CEO Neuroticism and Text-based Communicative Value of Annual Reports

Tsung-Kang Chen
Email: vocterchen@nycu.edu.tw
Department of Management Science,
National Yang Ming Chiao Tung University, TAIWAN

Yijie Tseng*
E-mail: 081647@mail.fju.edu.tw
Department of Accounting,
Fu Jen Catholic University, TAIWAN

Yu-Chun Lin
Email: superrock.lin@gmail.com
Department of Management Science,
National Yang Ming Chiao Tung University, TAIWAN

Yun Hao
Email: peterhao.c@nycu.edu.tw
Department of Management Science,
National Yang Ming Chiao Tung University, TAIWAN

* Corresponding author. We acknowledge the financial supports provided by Ministry of Science and Technology, Taiwan (Now National Science and Technology Council, Taiwan): [Grant Number MOST 109-2410-H-009 -012 -MY3].

CEO Neuroticism and Text-based Communicative Value of Annual Reports

Abstract

We investigate whether and how CEO neuroticism affects the text-based communicative value of annual reports using S&P 1500 firms. We employ annual report readability as the proxy of the text-based communicative value of annual reports, reflecting the degree of managers' strategic textual reporting in annual reports. We find that CEO neuroticism is significantly and positively related to annual report readability due to the increase in the CEOs' incentives to alleviate outside investors' information uncertainty perceptions. We provide new evidence that CEO neuroticism improves annual report readability via the mechanism of less severe management-equity agency problems, which enhances the CEOs' incentives of alleviating outside investors' information uncertainty perceptions. In addition, we also find that the CEO neuroticism effect becomes weaker when the firm has higher internal governance quality, better firm profitability, and greater management resources. Finally, our findings are robust when considering endogeneity issues and controlling for other CEO personality traits.

Keywords: CEO neuroticism; Text-based communicative value of annual report; Annual report readability; Information uncertainty perceptions; Management-equity agency problem

1. Introduction

This study explores whether CEO neuroticism affect the text-based communicative value (hereafter denoted as TCV) of annual reports by employing annual report readability, which is a managerial tool used to manipulate the cost of acquiring and processing the annual report information for outside investors (Li, 2008; De Franco et al., 2011; Hoberg and Phillips, 2010; Brown and Tucker, 2011; Peterson et al., 2015; Lang and Stice-Lawrence, 2015). The TCV of annual reports is meant to reflect the speed at which annual report information is conveyed to outside investors (Seebeck and Kaya, 2022; Chen et al., 2023). That is, a firm's annual report TCV is determined by managers' strategically textual reporting (hereafter denoted as MSTR) activities in annual reports. The main motivation for engaging in MSTR activities is to make the regulated disclosures more (less) favorable for managers to convey more (less) rapidly. Therefore, exploring the determinants of annual report TCV (namely annual report readability) is an essential issue, since it helps outside investors better understand the drivers for engaging in MSTR behaviors. Previous studies have shown that current earnings (Li, 2008), earnings persistence (Li, 2008), earnings management (Lo et al., 2017), management risk incentive (Chakrabarty et al., 2018), and pension plan characteristics (Chen and Tseng, 2020) are the determinants of annual report readability. However, these determinants are management outcomes and behaviors rather than managers' intrinsic characteristics (e.g. CEO personality traits). CEO neuroticism, one of a CEO's big five personality traits, is rarely discussed in the annual report TCV, annual report readability or MSTR literature. Since neuroticism reflects an individual's psychological construct information related to emotional instability (McCrae and John, 1992), CEO neuroticism may affect outside investors' perceptions for a firm's information uncertainty (Harrison et al., 2020) and be less able to deal with uncertain events and process the complicated information surrounding risky decisions (Herrmann and Nadkarni, 2014; Judge et al., 1998), which may increase outside investors' required information risk

premiums and thus costs of capital (Lambert et al., 2007). To alleviate outside investors' concerns about perceived information uncertainty, neurotic CEOs may have incentives to improve annual report TCV (i.e., annual report readability), especially if the conflict of the interests between neurotic CEOs and outside investors is slight. Although CEO neuroticism plays a critical role in outside investors' required information risk premium, it is rarely mentioned in annual report TCV literature. We therefore address this important gap by exploring the effects of CEO neuroticism on annual report TCV (i.e., annual report readability).

