

CORPORATE DEBT RATIOS AND MANAGERIAL PERSONALITY TRAITS: A CONTENT ANALYSIS OF CHIEF EXECUTIVE OFFICERS' SPEECHES AT ANNUAL GENERAL MEETINGS

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Abstract

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This study contributes to the literature by analysing the joint association of managerial overconfidence, certainty, narcissism, and the Big Five personality traits with debt ratios in the institutional setting of the German two-tier system. Moreover, it provides insights into how corporate governance quality moderates the effects of personality. The analysis relied on the chief executive officers' (CEOs') speeches at annual general meetings (AGMs) that were voluntarily disseminated, a novel data source. Managers' personality traits were measured using software-aided content analysis, and their impact on the debt ratio was analysed using panel regressions. Consistent with previous studies, the debt ratios of German issuers are significantly and positively related to the proxies of managerial certainty and narcissism. However, their model inclusion contributes only marginally to explanatory power. Conversely, the coefficients of the proxies for the Big Five personality traits remained statistically non-significant. Moreover, a significantly negative relationship between debt ratios and the interaction term between a proxy for corporate governance quality and managerial certainty is observed that corresponds to the risk-mitigating impact of corporate governance.

Keywords: Managerial Personality Traits, Debt Ratio, German Issuers, Content Analysis, CEO Speeches, Annual General Meetings

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1. INTRODUCTION

Traditional capital structure theories, such as the pecking order and trade-off theories, explain most of the observed variation in the debt ratio. The remaining variation can be partly due to the personality traits of managers, as supported by the perception of managers as having a strong influence on capital structure decisions and merger and acquisition decisions (Graham et al., 2013). Most of the existing studies have focused on the United States (US) market and the effect of one personality trait on the debt ratio, such as overconfidence (Cain & McKeon, 2016; Ho et al., 2016; Yung et al., 2015).

However, managerial personality traits vary across countries, limiting the generalizability of the findings in the US market. Graham et al. (2013) found that US chief executive officers (CEOs) are more optimistic and risk-tolerant than their European and Asian counterparts. Moreover, CEO power is particularly high in the US due to the one-tier system. Conversely, in several European countries, the two-tier system separates the duties of the management board from monitoring by the supervisory board and prohibits individuals from serving on both boards (Goergen et al., 2015). However, for consistency, the board chair in a two-tier system is generally considered to be equivalent to the CEO in a one-tier system (Crocchi et al., 2011), which is subsequently adopted.

The objective of this study is to provide a more comprehensive understanding of the psychological determinants of financial decision-making by examining a broader set of personality traits and considering the institutional environment of a two-tier corporate governance system. Specifically, the study addresses the following research questions:

RQ1: Do managerial personality traits jointly impact debt ratios within the institutional setting of a two-tier system?

RQ2: If so, does corporate governance quality moderate the impact of managerial traits on capital structure choices?

The latter question is motivated by previous research that has revealed that control mechanisms can help mitigate CEO overconfidence, for example, debt covenants (Voon et al., 2022). Similarly, the level of corporate governance quality, for instance, as measured by indicators such as the skills and experiences of supervisory board members, is expected to moderate the effect of CEO personality traits.

Our study contributes to the ongoing debate on the impact of managerial personality traits on debt ratios in the following ways.

First, we investigate the joint contribution of multiple personality traits to reduce the risk of model misspecification arising because of omitting relevant variables. We focus on managerial overconfidence, narcissism, and the Big Five personality traits (i.e., neuroticism, extraversion, openness, agreeableness, and conscientiousness) because they are associated with corporate risk-taking (Aktas et al., 2016; Malmendier & Tate, 2015; Nicholson et al., 2005; Zhu & Chen, 2015). Debt financing can also be perceived as a riskier funding alternative. To measure diverse personality traits, we employ increasingly popular content analysis techniques (Brunzel, 2022; Harrison et al., 2019).

Second, while previous studies have relied on transcripts of earnings calls (Harrison et al., 2019; Lartey et al., 2020), specifically CEO responses to tough questions raised by sell-side analysts who issue buy, hold, or sell recommendations on a company's stock, our analysis relies on a content analysis of CEO speeches at annual general meetings (AGMs), which are voluntarily distributed via issuers' web pages. Like corporate press releases (Gong, 2022), such speeches are likely to contain soft information to complement previously published quantitative data and personally addressed to shareholders and the interested public. In other words, they bypass intermediaries, such as sell-side analysts, and are directly regulated by the CEO although they are usually well-prepared. While the latter argument limits the analysis of CEO speeches, it may also be transferred — at least to some extent — to the analysis of CEO responses to sell-side analysts' questions, because CEOs may have been coached by experts or may have provided scripted answers (Malhotra et al., 2018). To the best of our knowledge, this study is the first in this context to rely on a content analysis of CEO speeches on AGMs.

Third, we analyse the impact of managerial personality traits in the institutional setting of a two-tier system, that potentially enforces corporate governance and may thus mitigate the consequences of managerial personality traits. Germany is one of the most prominent representatives of the two-tier system, and German firms have a more stakeholder-oriented governance approach (Bottenberg et al., 2017), which favours the use of corporate debt. Moreover, German issuers often provide transcripts of CEO speeches on their web pages (Bannier et al., 2019). Hence, we focused on the analysis of German issuers.

