	0.1047***	0.0398	0.0770**	−0.0319	−0.2872***	−0.0267	1	
SIZE	−0.3952***	0.0722**	−0.0146	0.5042****	0.2939***	−0.2281***	−0.0650**	0.1487***	0.0722**	0.1710***	1

Notes: *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

Table VI.
VIF analysis of independent and control variables

Variables	VIF	1/VIF
EAR_MAN	1.09	0.919369
TAX_AGRE	1.07	0.932769
MAJOR	1.05	0.954444
BIG 4	1.08	0.922200
NSKEW	1.15	0.870969
SIGMA	1.10	0.909932
RET	1.13	0.886031
ROA	1.35	0.741455
MTB	1.12	0.921089
LEV	1.19	0.895495
SIZE	1.09	0.915110

Table VII.
Tests of model specification

	Shareholder wealth	Stock price crash risk	
	Jensen's α	DUVOL	NCSKEW
Fixed effects			
Fisher	16.46	6.75	5.93
p-Value	0.000	0.000	0.000
Random effects			
χ^2	160.00	233.37	185.35
p-Value	0.000	0.000	0.000
Hausman test			
χ^2	95.51	101.94	108.88
p-Value	0.000	0.000	0.000
Modified Wald test			
Fisher	2.8e+33	2.6e+29	2.1e+30
p-Value	0.000	0.000	0.000
Wooldridge test			
Fisher	55.876	36.263	61.312
p-Value	0.000	0.000	0.000
Residuals normality test			
Pr(Skewness)	0.000	0.000	0.000
Pr(Kurtosis)	0.000	0.000	0.000
Prob > χ^2	0.000	0.000	0.000

Notes: This table reports upon the different tests used for panel regression data. We use fixed effect model, random effect model and Hausman test to specify our model (random or fixed effects)

We reject the null assumption of homoskedasticity (constant variance) and we infer the presence of a heteroscedasticity problem. To overcome autocorrelation and heteroskedasticity problems, we apply a linear general least square (GLS) panel regression model with corrected, firm-clustered standard errors.

Table VIII shows the results for three specifications of Model 1. The first column contains the regression coefficients for the model with EM as an independent variable, the second column contains the regression coefficients for the model with TA as an independent variable and the third column contains the regression coefficient for Model 1 with EM and TA as independent variables.

	Shareholder wealth (Model 1)		
	Earnings management and shareholder wealth (Model 1a)	Tax aggressiveness and shareholder wealth (Model 1b)	Determinants of shareholder wealth (Model 1c)
EAR_MAN	0.0026		−0.0311
	(0.03)		(0.29)
	0.979		0.770
TAX_AGRE		−0.1478***	−0.0768*
		(4.88)	(1.93)
		0.000	0.054
MAJOR	−0.0088	0.0126	−0.0139
	(0.33)	(0.64)	(0.49)
	0.740	0.520	0.625
BIG 4	0.0577***	0.0585***	0.0582***
	(2.89)	(4.15)	(2.75)
	0.004	0.000	0.006
NSKEW	−0.0122	−0.0094	−0.0113
	(1.11)	(0.93)	(1.04)
	0.267	0.354	0.298
SIGMA	0.2064***	0.2473***	0.1817**
	(2.88)	(4.17)	(2.48)
	0.004	0.000	0.013
RET	−0.0602**	0.1290***	−0.0673**
	(2.18)	(4.88)	(2.43)
	0.029	0.000	0.015
ROA	0.1333	0.1454**	0.1430
	(1.37)	(2.03)	(1.41)
	0.170	0.043	0.158
MTB	−0.0013	0.0045	−0.0020
	(0.33)	(1.35)	(0.47)
	0.744	0.176	0.639
LEV	0.0571	0.0530	0.0630
	(1.12)	(1.43)	(1.16)
	0.264	0.152	0.247
SIZE	−0.0442***	−0.0572***	−0.0506***
	(3.67)	(7.78)	(3.94)
	0.000	0.000	0.000
Constant	−0.4112***	−0.2936***	−0.3564***
	(4.43)	(4.26)	(3.68)
	0.000	0.000	0.000
R^2 (%)	15.69	15.72	15.88
Between R^2 (%)	00.37	00.49	0.48
Within R^2 (%)	31.40	31.19	31.18
χ^2-statistics	417.57	586.30	435.46