Among MSTR activities in annual reports, we primarily focus on the dimension of annual report TCV (i.e., readability). The annual report TCV (i.e., readability) (namely the narrative disclosure readability in annual reports) has been become an important issue, widely discussed in the finance and accounting literature (e.g. Li, 2008; Biddle et al., 2009; Lehavy et al., 2011; Lo et al., 2017; Asay et al., 2017; Ertugrul et al., 2017; Bonsall IV et al., 2017b; Bonsall IV and Miller, 2017; Chakrabarty et al., 2018; Abernathy et al., 2019; Chen and Tseng, 2021). Recent studies have documented that managers manipulate the narrative disclosure readability in annual reports because of management behaviors and firm outcomes, such as current earnings (Subramanian et al., 1993; Schrand and Walther, 2000; Bloomfield, 2002; Li, 2008), earnings persistence (Li, 2008), investment efficiency (Biddle et al., 2009), earnings management (Lo et al., 2017), and management risk incentive (Chakrabarty et al., 2018). Li (2008) shows that managers of firms with lower earnings or earnings persistence have more incentives to raise the costs of acquiring and processing annual report information for outside investors and thereby make annual reports less readable. Biddle et al. (2009) show that annual report readability is negatively (positively) associated with a firm's investment when the firm is more likely to have over-invested (under-invested). Lo et al. (2017) observe that firms with a higher likelihood of engaging in earnings management to beat the prior year's earnings have more complex descriptions in the 'Management Discussion and Analysis' (MD&A) section. In

addition, Chakrabarty et al. (2018) show that managers with higher risk incentives (measured by greater CEO/ CFO options vega) have lower annual report readability. These studies reveal that management outcomes, managers' behaviors, and managers' attitude are associated with annual report TCV (i.e., readability). Since annual report TCV (i.e., readability) is an important tool for managers to manipulate the speed at which the required disclosure in annual reports is conveyed, CEO neuroticism, one of big five personality traits (conscientiousness, extraversion, neuroticism, agreeableness, and openness; McCrae and John, 1992), may affect the incentives of engaging in MSTR activities of annual reports and thus annual report TCVs (i.e., annual report readability).

According to John and Robins (1993) and Harrison et al. (2020), neuroticism, as well as conscientiousness and extraversion, are more easily detected by external observers and less likely to be hidden by CEOs compared with other big five personality traits of agreeableness and openness. Neuroticism refers to the characteristics of showing emotional instability and being prone to high pressure, anxiety, and impulsiveness (McCrae and John, 1992). Neurotic individuals are more likely to be impulsive and irrational (Judge et al., 2002), have negative biases in receiving information (Chan et al., 2007), feel repulsed by uncertainty (Hirsh and Inzlicht, 2008), and be more risk-averse than emotionally stable individuals (Nicholson et al., 2005). In addition, Eysenck (1967) demonstrates that neurotic individuals usually lack effective cognitive skills and thus self-regulation abilities, which make them experience impaired cognitive functioning when they encounter difficulties. Judge et al. (1998) and Herrmann and Nadkarni (2014) demonstrate that neurotic CEOs are less able to deal with uncertain events and process the complicated information surrounding risky decisions. Hence, neurotic CEOs may create perceptions of information uncertainty for outside investors (Harrison et al., 2020), resulting in a higher information risk premium required by outside investors (Lambert et al., 2007). Accordingly, to mitigate outside investors' concerns, neurotic CEOs may have

incentives to increase the conveying speed of annual report information and thus annual report TCV (i.e., readability), especially if the interests between neurotic CEOs and outside investors are more closely aligned. Thus, we propose a potential mechanism for the association between CEO neuroticism and annual report TCV from the perspective of management-equity agency problem (measured by CEO equity incentive-based compensation ratio; Jensen and Meckling, 1976). That is, when management-equity agency problem is less severe, neurotic CEOs have more incentives to alleviate outside investors' information uncertainty perceptions and thus reduce required information risk premiums by improving annual report TCV (i.e., annual report readability). Based on the above discussions, we therefore theoretically hypothesize that (1) CEO neuroticism is positively associated with annual report TCV (i.e., annual report readability) for the purpose of alleviating outside investors' perceptions about information uncertainty; (2) the positive association between CEO neuroticism and annual report TCV is driven by the mechanism of the adverse level of management-equity agency problem.