Our results add to previous research in several ways. Although our proxies for managerial certainty and narcissism are significantly and positively related to debt ratios, their inclusion in the model contributes only marginally to explanatory power. Moreover, the proxies for the Big Five personality traits remain statistically non-significant when jointly investigated with managerial certainty and narcissism. Finally, when we tested the moderating effect of corporate governance, a significantly negative relationship was observed between debt ratios and the interaction term between a proxy for corporate governance quality and managerial certainty, thus, indicating a risk-mitigating impact of corporate governance.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 describes the data and methodology used in the study. Section 4 presents the results. Section 5 concludes the paper.

2. LITERATURE REVIEW

2.1. Managerial personality traits and debt ratios

According to upper echelons theory, managerial personality traits affect firm outcomes and policies (Hambrick & Mason, 1984). The major arguments regarding the relationship between managerial personality traits and debt ratios are as follows. First, managerial personality traits positively

(negatively) impact firms' debt ratios if they lead to the overestimation (underestimation) of expected cash flows and/or the underestimation (overestimation) of investment risk and, consequently, in the perceived undervaluation (overvaluation) of the shares of the managers' firms (Malmendier et al., 2011; Yung et al., 2015). Second, managerial personality traits may reflect managers' affinity for risk-taking and the vigour with which return on equity is maximized. If managers are risk-averse, as suggested by agency theory, they hold less-than-optimal debt levels to minimize the risk of bankruptcy (Choi et al., 2018). Lower debt ratios are more conservative and less risky (Hutton et al., 2014). Conversely, any personality trait that stimulates a manager's risk-taking affinity or aggressiveness implies a high level of corporate debt (Malmendier et al., 2011). Third, managerial personality traits may affect investors' willingness to provide additional funding. For instance, managerial overconfidence may indicate higher business and information risks, but it can also imply higher levels of firm innovation (Hirshleifer et al., 2012). Because their returns are left-skewed and leptokurtic, debt investors may dislike (favour) managers with personality traits that increase business risk (the likelihood of debt repayment), whereas equity investors may prefer managers who are successful innovators.

Existing studies have focused on the impact of: 1) overconfidence, 2) narcissism, and/or 3) at least one of the Big Five personality traits. Most studies have reported a positive relationship between managerial overconfidence and debt ratios (Ho et al., 2016; Yung et al., 2015). Such results may be due to managers' overestimation of issuer cash flows (Graham et al., 2013) and the tendency of overconfident CEOs to consider their firms' shares to be undervalued (Yung et al., 2015). Similarly, managerial narcissism is expected to have a positive effect on issuer debt ratios, as it is positively associated with risk-seeking behaviour (Bajo et al., 2022; Zhu & Chen, 2015), overconfidence, and hubris (Cragun et al., 2020).

Conversely, managerial neuroticism may negatively affect issuers' debt ratios. High levels of neuroticism are usually accompanied by characteristics such as pessimistic, fearful, and self-doubtful behaviour (Benischke et al., 2019; Brunzel, 2022; Yarkoni, 2011). Neurotic managers are uncomfortable with greater risks (Mahmoudian et al., 2021; Nicholson et al., 2005). Extraverted people are more optimistic, adventurous, more willing to change their status, and perceive low risk in decision-making (Benischke et al., 2019; Brunzel, 2022). Accordingly, extraversion is a positive factor for debt ratios (Lartey et al., 2020). However, if it helps convince potential equity investors and/or security analysts, equity costs decrease (Merton, 1987), reinforcing the attractiveness of equity financing. Thus, the theoretical implications of the causal relationship between extraversion and debt ratios remain elusive. Openness manifests as mental flexibility or unconventional thinking (Brunzel, 2022). Managers with higher levels of openness are willing to take more risk (Benischke et al., 2019; Nicholson et al., 2005), making managerial openness a positive factor for corporate debt ratios. Agreeableness, that is, characteristic features such as seeking social harmony or cooperation, is often considered a counter trait to narcissism (Brunzel, 2022).

Moreover, agreeableness reduces risk-taking behaviour (Nicholson et al., 2005), implying its negative impact on debt ratios. However, debt holders may consider agreeableness favourable because it contributes to the readability of corporate reports (Mahmoudian et al., 2021) and improves debt holders' risk assessment. Finally, conscientiousness is associated with qualities such as credibility, goal achievement, and ethical behaviour (Benischke et al., 2019; Brunzel, 2022) under controlled conditions, implying a lower willingness to take risks (Nicholson et al., 2005). However, conscientiousness is a positive factor in corporate social responsibility reporting volumes (Mahmoudian et al., 2021). As debt holders may appreciate voluntary information disclosure and conscientious managers are expected to raise debt for less risky investment projects, managerial conscientiousness may positively affect the issuer's debt ratio.

2.2. Content analysis of CEO speeches on AGMs

A reliable measurement of managers' personality traits on issuers' debt ratios is a challenge. For instance, managerial overconfidence is often captured by managers' personal wealth decisions, such as the late exercise of deep-in-the-money stock options or by their portrayal in the media (Hirshleifer et al., 2012; Malmendier & Tate, 2008). However, information on managers' exercise of stock options is unavailable for German issuers. Conversely, analysis of managers' media portrayals may not reflect their true personalities.