Notes: This table reports upon the output of general least square panel regressions. In Column 1, we show the results of the regression when shareholder wealth is a function of earnings management and control variables. Column 2 contains the results of the regression when shareholder wealth is a function of tax aggressiveness and control variables. The third column includes all variables of our model. The first line for each variable represents the coefficient, the parentheses contain the *Z*-statistics and the third line contains the *p*-value. *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

Table VIII.
Shareholder wealth determinants

For the model specification with EAR_MAN_t and control variables (Model 1a), we find that EAR_MAN_t has no significant effect on shareholder wealth. We report the same result when we run the full model (Model 1c: p-value = 0.770, $|Z| = 0.29$). Therefore, these results indicate that EM practiced in our sample is non-opportunistic and does not reduce shareholder wealth.

The results for the model specification with TA and control variables (Model 1b) show that TAX_AGRE_t has a significant positive effect on shareholder wealth, since a higher ETR reflects a lesser TA level. Our full model (Model 1c) reveals the same results (p-value = 0.054, $|Z| = 1.93$). Thus, tax management practices used by managers in the German context are non-opportunistic, as they do not jeopardize shareholder interests. In contrast, they increase their wealth.

High ownership concentration provides large investors with sufficient incentives and power to discipline management by limiting managerial opportunism and aligning divergent interests that may exist between the manager and shareholders. In our study, we find a non-significant relation between major shareholder ($MAJOR_{t-1}$), and shareholder wealth measured by abnormal return ($JENSEN_t$) (p-value = 0.625, $|Z| = 0.49$). Moreover, our finding confirms that BIG4 has a significant positive effect on shareholder wealth (p-value = 0.006, $|Z| = 2.75$). The coefficients of the other controls follow our expectations or are statistically insignificant.

Table IX shows the results for SPCR. The findings for both measures for SPCR indicate a significant impact of EAR_MAN_t on SPCR, while TA has no significant impact on SPCR. Both results persist for model specifications with only one independent variable, as well as those with EM and TA variables. The effect of EM on both measures of SPCR is significant at a 1 percent level ($DUVOL_t$: p-value = 0.005, $|Z| = 2.83$; $NCSKEW_t$: p-value = 0.002, $|Z| = 3.02$, respectively). We report the same significant result for the full model (Model 2a/b3: p-value = 0.001, $|Z| = 3.29$; p-value = 0.00, $|Z| = 3.54$). $MAJOR_{t-1}$ has no significant relationship with SPCR measured by $DUVOL_t$ or $NCSKEW_t$. Moreover, we observe a non-significant positive effect of BIG4 on SPCR measured by $DUVOL_t$ and $NCSKEW_t$. The results of the control variables are generally consistent with prior studies. In addition, we find that the average of company-specific weekly returns in year $t-1$ (RET_{t-1}), ROA_{t-1} and $SIZE_{t-1}$ has a significant positive effect on SPCR measured by $DUVOL_t$ and $NCSKEW_t$. This is consistent with Chen *et al.* (2001), who report that stocks with high past returns are more likely to be crash prone. However, we find that $NSKEW_{t-1}$ and MTB_{t-1} have a negative impact on SPCR.

Our results regarding SPCR demonstrate that EM affects SPCR. However, because EM is measured by the value of discretionary accruals, we need to divide the whole sample by income-increasing EM and income-decreasing EM, so as to avoid misinterpretation of this result. This will be analyzed in an additional analysis section (6.2).

Our results also indicate that managers display non-opportunistic behavior in managing taxable income, implying that TA practices in the German context are not opportunistic. In addition, as claimed by Kim *et al.* (2011b), TA increases SPCR only if it facilitates managerial rent extraction and bad-news-hoarding activities. In particular, TA is opportunistic only if it increases SPCR. Moreover, the results suggest that EM and TA are not related when they affect SPCR. This suggestion is tested empirically in the additional analysis section (6.3).