In addition to the mentioned mechanism of the management-equity agency problem, we propose another three new mechanisms related to corporate internal governance (Cheng et al., 2016), firm profitability (Li, 2008), and management resources that change the association between CEO neuroticism and annual report TCV (i.e., readability). The measures of management resources include management efficiency (Demerjian et al., 2012), market share, and CEO social network size (Ferris et al., 2017). First, for the moderator of internal governance quality, we follow Cheng et al. (2016) to introduce the subordinate executives' relative power as the measure of internal governance quality and discuss whether the subordinate executives' relative power moderates the association between CEO neuroticism and annual report TCV. For the subordinate executives' relative power, higher subordinate executives' relative power suggests better internal governance quality (Cheng et al., 2016). Hence, higher subordinate executives' relative power implies better monitoring mechanisms

on CEO decisions, which may weaken outside investors' information uncertainty perceptions and thus reduce the neurotic CEOs' incentives of improving annual report TCV. Second, since higher firm profitability may lead outside investors to have less concern about the information uncertainty perceptions of neurotic CEOs, the association between CEO neuroticism and annual report TCV may become weaker when firm profitability is higher. Third, for the moderator of management resources, management resources may alleviate the doubts of outside investors about the information uncertainty perceptions of neurotic CEOs and thus reduce the firm's information asymmetry level (e.g. Chemmanur et al., 2009). Therefore, greater management resources seem to mitigate the positive association between CEO neuroticism and annual report TCV.

We further measure management resources using management efficiency (Demerjian et al., 2012), market share, and CEO social network size (Ferris et al., 2017). For the mechanism of management efficiency, firms with greater management efficiency can help neurotic CEOs develop more appropriate strategies to deal with uncertainty (e.g. Chemmanur et al., 2009) and provide better earnings quality (Demerjian et al., 2012). Hence, management efficiency may mitigate outside investors' concerns about the information uncertainty perceptions of neurotic CEOs and thus weaken neurotic CEOs' incentives of improving annual report TCV (i.e. annual report readability). For the mechanism of market share, firms with greater market share have superior competitive advantages and less operating uncertainty, which may mitigate outside investors' concerns about the information uncertainty perceptions of neurotic CEOs and thereby weaken the positive association between CEO neuroticism and annual report TCV (i.e. annual report readability). For the mechanism of CEOs social networks, greater CEOs social network size may lead the firm to have (1) easier access to funding and resources (Rauch and Casella, 2001; Cohen et al., 2008; Kuhnen, 2009; Hochberg et al., 2010; Engelberg et al., 2012); (2) greater information sharing (Glaeser et al., 1992; Jaffe et al., 1993); and (3) lower

information asymmetry levels (Ferris et al., 2017; Hong et al., 2017). Hence, CEOs social network size helps alleviate outside investors' concerns about the information uncertainty perception of neurotic CEOs, which thus reduces neurotic CEOs' incentives of improving annual report TCV (i.e., readability). Based on the above discussions, we can reasonably conjecture that management efficiency, market share, and CEOs social network size all weaken the positive association between CEO neuroticism and annual report TCV (i.e., readability).

It is worth noting that neuroticism has several differences in psychological and behavioral aspects from narcissism. Neurotic individuals own the characteristics of emotional instability, high pressure, and impulsiveness (McCrae and John, 1992) while narcissistic individuals have the characteristics of arrogance, exhibitionism, exploitativeness, entitlement, vanity, self-absorption, self-admiration, self-importance, and uniqueness (American Psychiatric Association, 2000; Olsen et al.,2014). In addition, neurotic individuals generally feel repulsed by uncertainty and tend to display negative emotions and behaviors, whereas narcissistic individuals still believe they will do well in the future even though they have failure experiences. Different from the previous studies, we address the relationship between CEO neuroticism and annual report TCV (i.e., readability) from the perspective of neurotic CEOs' incentives of mitigating outside investors' information uncertainty perceptions resulting from the neurotic CEOs' emotional instability and negative emotions and behaviors.