Recently, content analysis techniques have gained greater attention in academic research to obtain reliable measures of managers' personality traits (Harrison et al., 2019). Word count software, such as Linguistic Inquiry and Word Count (LIWC), is used to analyse texts (Tausczik & Pennebaker, 2010) that can be directly attributed to managers, particularly transcripts of earnings calls (Harrison et al., 2019; Lartey et al., 2020) or CEO letters to shareholders (Aerts & Yan, 2017). However, our analysis relies on CEO speeches at the AGM. CEO speeches do not involve voting or legal restrictions (Nyqvist, 2015). They provide managers with a rare opportunity to share their views on their company and its future prospects with shareholders via monologues (Martinez-Blasco et al., 2015). They are among the most popular items at AGMs (Nyqvist, 2015). Thus, analysing CEO speeches offers three main advantages. First, because the AGM is typically held several weeks after the release of annual reports and related earnings conference calls, the CEO's speech, like corporate press releases (Gong, 2022), is likely to contain qualitative information that complements the previously published quantitative data. Second, the content of the speech, although presumably prepared by staff, is directly controlled by the CEO. Third, shareholders and interested publics are addressed personally, bypassing intermediaries such as sell-side analysts.

In contrast to their US counterparts, German issuers provide transcripts of CEO speeches on their web pages (Bannier et al., 2019). Similarly, CEOs' letters to shareholders, which German issuers usually publish in annual reports, are not subject to legal constraints. However, the average letter to shareholders in the US or the United Kingdom

contains up to 1,700 words (Aerts & Yan, 2017), whereas the average speech length in our sample is considerably longer.

3. RESEARCH METHODOLOGY

3.1. Sample selection

The initial sample included all firms that were members of the German Prime Standard segment for at least one year during the sample period. We selected Prime Standard issuers because they fulfil the most rigid disclosure standards in the German stock market, thus ensuring reliable firm-specific data¹. The sample period was from 2018 to 2021. Because of the COVID-19 crisis, virtual general meetings were permitted in Germany in 2020 (Zetzsche et al., 2022). Thus, issuers are expected to provide more information on AGM, such as CEO speeches, on their web pages, which was also evident in our sample period. To avoid both survivorship and newness biases, we added firms to the sample in the year they first entered the segment and remained part of the sample until they ceased business activities during the investigation period. Unless otherwise stated, we obtained the data required from LSEG Eikon (formerly: Refinitiv), LSEG Datastream, and the LSEG Worldscope databases.

We identified 347 firms that were listed on the Prime Standard segment at least once during the sample period. The initial sample included 1,300 firm-year observations over four years, with annual observations ranging from 330 firms in 2018 and 2019 to 317 in 2021. Consequently, our sample was affected by the trend towards exits from the stock exchange, due to insolvencies, mergers, or going private transactions, a trend already observed in previous years (Bessler et al., 2023). The initial sample contained companies that belonged to all 11 industries according to the Industry Classification Benchmark (ICB), with the largest number of observations in the ICB industries Consumer Discretionary (267 firm-year observations) and Industrials (257 firm-year observations). We excluded 106 firm-year observations from the financial industry based on the ICB. We then excluded 49 firm-year observations to avoid double-counting when firms have common and preferred outstanding stocks. Third, we omitted 806 firm-year observations because of incomplete data; 44 firm-year observations were removed because of missing information on at least one of the control variables, and 177 firm-year observations were excluded because no AGM archive existed. We excluded 585 firm-year observations because the AGM speeches were not available (345 firm-year observations), and the issuer's AGM archive only provided presentation slides of the CEO's speech (240 firm-year observations). Altogether, these modifications resulted in an unbalanced dataset comprising 339 observations across four years and 114 firms, with yearly observations ranging from 75 firms in 2019 to 100 in 2021. Of these, the majority of firm-year observations were still attributable to the ICB industries: Consumer Discretionary (69 firm-year observations) and Industrials (100 firm-year observations).

3.2. Dependent and control variables

The debt ratio, defined as total financial debt scaled by total assets (*DEBT*), served as the dependent variable. The set of control variables was selected based on previous research (Lartey et al., 2020). Thus, *SIZE* was measured by taking the natural logarithm of a firm's total assets and was expected to be a positive factor for *DEBT* (Fama & French, 2002). *ROA* was calculated as earnings before interest and taxes divided by total assets and was negatively related to debt ratios (Rajan & Zingales, 1995). Capital expenditure (*CAPEX*), defined as the ratio of capital expenditure to total assets, and annual sales growth rates (*GROWTH*) reflect an issuer's investment potential. *CASH* was calculated as cash and marketable security divided by total assets. High cash reserves may indicate an issuer's investment potential (DeAngelo et al., 2006). Greater investment opportunities are often accompanied by lower debt ratios (Fama & French, 2002; Rajan & Zingales, 1995). *TANG*, the ratio of fixed assets, such as plants and equipment, divided by total assets, was included to control for differences in asset structures across the sample firms. Because tangible assets provide high collateral value, we assumed a positive impact on *DEBT* (Rajan & Zingales, 1995). Moreover, we employed a variable to capture ownership concentration. Since both debt holders and shareholders have incentives to monitor the issuer's management, they can help mitigate agency problems (Jensen, 1986); thus, they can be considered substitutes. Following Thomsen and Pedersen (2000), we measured ownership concentration as the proportion of shares owned by the largest shareholder (*LARGEST*). Shareholders' motivation to control management is positively related to the size of their equity stakes and investment horizons (Shleifer & Vishny, 1986). We focused on the ownership concentration in the hands of the largest shareholder, because such investors usually hold substantial stakes in the German stock market, whereas the equity stakes of the second-largest investor are on average considerably lower (Rojahn & Zechser, 2022). Our dataset primarily comprises larger companies. The largest individual shareholders of these companies are typically institutional financial investors or corporate investors. Individuals hold the largest equity position in 58 firm-year observations. Therefore, we did not make further distinctions regarding the identities of major shareholders. Finally, we included the relative bid/ask spread (*BAS*), calculated as the daily average over the 30 days before the fiscal year-end, as a proxy for stock liquidity. High stock liquidity (i.e., a low *BAS*) increases the probability of a seasoned equity offering (Cheung et al., 2016; Rojahn & Zechser, 2022). Thus, a positive relationship between *BAS* and *DEBT* was predicted. With the exception of *BAS*, all variables were calculated as of the fiscal year-end. Panel A of Table 1 presents the descriptive statistics for the dependent and control variables. All variables are defined in the Appendix.