To summarize our baseline results, this work reveals a non-significant effect of EAR_MAN_t on shareholder wealth and a significant effect of EAR_MAN_t on SPCR. Therefore, we find supporting evidence for our *H1*. Moreover, we find a significant positive effect of TAX_AGRE_t on shareholder wealth and an insignificant effect on SPCR. These results suggest that tax management practices used in our particular context are not opportunistic. This can be explained by the efficiency of German regulation in protecting the stock market and shareholder wealth.

6. Additional analysis and robustness tests

In this section, we analyze whether our baseline results of Section 5 are driven by our identification strategy or whether it is robust to changes in methodology. Furthermore, we discuss whether EM and TA are complementary, substitutes for each other or have no

	Model 2a: DUVOL			Model 2b: NCSKEW		
	(1)	(2)	(3)	(1)	(2)	(3)
EAR_MAN	0.2989***		0.3848***	0.5480***		0.6833***
	(2.83)		(3.29)	(3.02)		(3.54)
	0.005		0.001	0.002		0.000
TAX_AGRE		−0.0085	−0.0124		0.0001	0.0078
		(0.19)	(0.27)		(0.00)	(0.10)
		0.853	0.784		0.999	0.923
MAJOR	0.0158	0.0345	0.0269	−0.0516	−0.0221	−0.0525
	(0.45)	(0.89)	(0.64)	(0.93)	(0.38)	(0.94)
	0.653	0.375	0.523	0.350	0.703	0.347
BIG4	0.0194	0.0193	0.0114	0.0083	−0.0050	−0.0132
	(0.94)	(0.84)	(0.47)	(0.23)	(0.13)	(0.35)
	0.346	0.400	0.636	0.817	0.895	0.727
NSKEW	0.0058	−0.0170	−0.0366***	0.0753**	0.0271	0.0236
	(0.42)	(1.20)	(2.61)	(2.54)	(0.93)	(0.80)
	0.678	0.230	0.009	0.011	0.350	0.424
SIGMA	−0.1105*	−0.0655	−0.0578	−0.2037	−0.1307	−0.1247
	(1.65)	(0.92)	(0.80)	(1.54)	(1.01)	(0.94)
	0.099	0.355	0.421	0.122	0.312	0.345
RET	0.0632***	0.0628***	0.0596***	0.1322***	0.1410***	0.1279***
	(2.88)	(2.91)	(2.78)	(3.47)	(3.77)	(3.37)
	0.004	0.004	0.005	0.001	0.000	0.001
ROA	0.2671***	0.3257***	0.2904***	0.5094***	0.5779***	0.5218***
	(4.29)	(4.78)	(4.02)	(3.79)	(4.62)	(3.83)
	0.000	0.000	0.000	0.000	0.000	0.000
MTB	−0.0064***	−0.0089***	−0.0089***	−0.0091	−0.0142***	−0.0106**
	(2.87)	(3.46)	(3.4)	(1.46)	(3.21)	(1.98)
	0.004	0.001	0.001	0.145	0.001	0.048
LEV	0.0345	0.0272	0.0564	−0.0134	−0.0532	−0.0056
	(0.83)	(0.60)	(1.17)	(0.19)	(0.71)	(0.08)
	0.406	0.551	0.243	0.852	0.475	0.939
SIZE	0.1024***	0.0963***	0.1181***	0.2036***	0.1977***	0.2320***
	(8.57)	(7.87)	(8.50)	(9.65)	(9.79)	(10.41)
	0.000	0.000	0.000	0.000	0.000	0.000
Constant	−0.1026	−0.0497	−0.1667*	−0.2115	−0.1208	−0.3200*
	(1.23)	(0.60)	(1.69)	(1.40)	(1.12)	(1.91)
	0.220	0.550	0.091	0.162	0.263	0.056
R^2 (%)	21.46	21.17	21.85	17.96	17.69	18.26
Between R^2 (%)	0.62	0.72	0.74	0.77	0.85	0.86
Within R^2 (%)	16.28	15.37	15.67	14.44	13.76	14.03
χ^2-statistics	716.28	497.53	17,234.78	535.82	832.67	1,862.32

Notes: This table reports upon the results of general least square panel regressions with measures for stock crash as the dependent variables. We measure crash risk by the down-to-up volatility (Model 2a: DUVOL) and by the negative conditional skewness (Model 2b: NCSKEW). The first line for each variable represents the coefficient, the parentheses contain the *Z*-statistics and the third line contains the *p*-value. *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

Table IX.
Stock price crash risk determinants

relationship between them at all. We also test the effect of lagged discretionary accruals and lagged TA on shareholder wealth and SPCR. Overall, the findings from the robustness tests support the baseline results.