We empirically examine the effect of CEO neuroticism on annual report TCV (i.e. annual report readability, measured by the Bog index, the adverse proxy of readability; Bonsall et al., 2017) with different two model specifications of random effect (Harrison et al., 2020) and fixed effect (year and firm) by employing 11,785 S&P 1500 component firm observations from 2006 to 2019. It has to be noted that other big five personality traits and well-known determinant variables of annual report TCV (i.e., readability) (Li, 2008; Lo et al., 2017) are also controlled in the model specifications. The CEO big five personality traits variables (Agree, Consc, Extra,

Neuro, Openn) are estimated using the Open Language Chief Executive Personality Tool (hereafter denoted as *OLCPT*) developed by Harrison et al. (2019). Empirical results of this study show that (1) CEO neuroticism (Neuro) is significantly and positively related to annual report TCV (i.e., readability) when controlling for the other big five personality traits and well-known determinant variables of annual report TCV (i.e., readability); (2) greater CEOs equity incentive-based compensation ratio boosts the positive association between CEO neuroticism and annual report TCV (i.e., readability). That is, CEOs equity incentive-based compensations play a theoretical mechanism for the positive association between CEO neuroticism and annual report TCV (i.e., readability). These results indicate that (1) neurotic CEOs have more incentives of improving annual report TCV to mitigate outside investors' concerns about the information uncertainty perceptions of neurotic CEOs and thus reduce their required information risk premium; and (2) more aligned interests between neurotic CEOs and outside investors enhances the positive association between CEO neuroticism and annual report TCV due to the less severe management-equity agency problem.

Moreover, we also find that internal governance quality, firm profitability, and management resources (management efficiency, market share, and CEO social network sizes) all significantly weaken the positive association between CEO neuroticism and annual report TCV (i.e. readability). The results also indicate that better internal governance quality, higher firm profitability, and greater management resources all mitigate more outside investors' information uncertainty perceptions and thus lead the neurotic CEOs to have less incentive of improving annual report TCV. Furthermore, we also find that the positive association between CEO neuroticism and annual report TCV (i.e. readability) becomes stronger when subprime mortgage crisis occurs. The result implies that outside investors have greater information uncertainty perceptions during the subprime mortgage crisis period, which thus enhances the neurotic CEOs' incentives of improving annual report TCV.

We further discuss the endogeneity issue for the effects of CEO neuroticism on annual report TCV (i.e. readability). Since an individual's big five personality traits are innate and tend to remain unchanged after the age of 40 (Roberts et al., 2006; McCrae and Costa, 1982), the traits of conscientiousness, extraversion, neuroticism, agreeableness, and openness may be viewed as exogenous, rendering endogeneity issues such as reverse causality less serious. To further mitigate endogeneity concerns about omitted variables, reverse causality, and measurement errors, we employ the difference-in-difference (DID) design to perform robustness tests. The results of the DID design are consistent with our main findings. In addition, our conclusions still hold when additionally controlling for CEO narcissism and overconfidence. Hence, our findings that CEO neuroticism has a positive association with annual report TCV (i.e. readability) is robust when considering endogeneity issue and the presence of CEO narcissism and overconfidence.

The main contributions of this study are: (1) focusing on the perspectives of managers' intrinsic and psychological characteristics rather than those of management outcomes and behaviors; (2) first introducing the importance and implications of CEO neuroticism for the text-based communicative value of annual reports; (3) investigating whether and how CEO neuroticism affect annual report TCV (i.e. readability) through the potential mechanism of the less severe management-equity agency problem (measured by CEO equity incentive-based compensation ratio); (4) discussing several moderating roles for the association between CEO neuroticism and annual report TCV (i.e. readability), such as internal governance mechanism, firm profitability, management resources, and subprime crisis period; and (5) providing evidence for links between specific personality traits of CEOs and specific tones in annual reports. These contributions suggest that this study not only contributes to the annual report TCV (i.e. readability) literature but also the CEO personality traits literature.

The remainder of this paper is organized as follows. Section 2 presents the measures of CEO personality traits and annual report TCV (i.e. readability). Section 3 describes the

hypotheses developments. Section 4 summarizes the other major variables used in the empirical examinations. Section 5 presents and analyzes the results. Finally, section 6 provides concluding remarks.