¹ To be in the Prime Standard segment of the Frankfurt Stock Exchange, companies must meet high transparency standards, including quarterly reports, disclosures in German and English, international accounting standards (IFRS/IAS or US-GAAP), a financial calendar, and an annual analyst conference.

Table 1. Summary statistics

Variables	Min	Max	Mean	Standard deviation
Panel A: Descriptive statistics of dependent and control variables				
DEBT	0	0.8830	0.4085	0.2125
SIZE	10.2250	20.0601	15.2369	1.9221
ROA	-0.9589	0.3896	0.0474	0.0901
CAPEX	0.0003	0.1799	0.0382	0.0256
GROWTH	-0.6797	0.9305	0.0483	0.1771
CASH	0.0014	0.6232	0.1251	0.0932
TANG	0.0033	0.9908	0.3042	0.2084
LARGEST	0.0312	0.9455	0.3234	0.2414
BAS	0.0009	0.0529	0.0088	0.0085
Panel B: Descriptive statistics of explanatory variables as specified in Model 1				
SELF-REF	-3.08	0.63	-0.7563	0.5004
NARCISSISM	0	0.5787	0.1530	0.0713
NEURO	-11.94	-5.14	-8.5435	1.2622
EXTRA	-16.49	13.51	0.8658	4.9079
OPEN	-7.47	3.75	-2.1141	2.0639
AGREE	8.57	17.79	12.908	1.8834
CONSC	-2.18	-0.1	-0.6389	0.3108
Panel C: Descriptive statistics of explanatory variables as specified in Model 2				
CERTAIN	1.37	4.43	2.9970	0.5760
NARCISSISM	0	0.5787	0.1530	0.0713
NEURO-ALT	-5.81	2.7	-1.4893	1.3232
EXTRA-ALT	7.87	26.55	16.1490	3.4109
OPEN-ALT	-9.85	-4.33	-6.9644	0.9432
AGREE-ALT	-2.29	6.22	1.5850	1.331
CONSC-ALT	6.85	15.64	11.4630	1.5687

Note: All variables are defined in the Appendix.

3.3. Explanatory variables

The proxy variables for personality traits were derived from the content analysis of CEO speeches at AGMs of shareholders. To reduce reverse causality in the analysis of variations in debt ratios at the end of the fiscal year t , we relied on CEO speeches held in the same period t for the content analysis. We used LIWC software (Tausczik & Pennebaker, 2010), which is widely used in scientific research (Brunzel, 2022; Pan et al., 2018). This word-counting software identifies more than 70 categories (e.g., anger, anxiety, certainty, friendliness) containing hundreds of words (Yarkoni, 2011). The average speech in our sample comprised 3,901 words, ranging from 1,087 to 9,298.

Following Czaja and Röder (2020), we employed *SELF-REF* as a proxy for overconfidence, defined as the ratio of the number of first-person personal pronouns (category "SELF" in LIWC) minus the number of third-person personal pronouns (category "OTHER" in LIWC) to the total number of words in the CEO's speech. As in previous studies (Aktas et al., 2016; Bajo et al., 2022), CEO narcissism (*NARCISSISM*) was calculated as the ratio of first-person singular pronouns to all first-person pronouns in the speech.

Regarding the Big Five personality traits, we relied on the study of Woo and Ahn (2015), who created proxy variables by: 1) extracting LIWC categories that were significantly correlated with

personality traits in several studies, such as Yarkoni (2011), and 2) summing up the ratio of these LIWC categories that were positively correlated with the personality trait; otherwise, we subtracted them. All subsequently mentioned variables were measured in terms of the total number of words in the CEO's speech. Based on this procedure, we constructed *NEURO* as a proxy for neuroticism, which, for instance, is positively correlated with words expressing negative emotions (Yarkoni, 2011) and, thus, is based on LIWC categories such as "SAD". Since *EXTRA* captures the CEO's extraversion, which is associated with positive emotions (Benischke et al., 2019), it includes a relative fraction of LIWC categories such as "SOCIAL" or "FRIEND". Openness (*OPEN*) contains the LIWC category "ARTICLES", because, among other things, people high in openness use articles more often, while agreeableness (*AGREE*) consists of LIWC categories such as "WE", "HOME", or "LEISURE", reflecting the speaker's social orientation and tendency to avoid conflicts (Yarkoni, 2011). Individuals with high scores on conscientiousness (*CONSC*) rarely use negatives (LIWC category "NEGATE") and behave more ethically (Benischke et al., 2019; Brunzel, 2022). A complete list of all LIWC word categories used to calculate *NEURO*, *EXTRA*, *OPEN*, *AGREE*, and *CONSC* is provided in the Appendix. Panel B of Table 1 provides the descriptive statistics for these explanatory variables. Thus, Model 1 is specified in Eq. (1):