6.1 The effect of EM, measured by discretionary working capital accruals, on shareholder wealth and SPCR

In this section, we modify the EM data and apply the value of discretionary accruals (residuals) of Dechow and Dichev (2002):

$$\Delta \mathrm{WC}_{i,t} = \alpha_0 + \alpha_1 \mathrm{CFO}_{i,t-1} + \alpha_2 \mathrm{CFO}_{i,t} + \alpha_3 \mathrm{CFO}_{i,t+1} + \alpha_4 \Delta \mathrm{REV}_{i,t} + \alpha_5 \mathrm{PPE}_{i,t} + \varepsilon_{i,t}.$$

All variables are scaled by total assets at the beginning of year t, where $\Delta WC_{i,t}$ is the change in working capital, $CFO_{i,t-1}$the cash flow from continuing operations year $t-1$, $CFO_{i,t}$ the cash flow from continuing operations year t, $CFO_{i,t+1}$ the cash flow from continuing operations year $t+1$, $\Delta REV_{i,t}$ the difference of the sales revenues of company i in year t and in year $t-1$, $PPE_{i,t}$ the gross property, plant and equipment of company i at the end of year t and $\varepsilon_{i,t}$ the working capital discretionary accruals. Table X summarizes the results.

We observe an insignificant relationship between EM and shareholder wealth (Model 1) (p-value = 0.881, $|Z| = 0.15$) and a significant positive relationship between EM and SPCR (Model 2) measured by $DUVOL_t$, or $NCSKEW_t$ (p-value = 0.003, $|Z| = 3.00$; p-value = 0.002, $|Z| = 3.10$). Therefore, these results show that current discretionary accruals did not affect

	Shareholder wealth	Stock price crash risk	
	Model 1	Model 2a: DUVOL	Model 2b: NCSKEW
EAR_MAN	0.0265	0.6052***	1.1305***
	(0.15)	(3.00)	(3.10)
	0.881	0.003	0.002
TAX_AGRE	−0.0947**	−0.0127	−0.0032
	(2.51)	(0.28)	(0.04)
	0.012	0.783	0.970
MAJOR	−0.0095	0.0390	−0.0103
	(0.37)	(0.99)	(0.18)
	0.712	0.321	0.858
BIG4	0.0592***	0.0169	−0.0083
	(3.10)	(0.74)	(0.22)
	0.002	0.458	0.825
NSKEW	−0.0125	−0.0182	0.0417
	(1.15)	(1.30)	(1.43)
	0.249	0.194	0.153
SIGMA	0.1865***	−0.0762	−0.1526
	(2.65)	(1.07)	(1.17)
	0.008	0.283	0.242
RET	−0.0374	0.0583***	0.1306***
	(1.35)	(2.75)	(3.60)
	0.177	0.006	0.000
ROA	0.1451	0.3195***	0.5538***
	(1.52)	(4.66)	(4.40)
	0.129	0.000	0.000
MTB	−0.0005	−0.0092***	−0.0140***
	(0.13)	(3.46)	(3.06)
	0.894	0.001	0.002
LEV	0.0659	0.0343	−0.0446
	(1.32)	(0.75)	(0.60)
	0.188	0.452	0.548
Size	−0.0505***	0.1000***	0.2020***
	(4.88)	(8.15)	(10.10)
	0.000	0.000	0.000
Constant	−0.3510***	−0.0473	−0.1080
	(4.03)	(0.53)	(0.91)
	0.000	0.599	0.365
χ^2-statistics	436.98	482.72	689.51

Table X.
Test of the effect of earnings management measured by discretionary working capital accruals on shareholder wealth and stock price crash risk

Notes: This table reports upon the main coefficients of our Models 1 and 2 when using the working capital earnings management model as additional analysis. In this test, we regress our two models using, in addition to the value of earnings management and tax aggressiveness, the same control variables used on the main analysis. The first line for each variable represents the coefficient, the parentheses contain the Z-statistics and the third line contains the p-values. *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

shareholder wealth, but increased SPCR. Thus, these results support our baseline results. Indeed, we confirm that managers have more discretion over current accruals (working capital discretionary accruals) than long-term accruals (discretionary accruals), because working capital discretionary accruals increase SPCR.