2. Main Measures

This section introduces the CEO big five personality traits variables and annual report TCV (i.e. readability) measures used to examine our main hypotheses and how to calculate these variables. The CEO big five personality traits variables include conscientiousness, extraversion, neuroticism, agreeableness, and openness. For the estimations of these five personality traits, we follow Harrison et al. (2019) and use the *OLCPT* developed by Harrison et al. (2019) to analyze the dialogue records of the CEO in the firm's quarterly earnings call transcripts and calculate the CEO's five personality trait scores, which range from 1 to 7 points.[1] The data of earnings call transcripts used in this study are obtained from the Capital IQ database. The higher values of the CEO's neuroticism and other big five personality traits scores represent the stronger personality trait. The variables of CEOs' neuroticism, conscientiousness, extraversion, agreeableness, and openness are denoted *Neuro*, *Consc*, *Extra*, *Agree*, and *Openn*, respectively.

It has to be noted that the *OLCPT* program of Harrison et al. (2019) is to facilitate machine learning models (e.g. Gradient Boosting Machine) to imitate how experts in psychology evaluate the levels of CEOs' big five personality traits. The *OLCPT* program is based on the semi-supervised learning model in the following procedures: (1) selecting 207 CEOs from 3,573 CEOs of S&P 1500 component firms with the personality scores evaluated by three trained doctors of psychology according to the Questions and Answers (Q&A) videos of

[1] In addition, it should be noted that the OLCPT is open language rather than closed language, unlike previous studies.

earnings call conferences; (2) employing Word2Vec method to extract word features of 3,573 CEOs' talks in earnings call transcripts; (3) training and testing the real personality trait scores data of 207 CEOs to establish a prediction model based on the Gradient Boosting Machine; (4) predicting the big five personality trait scores of 3,573 CEOs by employing the most optimal regression model with the word and phrase vectors of the 3,573 CEO speeches in earnings call transcripts. Finally, the value of the big five personality trait score for each CEO ranges from 1 to 7 and is continuous.

Regarding the annual report TCV (i.e. readability), we follow Bonsall et al. (2017) and use the Bog index (BOG) of annual reports as the main measure. According to Bonsall et al. (2017), the Bog index (BOG) is defined as the sum of *Sentence Bog* and *Word Bog* minus *Pep*. *Sentence Bog* is defined as the standardized average sentence length, which identifies readability issues stemming from sentence length. *Word Bog* is defined as the sum of plain English style problems and word difficulty multiplied by 250 and divided by the number of words. *Pep* suggests the writing attributes that facilitate understanding of texts by readers, defined as the sum of the usage of items such as names and interesting words. Higher BOG variable values represent lower annual report TCV (i.e. readability). The relationship between text readability and the Bog index is as follows: excellent ($20 \geq \mathrm{BOG} \geq 0$), good ($40 \geq \mathrm{BOG} \geq 21$), average ($70 \geq \mathrm{BOG} \geq 41$), poor ($100 \geq \mathrm{BOG} \geq 71$), bad ($130 \geq \mathrm{BOG} \geq 101$) and dreadful ($1000 \geq \mathrm{BOG} \geq 131$).

In addition, we use the Flesch reading-ease score (FRES, Flesch, 1948) as another proxy of annual report TCV (i.e. readability). First, the definition of the FRES variable is shown in Eq. (1), where it is defined as inverse of the educational level necessary to comprehend a piece of writing. Hence, a higher FRES value means higher text readability, meaning that the FRES variable is positively associated with readability level.

$$FRES = 206.835 - 1.015\left(\frac{\text{Total words}}{\text{Total sentences}}\right) - 84.6\left(\frac{\text{Total syllables}}{\text{Total words}}\right) \quad (1)$$

Furthermore, we also introduce several tone variables to capture the sentiment characteristics of CEOs with different big five personality traits. We describe CEOs' sentiment features by employing POS, NEG, UNC, LIT, M_STR, and M_Weak variables, which respectively represent the positive tone, negative tone, uncertainty tone, litigious tone, strong modal tone, and weak modal tone for the CEOs' conversations in quarterly earnings calls. The above tone variables are measured by the ratio of word counts of each tone to total word counts and the sentiment word lists are based on Loughran-McDonald Master Dictionary w/ Sentiment Word Lists (Loughran and McDonald, 2011).