$$DEBT_{it} = f(\text{controlling variables}_{it}, SELF-REF_{it}, NARCISSISM_{it}, NEURO_{it}, EXTRA_{it}, OPEN_{it}, AGREE_{it}, CONSC_{it}) \quad (1)$$

Model 2 tested the robustness of our results to alternative proxies for the managerial personality traits. We replaced the *SELF-REF* with the LIWC certainty subscale (*CERTAIN*) because certainty is considered the closest to cognitive rigidity, which includes overconfidence among other aspects of absolutistic thinking (Cohen, 2012). Regarding proxies for the Big Five personality traits, we used

alternative variable definitions based on Glasauer and Alexandrowicz (2022): *NEURO-ALT*, *EXTRA-ALT*, *OPEN-ALT*, *AGREE-ALT*, and *CONSC-ALT*. We adopted the procedure applied by Woo and Ahn (2015): to create proxy variables, we summed (subtracted) the relative fraction of LIWC categories that significantly and positively (negatively) correlated with their corresponding personality traits.

An overview of the LIWC categories on which these alternative definitions are based is presented in the Appendix. The proxy variable *NARCISSISM* remains unchanged. Panel C of Table 1 provides

$$DEBT_{it} = f(\text{controlling variables}_{it}, CERTAIN_{it}, NARCISSISM_{it}, NEURO-ALT_{it}, EXTRA-ALT_{it}, OPEN-ALT_{it}, AGREE-ALT_{it}, CONSC-ALT_{it}) \quad (2)$$

We found significant positive correlations between the personality trait proxies used in Model 1 and their corresponding counterparts in Model 2, with the exception of *SELF-REF* in Model 1 and *CERTAIN* in Model 2, which showed a negative correlation (results not reported for brevity). Therefore, with regard to the interpretation of the subsequently reported results, we relate *SELF-REF* (*CERTAIN*) results to managerial overconfidence (managerial certainty).

3.4. Methodology

We then analysed the effects of the above personality traits on the debt ratio using panel regressions. Our analyses relied on the results of two-way fixed-effects regressions, which also considered endogeneity due to time-invariant unobserved explanatory variables. Unless otherwise stated, subsequently reported t-values were not affected by heteroscedasticity, autocorrelation, or cross-correlation (regression diagnostic results are not disclosed for brevity); however, standard errors were corrected for firm-level and time-level clustering.

4. RESEARCH RESULTS

4.1. Primary findings

The primary results are summarized in Table 2. For comparison, column (1) of Table 2 presents

the descriptive statistics for the alternative proxies for managerial personality traits. Model 2 is expressed by Eq. (2):

a baseline regression with all the control variables, as discussed in subsection 3.2. However, personality traits have no proxy variables. Columns (2) and (3) of Table 2 summarize the results for the joint effects of our seven personality trait proxies according to Model 1 (Model 2). None of the results presented subsequently have a multicollinearity problem, as the variance inflation factors (VIFs) are less than five in all model specifications.

Regarding the control variables, except for *GROWTH*, the signs of the regression coefficients are consistent with the expectations outlined in subsection 3.2. Based on the conventional 5% significance level, *SIZE*, *ROA*, and *CAPEX* are statistically significant factors for *DEBT* in all model specifications. Regarding the variables of interest, the results for Model 1 show that *NARCISSISM* has a significant positive relationship with *DEBT*, which is consistent with previous studies (Bajo et al., 2022; Cragun et al., 2020). When we tested the joint effects of our personality trait proxies on *DEBT* in Model 2, we found a significantly positive association between *CERTAIN* and *DEBT*, while the coefficients of the alternative proxies for the Big Five personality traits remained statistically insignificant. However, a comparison with the baseline regression illustrates that much of the variation in *DEBT* is attributable to traditional firm-specific variables, such as *SIZE*, *ROA*, or *CAPEX*.