6.2 The impact of income-increasing and income-decreasing discretionary accruals on shareholder wealth and SPCR

We divided the sample according to the sign of discretionary accruals and test the effects of both income-increasing and income-decreasing discretionary accruals on shareholder wealth and SPCR. We use the same variables as in the baseline analysis in both GLS regressions. Tables XI and XII contain the results of income-decreasing and income-increasing regressions, respectively.

This analysis shows that neither income-deceasing EM (Table XI) nor income-increasing EM (Table XII) affects shareholder wealth (p-value = 0.847; $|Z| = 0.19$; p-value = 0.738; $|Z| = 0.34$, respectively). The results are in line with our main results which show that EM over the total observations does not affect shareholder wealth. Moreover, we report that income-increasing EM has a non-significant effect on SPCR (Table XII). However, we find that income-deceasing EM (Table XI) has a significant negative effect on SPCR, measured by both $DUVOL_t$ and $NCSKEW_t$ (p-value = 0.056; $|Z| = 1.91$; p-value = 0.091; $|Z| = 1.69$, respectively). This is in line with previous studies (e.g. Kim and Zhang, 2016) which argue that income-decreasing EM tactics are not a risky alternative, as they do not affect investor welfare or SPCR. This result suggests that the significant effect of EM on SPCR in our main analysis is due to income-decreasing practices. Thus, EM affects SPCR negatively, a result which confirms the non-opportunistic use of EM and supports the stewardship view of EM in our particular context.

6.3 EM and TA: complements or substitutes?

To test our *H3*, we analyze the interaction between EM and TA in Models 1 and 2. We create a new variable $EAR\_MAN_{i,t} \times TAX\_AGRE_{i,t}$ and estimate the significance of this interaction variable on shareholder wealth and SPCR separately. Table XIII (Model 1) shows that EM and TA are negatively but not significantly related when affecting shareholder wealth (p-value = 0.441, $|t| = 0.77$). This confirms the third view of the relationship between EM and TA discussed in the *H3*. Thus, managers in German companies evidently use EM and TA randomly. This finding can be explained by the high level of German laws and regulations protecting shareholder interests, which prevents EM from affecting shareholder wealth and enables TA to increase shareholder wealth.

Moreover, the two specifications of Model 2 (see Table XIII) indicate the non-existence of a significant interaction between EM and TA when affecting SPCR measured by $DUVOL_t$ or $NCSKEW_t$ (p-value = 0.946, $|t| = 0.07$; p-value = 0.947, $|t| = 0.58$).

6.4 The reversal effect of EM

Finally, we include the lagged variables EAR_MAN_{t-2} as additional variable in our three models. The EM variable is derived from the Kothari *et al.* (2005) model for all observations.

The results in Table XIV reveal that lagged EM in year $t-2$ has a positive and significant effect on shareholder wealth (p-value = 0.035, $|Z| = 2.11$). However, EAR_MAN_{t-2} has an insignificant negative effect on SPCR (Model 2) measured by $DUVOL_t$, or $NCSKEW_t$ (p-value = 0.145, $|Z| = 1.46$; p-value = 0.465, $|Z| = 0.73$). The results confirm the robustness of our baseline results and provide evidence of the non-opportunistic use of EM in our particular context.