Table 2. The joint influence of personality traits on debt ratio

Variables	Baseline model (1)		Model 1 (2)		Model 2 (3)	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
<i>SIZE</i>	0.2103	4.05***	0.1903	4.07***	0.1979	4.06***
<i>ROA</i>	-0.4767	-3.48***	-0.4592	-3.40***	-0.4425	-3.55***
<i>CAPEX</i>	-1.3674	-3.38***	-1.2832	-2.99***	-1.3361	-3.23***
<i>GROWTH</i>	0.0225	1.74*	0.0136	0.80	0.0076	0.57
<i>CASH</i>	-0.2901	-1.66*	-0.3376	-2.05**	-0.3641	-2.21**
<i>TANG</i>	0.1293	1.06	0.0706	0.58	0.0755	0.64
<i>LARGEST</i>	-0.0407	-1.10	-0.0205	-0.62	-0.0381	-0.96
<i>BAS</i>	2.7420	1.56	3.1349	1.87*	3.2365	1.67*
<i>SELF-REF</i>			-0.0106	-0.86		
<i>NARCISSISM</i>			0.2163	1.99**	0.1250	1.73*
<i>NEURO</i>			0.0186	1.48		
<i>EXTRA</i>			-0.0054	-1.31		
<i>OPEN</i>			0.0091	0.96		
<i>AGREE</i>			0.0160	1.21		
<i>CONSC</i>			-0.0230	-1.06		
<i>CERTAIN</i>					0.0353	2.70***
<i>NEURO-ALT</i>					0.0028	0.39
<i>EXTRA-ALT</i>					-0.0040	-0.60
<i>OPEN-ALT</i>					-0.0086	-1.52
<i>AGREE-ALT</i>					0.0042	0.32
<i>CONSC-ALT</i>					-0.0034	-0.54
Firm fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
χ^2 Hausman test (p-value)	16.53 (0.0354)		15.23 (0.4352)		56.30 (0.0001)	
R ²	0.3842		0.4176		0.4291	
R ² adjusted	0.0273		0.0490		0.0678	

Note: Column (1) reports the results of the fixed-effects panel regressions of a baseline model with controlling variables only. Columns (2) and (3) report the results of the fixed effects estimates for Model 1 and Model 2. Significance tests of the regression coefficients rely on standard errors corrected for firm-level and time clustering. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

4.2. Robustness tests

To reduce model complexity in our robustness tests, all statistically non-significant proxies for personality traits, as reported in Table 2, were

omitted. Thus, all robustness tests initially relied on Model 3, as specified in Eq. (3).

The estimates for a fixed-effects regression based on Model 3 are reported in column (1) of Table 3.

$$DEBT_{it} = f(\text{controlling variables}_{it}, CERTAIN_{it}, NARCISSISM_{it}) \quad (3)$$

Table 3. The influence of certainty and narcissism on the debt ratio: Two-stage least squares regression

Variables	Single stage regression (1)	First stage regression (2)	First stage regression (3)	Second stage regression (4)
Dependent variable	DEBT	CERTAIN	NARCISSISM	DEBT
SIZE	0.1965	0.1972	0.0334	0.2037
(t-value)	(8.2446)***	(1.4488)	(1.1150)	(9.1737)***
ROA	-0.4569	-0.3964	-0.0930	-0.4683
(t-value)	(-7.3583)***	(-0.7892)	(-4.9972)***	(-7.0161)***
CAPEX	-1.4000	0.4855	-0.1057	-1.4085
(t-value)	(-6.3658)***	(0.4295)	(-0.5897)	(-6.7338)***
GROWTH	0.0141	0.0392	0.0377	0.0203
(t-value)	(2.0269)**	(0.2994)	(2.0899)**	(3.3247)***
CASH	-0.3334	0.9350	0.1716	-0.3174
(t-value)	(-7.3172)***	(1.7396)*	(6.2689)***	(-6.8396)***
TANG	0.0908	0.5261	0.1155	0.1047
(t-value)	(0.9894)	(0.5866)	(1.3827)	(1.1259)
LARGEST	-0.0403	0.2269	0.0354	-0.0360
(t-value)	(-3.3889)***	(0.6452)	(7.2029)***	(-2.5855)**
BAS	2.9782	-7.3910	-1.8050	2.7997
(t-value)	(5.9384)***	(-3.2827)***	(-2.8632)***	(6.3588)***
CERTAIN	0.0322			
(t-value)	(8.1228)***			
NARCISSISM	0.1492			
(t-value)	(5.3648)***			
ANALYTIC		-0.0375	-0.0047	
(t-value)		(-17.3387)***	(-7.4112)***	
AGREE		0.0230	-0.0186	
(t-value)		(1.0249)	(-7.5283)***	
CERTAIN (fitted values)				0.0375
(t-value)				(2.3685)**
NARCISSISM (fitted values)				-0.0001
(t-value)				(-0.0113)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
F-test excluded instruments		17.777	19.367	
(p-value)		(0.00001)	(0.00001)	
χ^2 endogeneity test (p-value)				0.5098
				(0.9999)
R ²	0.4161	0.1558	0.1873	0.4056
R ² adjusted	0.0691	-0.3460	-0.2957	0.0524

Note: Column (1) shows the single-stage regression results for Eq. (3). Columns (2) and (3) report the first-stage regression results for CERTAIN (NARCISSISM) as an endogenous variable. ANALYTIC and AGREE were used as instruments. Column (4) displays the second-stage regression results. Significance tests of the regression coefficients rely on standard errors corrected for firm-level and time clustering (corresponding t-values in brackets). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

4.2.1. Endogeneity concerns

We tested whether our regression results had endogeneity concerns, such as those owing to self-selection. Evaluating whether firms hire managers with personality traits that fit their financial policies or whether managers affect a corporation's debt ratio because of their personality is challenging. Moreover, another source of self-selection may arise from our data collection process, because we derive personality traits from voluntarily published CEO speeches.

To apply a two-stage least squares (2SLS) regression, strong instrumental variables were required that were uncorrelated with the error term and strongly correlated with potentially endogenous regressors, i.e., NARCISSISM and CERTAIN. We did not use sociodemographic variables such as gender and education (Ho et al., 2016) due to insufficient variability in our sample. For instance, women made fewer than 20 speeches in our sample. Instead, we

chose AGREE from Eq. (1) and ANALYTIC, a proxy for analytical thinking measured by the categorical-dynamic index (CDI) score (Pennebaker et al., 2014), as instruments for NARCISSISM and CERTAIN. Agreeableness is considered the opposite trait of narcissism (Brunzel, 2022), while the Dunning-Kruger effect suggests that individuals with low analytical skills suffer from overestimation. Columns (2) and (3) of Table 3 display the first stage of the 2SLS regression results, revealing that CERTAIN (NARCISSISM) is strongly negatively correlated with ANALYTIC (ANALYTIC and AGREE). The first-stage regressions yield F-statistics of the excluded instruments that are significantly greater than 10, passing the threshold of Stock et al. (2002). Hausman test does not indicate the presence of endogeneity with a χ^2 test statistic of 0.51 ($p \approx 0.99$), and 2SLS is less efficient than one-stage regressions (Ebbes et al., 2016). Thus, our statistical inference statements rely on previously reported one-stage regressions. For transparency, the results of

the second stage 2SLS regression with fitted values for *CERTAIN* and *NARCISSISM* as explanatory variables are displayed in column (4) of Table 3. Except for *NARCISSISM*, they remain broadly unchanged from the one-stage regression.

4.2.2. Moderating effects of corporate governance

Effective corporate governance can not only help mitigate agency conflicts between managers and shareholders but also alleviate the consequences of managerial personality traits (Lartey & Danso, 2022). As a proxy for corporate governance quality,

we used the LSEG Eikon environmental, social, and governance (ESG) score (*GOVERNANCE*), a component of the LSEG governance pillar ESG score (Rajesh & Rajendran, 2020) that rises with the effectiveness of applying best practices of corporate governance. It reflects the issuer's commitment to corporate governance principles and includes governance indicators such as the skills and experience of supervisory board members. Since *GOVERNANCE* did not contribute to explaining *DEBT* (results not reported here), we included the interaction terms between *GOVERNANCE* and both *CERTAIN* and *NARCISSISM*, as shown in Eq. (4).

$$DEBT_{it} = f(\text{controlling variables}_{it}, CERTAIN_{it}, NARCISSISM_{it}, CERTAIN_{it} \times GOVERNANCE_{it}, NARCISSISM_{it} \times GOVERNANCE_{it}) \quad (4)$$

The findings summarized in Table 4 reveal a significantly negative relationship between *DEBT* and the interaction term *GOVERNANCE* × *CERTAIN*, which corresponds to the risk-mitigating impact of corporate governance. However, compared to the results without interaction terms, as reported in column (1) of Table 3, adding the two interaction terms only slightly increased the adjusted R².

Table 4. The influence of certainty and narcissism on the debt ratio: The moderating effect of corporate governance

Variables	Coefficient	t-value
SIZE	0.1875	7.7425***
ROA	-0.4707	-7.5413***
CAPEX	-1.4393	-6.8137***
GROWTH	0.0105	1.0347
CASH	-0.3516	-6.6174***
TANG	0.0857	0.9805
LARGEST	-0.0485	-3.3461***
BAS	2.9534	5.9825***
CERTAIN	0.0369	7.097***
NARCISSISM	0.1432	4.3109***
CERTAIN × GOVERNANCE	-0.0001	-2.1166**
NARCISSISM × GOVERNANCE	0.0003	0.4249
Firm fixed effects		Yes
Year fixed effects		Yes
χ ² Hausman test (p-value)	96.026	(0.0001)
R ²		0.4231
R ² adjusted		0.0715

Note: The table reports the regression results for Eq. (4). Significance tests of the regression coefficients rely on standard errors corrected for firm-level and time clustering (corresponding t-values in brackets). *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels (two-tailed), respectively.

4.2.3. Nonlinear relationships

Finally, we tested for nonlinear associations between *CERTAIN* (*NARCISSISM*) and *DEBT*. These tests were motivated by previous research that found a nonlinear relationship between the cost of equity and overconfidence (Aghazadeh et al., 2018). Therefore, we added the squared terms of the proxies for personality traits to Model 3. Because the results did not indicate any nonlinear relationship, we abstained from further reporting.

5. CONCLUSION

This study examined the association between managerial personality traits and firm debt ratios. We analysed issuers in the German stock market, where managerial power is presumably lower than that of their US counterparts due to institutional control mechanisms of the two-tier system.

Our study investigated joint modelling using overconfidence, certainty, narcissism, and the Big Five personality traits. To construct proxy variables for the personality traits, we applied content analysis using the LIWC software. Our analyses were based on CEO speeches on AGMs, which are often voluntarily published by German issuers.

Our key findings are as follows:

First, regardless of the definitions of the proxy variables for personality traits applied, most of the variance in debt ratios can be explained by traditional firm-specific variables derived from the pecking order and trade-off theories, especially firm size, return on assets, and capital expenditure.

Second, the proxies for the Big Five personality traits remain statistically non-significant when jointly investigated with managerial certainty and narcissism. This contrasts with previous studies that have suggested a potential influence of at least one of the Big Five personality traits on managers' affinity for risk-taking (Benischke et al., 2019; Lartey et al., 2020).