	Shareholder wealth	Stock price crash risk	
	Model 1	Model 2a: DUVOL	Model 2b: NCSKEW
INCOME_DECR	−0.0238	−0.2181*	−0.4630*
	(0.19)	(1.91)	(1.69)
	0.847	0.056	0.091
TAX_AGRE	0.0099	0.1632**	0.4341***
	(0.13)	(2.09)	(2.91)
	0.897	0.037	0.004
MAJOR	−0.0829	−0.0325	−0.0428
	(1.41)	(0.61)	(0.32)
	0.158	0.545	0.749
BIG4	0.0261	0.0253	0.0634
	(0.52)	(0.72)	(0.70)
	0.600	0.472	0.484
NSKEW	−0.0122	0.1141***	0.0093
	(0.66)	(4.76)	(0.19)
	0.509	0.000	0.849
SIGMA	0.0376	−0.2530**	−0.1539
	(0.26)	(2.02)	(0.55)
	0.792	0.043	0.583
RET	−0.0839**	0.0370	0.0050
	(2.12)	(0.85)	(0.06)
	0.034	0.398	0.954
ROA	0.1200	0.1402*	0.4229**
	(1.02)	(1.92)	(2.15)
	0.307	0.055	0.032
MTB	−0.0019	−0.0032	−0.0021
	(0.36)	(0.62)	(0.20)
	0.721	0.538	0.839
LEV	−0.0508	−0.0265	−0.1058
	(0.51)	(0.42)	(0.66)
	0.612	0.675	0.508
SIZE	−0.0196	0.0807***	0.2144***
	(1.07)	(4.35)	(4.57)
	0.283	0.000	0.000
Constant	−0.0020	−0.0041	−0.3901*
	(0.02)	(0.04)	(1.80)
	0.985	0.964	0.072
χ^2-statistics	91.28	382.69	280.46
Number of observations	290	290	290

Notes: This table reports upon the main coefficients of our Models 1 and 2 in observations that use income-decreasing discretionary accruals. The variable for income-decreasing discretionary accruals (INCOME_-DECR) is measured by the Kothari model and represents the year-industry absolute value of discretionary accruals $\varepsilon_{i,t}$ in the Kothari model $TAC_{i,t}/TA_{i,t} = \alpha_0[1/TA_{i,t-1}]+\alpha_1[(\Delta REV_{i,t}-\Delta REC_{i,t})/TA_{i,t-1}]+\alpha_2[PPE_{i,t}/TA_{i,t-1}]+\alpha_3 ROA_{i,t-1}+\varepsilon_{i,t}$ for all observations that have $EAR\_MAN_t < 0$. In this test, we regress our two models using, in addition to the value of income-decreasing accruals and tax aggressiveness, the same control variables used on the main analysis. The first line for each variable represents the coefficient, the parentheses contain the *Z*-statistics and the third line contains the *p*-values. *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

Table XI.
The impact of income-decreasing discretionary accruals on shareholder wealth and stock price crash risk

	Shareholder wealth	Stock price crash risk	
	Model 1	Model 2b: DUVOL	Model 2c: NCSKEW
INCOME_INCR	−0.1280	0.1657	−0.7656
	(0.34)	(1.01)	(1.30)
	0.738	0.313	0.193
TAX_AGRE	−0.0702	−0.0527	−0.2318**
	(1.39)	(1.05)	(2.34)
	0.165	0.294	0.019
MAJOR	0.0161	0.0203	−0.0557
	(0.49)	(0.56)	(0.89)
	0.622	0.578	0.374
BIG4	0.0792***	−0.0015	−0.0057
	(3.50)	(0.07)	(0.16)
	0.000	0.945	0.872
NSKEW	−0.0069	0.0180	0.1685***
	(0.48)	(1.17)	(5.03)
	0.632	0.242	0.000
SIGMA	0.2999***	−0.0864	−0.2993*
	(3.30)	(1.11)	(1.90)
	0.001	0.266	0.058
RET	−0.0327	0.1016***	0.14094***
	(0.90)	(4.24)	(2.96)
	0.369	0.000	0.003
ROA	0.0162	0.0510	0.5718*
	(0.08)	(0.30)	(1.65)
	0.933	0.764	0.100
MTB	−0.0038	−0.0023	−0.0122
	(0.69)	(0.38)	(1.19)
	0.491	0.703	0.233
LEV	0.0712	0.0063	0.0539
	(1.16)	(0.11)	(0.55)
	0.248	0.911	0.580
SIZE	−0.0759***	0.1314***	0.2401***
	(4.72)	(8.48)	(9.51)
	0.000	0.000	0.000
Constant	−0.2979**	−0.1410	−0.0553
	(2.38)	(1.62)	(0.28)
	0.017	0.105	0.780
χ^2-statistics	348.34	363.67	290.62
Number of observations	530	530	530