Third, the debt ratios of German issuers are significantly and positively associated with the proxies for managerial certainty and narcissism. Consistent with previous research, this finding links managerial narcissism (Bajo et al., 2022; Zhu & Chen, 2015) and overconfidence (Ho et al., 2016; Yung et al., 2015) to risk-seeking behaviour, though their inclusion in the model contributes only marginally to explanatory power.

Fourth, our results remain essentially unchanged when we perform robustness checks; that is, they indicate neither endogeneity concerns nor nonlinear relationships between our proxies for the personality traits applied and debt ratios. Moreover, when we test the moderating effect of corporate governance, there is a significant negative relationship between debt ratios and the interaction term between the proxies for corporate governance quality and managerial certainty. These findings correspond to the perception of a risk-mitigating impact of corporate governance (Lartey & Danso, 2022). Overall, however, our analyses conclude that under the institutional setting of a two-tier governance system, variation in the debt ratio can only be marginally related to managerial personality traits.

Our analysis has some limitations that could be addressed in future research. First, the generalizability of our results is limited because they rely on a relatively small sample of German issuers. Subsequent studies may investigate whether our finding that managerial certainty and narcissism only marginally contribute to explaining variations

in the debt ratio is specific to the German market or whether such findings can also be replicated across other countries with a two-tier system. Second, our study does not differentiate between public and private debt or short- and long-term debt, which could provide additional insights. To illustrate,

if a loan is long-term and not tradable via the public market, a potential investor's willingness to provide debt capital may particularly depend on managerial personality traits that may positively affect repayment probability, such as conscientiousness.

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APPENDIX. VARIABLE DEFINITIONS

Variables	Definition
Dependent variable	
<i>DEBT</i>	Total financial debt scaled by total assets
Control variables	
<i>SIZE</i>	Natural logarithm of the firm's total assets
<i>ROA</i>	Earnings before interest and taxes divided by total assets
<i>CAPEX</i>	Capital expenditures scaled by total assets
<i>GROWTH</i>	Annual sales growth rate
<i>CASH</i>	Cash plus short-term investments to total assets
<i>TANG</i>	Property, plant and equipment over total assets
<i>LARGEST</i>	Fraction of shares held by the largest shareholder
<i>BAS</i>	Relative bid/ask spread
Explanatory variables employed in Model 1	
<i>SELF-REF</i>	The ratio of the number of first-person personal pronouns (category "SELF" in LIWC) minus the number of third-person personal pronouns (category "OTHER" in LIWC) to the overall number of words in the CEO's speech
<i>NARCISSISM</i>	The ratio of first-person singular pronouns to all first-person pronouns over the entire document
<i>NEURO</i>	The sum of the ratio of words assigned to the LIWC categories "I", "NEGATE", "SAD", and "FEEL" minus the ratio of words assigned to the LIWC category "ARTICLE"
<i>EXTRA</i>	The sum of the ratio of words assigned to the LIWC categories "WE", "SOCIAL", "FRIEND", and "SEXUAL" minus the sum of the ratio of words assigned to the LIWC categories "ARTICLE", "NUMBER", and "NEGATE"
<i>OPEN</i>	The sum of the ratio of words assigned to the LIWC categories "ARTICLE", and "DEATH" minus the sum of the ratio of words assigned to the LIWC categories "HOME", "TIME", "I", "FAMILY", "LEISURE", and "FOCUS_PRESENT"
<i>AGREE</i>	The sum of the ratio of words assigned to the LIWC categories "HOME", "TIME", "WE", "FAMILY", and "LEISURE" minus the sum of the ratio of words assigned to the LIWC categories "SWEAR", and "ANGER"
<i>CONSC</i>	Minus the sum of the ratio of words assigned to the LIWC categories "SWEAR", "ANGER", "DEATH", and "NEGATE"
Explanatory variables employed in Model 2	
<i>CERTAIN</i>	The ratio of words assigned to the LIWC category "CERTAIN"
<i>NEURO-ALT</i>	The sum of the ratio of words assigned to the LIWC categories "AFFECT", "SAD", "ANX", and "I" minus the ratio of words assigned to the LIWC category "WORK"
<i>EXTRA-ALT</i>	The sum of the ratio of words assigned to the LIWC categories "WE", "YOU_TOTAL", "FAMILY", and "SOCIAL"
<i>OPEN-ALT</i>	The sum of the ratio of words assigned to the LIWC categories "BODY", and "SEXUAL" minus the ratio of words assigned to the LIWC category "TIME"
<i>AGREE-ALT</i>	The sum of the ratio of words assigned to the LIWC categories "FAMILY", "HOME", "WE", "ANGER", and "LEISURE" minus the ratio of words assigned to the LIWC category "POSEMO*"
<i>CONSC-ALT</i>	The sum of the ratio of words assigned to the LIWC categories "ACHIEVE", and "WORK" minus the sum of the ratio of words assigned to the LIWC categories "ANGER", "BODY", "SWEAR", "DEATH," and "NEGEMO*"
Instrumental variable	
<i>ANALYTIC</i>	A proxy variable for analytical thinking, originally published as the CDI score (Pennebaker et al., 2014)
Moderating variable	
<i>GOVERNANCE</i>	LSEG Eikon ESG management score

Note: * Terms from the LIWC positive emotion (POSEMO) and negative emotion (NEGEMO) lexica.