Notes: This table reports upon the main coefficients of our Models 1 and 2 in observations that use income-increasing discretionary accruals. The variable for income-increasing discretionary accruals (INCOME_INCR) is measured by the Kothari model and represents the year-industry absolute value of discretionary accruals $\varepsilon_{i,t}$ in the Kothari model $TAC_{i,t}/TA_{i,t} = \alpha_0[1/TA_{i,t-1}]+\alpha_1[(\Delta REV_{i,t}-\Delta REC_{i,t})/TA_{i,t-1}]+\alpha_2[PPE_{i,t}/TA_{i,t-1}]+\alpha_3 ROA_{i,t-1}+\varepsilon_{i,t}$ for all observations that have $EAR\_MAN_t > 0$. In this test, we regress our two models using, in addition to the value of income-increasing accruals and tax aggressiveness, the same control variables used on the main analysis. The first row of each variable represents the coefficient, the parentheses contain the *Z*-statistics and the third line contains the *p*-values. *,**,***Significant at 0.1, 0.05 and 0.01 levels, respectively

Table XII.
The impact of income-increasing discretionary accruals on shareholder wealth and stock price crash risk

7. Conclusion

This study examines the impact of EM and TA on shareholder wealth, measured by abnormal stock returns and on SPCR. Furthermore, we test whether CG structure influences these relationships. We analyze a sample of non-financial German companies from 2008 to 2014 and find that EM and TA have no combined effect on either shareholder wealth or SPCR. In addition, we report that EM has an insignificant effect on shareholder wealth and

	Shareholder wealth Model 1	Stock price crash risk Model 2a: DUVOL	Model 2b: NCSKEW
EAR_MAN	0.2899	0.3278	1.0093
	(0.82)	(0.99)	(1.56)
	0.414	0.323	0.121
TAX_AGRE	−0.0357	0.0024	−0.0104
	(0.51)	(0.04)	(0.07)
	0.613	0.964	0.941
EAR_MAN × TAX_AGRE	−0.0873	−0.0068	−0.1172
	(0.77)	(0.07)	(0.58)
	0.441	0.946	0.561
MAJOR	0.0049	−0.04904	−0.1460
	(0.11)	(1.01)	(1.32)
	0.914	0.315	0.188
BIG4	0.0627*	0.0011	0.0180
	(1.81)	(0.04)	(0.29)
	0.072	0.968	0.775
NSKEW	0.0087	0.0275	0.0476
	(0.52)	(1.59)	(1.14)
	0.607	0.113	0.256
SIGMA	0.3631**	−0.1201	−0.1504
	(2.11)	(1.23)	(0.69)
	0.036	0.219	0.492
RET	−0.0241	0.0713***	0.1447***
	(0.65)	(2.92)	(2.67)
	0.514	0.004	0.008
ROA	0.0740	0.1758**	0.3745**
	(0.92)	(2.37)	(1.97)
	0.360	0.019	0.050
MTB	0.0022	−0.0099	−0.0188
	(0.43)	(1.62)	(1.24)
	0.669	0.106	0.216
LEV	−0.0477	0.0954**	0.1929*
	(0.65)	(2.09)	(1.83)
	0.515	0.038	0.069
SIZE	−0.0740***	0.1108***	0.2248***
	(4.06)	(7.76)	(6.98)
	0.000	0.000	0.000
Constant	0.0878	−0.4403***	−0.8565***
	(0.66)	(4.76)	(4.73)
	0.511	0.000	0.000
R^2 (%)	15.93	21.85	18.29

Table XIII.
Tests of the significance of the interaction term between earnings management and tax aggressiveness

Notes: We use OLS regressions in order to check the complementary hypothesis. The regressions do not include the other variables. The first line for each variable represents the coefficient, the parentheses contain the *t*-statistics, and the third line contains the *p*-values. *,**,***Significant at 0.1, 0.05, and 0.01 levels, respectively

a significant effect on SPCR. However, TA has a significant positive effect on shareholder wealth. We check the robustness of our results by means of several tests. We divide our sample into two subsamples, the first using income-decreasing EM tactics and the second using income-increasing EM tactics. We find that for both firms that use income-decreasing EM, and these that use income-increasing EM, EM has no significant effect on shareholder wealth. However, we find that in firms that use income-decreasing EM tactics, EM decreases SPCR. Thus, we confirm the non-opportunistic use of both EM and TA in our particular context. Accordingly, this study yields new insights into accounting studies, through

	Shareholder wealth	Stock price crash risk	
	Model 1	Model 2a: DUVOL	Model 2b: NCSKEW
EAR_MAN	−0.1508	0.4000**	0.6547**
	(1.46)	(2.40)	(2.53)
	0.143	0.016	0.012
EAR_MAN_{t-2}	0.2025**	−0.1886	−0.1581
	(2.11)	(1.46)	(0.73)
	0.035	0.145	0.465
TAX_AGRE	−0.1099**	0.0067	−0.0913
	(2.38)	(0.11)	(0.79)
	0.017	0.912	0.427
MAJOR	−0.0356	−0.0256	−0.1267*
	(1.31)	(0.59)	(1.93)
	0.191	0.556	0.054
BIG4	0.0209	−0.0078	−0.0526
	(1.13)	(0.32)	(1.38)
	0.258	0.745	0.168
NSKEW	−0.0206*	0.0448***	0.2168***
	(1.75)	(2.62)	(6.39)
	0.080	0.009	0.000
SIGMA	−0.0716	−0.2457**	−0.5117***
	(0.83)	(2.48)	(3.09)
	0.407	0.013	0.002
RET	0.0352	0.0621***	0.1077***
	(1.29)	(2.73)	(3.80)
	0.196	0.006	0.000
ROA	0.0404	0.3031	0.5012***
	(0.37)	(3.08)	(3.08)
	0.710	0.002	0.002
MTB	0.0084	−0.0125*	−0.0239**
	(1.41)	(1.79)	(2.03)
	0.158	0.074	0.042
LEV	0.1651***	0.0239	0.0629
	(3.25)	(0.47)	(0.80)
	0.001	0.639	0.421
SIZE	−0.0460***	0.0742***	0.1380***
	(4.07)	(5.00)	(5.90)
	0.000	0.000	0.000
Constant	−0.3791***	−0.0935	0.2921
	(3.45)	(0.35)	(0.50)
	0.001	0.723	0.619
χ^2-statistics	295.83	251.14	368.17

Notes: In this test, we regress our two models using, in addition to the value of earnings management and tax aggressiveness, the lagged value of earnings management $t-2$. We run the regressions in addition to those three variables reported in the table, which are the same control variables used in the main analysis. The first line for each variable represents the coefficient, the parentheses contain the Z-statistics and the third line contains the p-value. *,**,***Significance at 0.1, 0.05 and 0.01 levels, respectively

Table XIV.
The reversal effect of earnings management on shareholder wealth and stock price crash risk

exploring the joint effect of both EM and TA practices on shareholder wealth and SPCR. Moreover, our results provide insights for improving managers' accounting choice (EM vs TA), by testing the effect of these choices on shareholder wealth and SPCR, and so too is the analysis of whether EM and TA are complementary or substitute for each other in this relationship.

Our findings have potentially significant implications for accounting and financial researchers, regulators and shareholders. First, our investigation is one of the few studies to

shed light on the German business context, despite its stability and reliability and the investment opportunities it offers. Hence, it might serve as a guide to investors in German companies. In addition, our results show that EM and TA practices used in this particular context were non-opportunistic and therefore, not risky, as they do not affect shareholder wealth. The non-significant interaction between EM and TA when affecting shareholder wealth and SPCR supports this finding. Thus, our results provide some evidence of the effectiveness of German tax laws and an example of how to protect both shareholder wealth and stock markets from future crashes.

Nevertheless, this study has some limitations. First, because the investigation includes only companies listed on the German stock exchange, it would be difficult to make generalizations from our findings. Second, because this investigation uses the ETR to measure TA, it is very likely that the adoption of other measures of TA, such as discretionary book tax differences, would yield different results. Third, the error measurement associated with discretionary accruals models can be considered as another limitation. Finally, to extend our research, we suggest examining the role of culture in order to explain inter-country differences regarding earnings and tax management motivations.

Note

1. All control variables used in our paper are lagged. We use the lagged variables as instruments for correcting possible endogeneity concerns.

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