3. Hypotheses Developments

This section proposes the hypotheses regarding the association between CEO neuroticism and annual report TCV (i.e. annual report readability). The main theoretical foundations of hypotheses development are that: (1) the emotional instability characteristics of neurotic CEOs (McCrae and John, 1992) not only bring outside investors to have information uncertainty perceptions on firm value (Harrison et al., 2020) but also lead the CEOs to be less able to deal with uncertain events and process the complicated information surrounding risky decisions (Herrmann and Nadkarni, 2014; Judge et al., 1998); (2) neurotic CEOs may have incentives to improve annual report TCV (i.e., readability) to alleviate outside investors' concerns about perceived information uncertainty and thus required information risk premiums (Lambert et al., 2007), especially if the interests between neurotic CEOs and outside investors are more closely aligned (namely slight management-equity agency problem).

Based upon the above discussions, neurotic CEOs may have incentives to manipulate the conveying speed and processing costs of annual report information for mitigating outside

investors' concerns about the information uncertainty perceptions resulting from the emotional instability characteristics. Therefore, we hypothesize that CEO neuroticism is positively related to annual report TCV (i.e. readability) levels.

In addition, we also propose a theoretical mechanism of the management-equity agency problem to describe the association between CEO neuroticism and annual report TCV (i.e. readability). When management-equity agency problem concerns are less severe, neurotic CEOs are conjectured to have more incentives to improve annual report TCV (i.e. readability), which reduces the required information risk premiums and thus costs of capital (Lambert et al., 2007).

Hypothesis 1*: CEO neuroticism is positively associated with annual report text-based communicative value (readability).*

Hypothesis 1a*: CEO neuroticism is positively associated with annual report text-based communicative value (readability) through the mechanism of less severe management-equity agency problem (e.g. more closely aligned interests between neurotic CEOs and outside investors).*

In addition to the above mentioned theoretical channels, we propose another new potential three mechanisms that may change the CEO neuroticism effect on annual report TCV from the perspectives of internal governance (Cheng et al., 2016), firm profitability, and management resources. The measures of management resources used in this study include management efficiency (Demerjian et al., 2012), market share, and CEO social network size (Ferris et al., 2017).

For the moderator of internal governance quality, we introduce the subordinate executives' relative power as the measure of internal governance quality (Cheng et al., 2016) and further investigate whether subordinate executives' relative power moderates the association between CEO neuroticism and annual report TCV (i.e. readability). Since higher subordinate executives'

relative power provides better monitoring mechanisms on CEO decisions, internal governance quality seems to be helpful for mitigating outside investors' information uncertainty perceptions, which decreases the required information risk premium and thereby weakens the neurotic CEOs' incentives of improving annual report TCV. This inference can be shown as Hypothesis 2.

Hypothesis 2. *Corporate internal governance quality weakens the positive association between CEO neuroticism and annual report TCV.*

For the moderator of firm profitability, firms with higher profitability generally have greater asset values. Accordingly, higher firm profitability is helpful for mitigating outside investors' concerns about the emotional instability characteristics of neurotic CEOs and the information uncertainty perceptions on firm value. Therefore, we can reasonably conjecture that firm profitability weakens the positive association between CEO neuroticism and annual report TCV, shown as Hypothesis 3.

Hypothesis 3. *Firm profitability weakens the positive association between CEO neuroticism and annual report TCV.*

For the moderators of management resources, we employ management efficiency (Demerjian et al., 2012), market share, and CEO social network size (Ferris et al., 2017) as the proxies of management resources and further investigate whether management resources moderate the positive association between CEO neuroticism and annual report TCV. First, for the mechanism of management efficiency, since greater management efficiency helps neurotic CEOs develop more appropriate strategies to deal with uncertainty (e.g. Chemmanur et al., 2009) and provide better earnings quality (Demerjian et al., 2012), management efficiency may mitigate outside investors' concerns about the information uncertainty perceptions of neurotic CEOs. Therefore, management efficiency is conjectured to weaken neurotic CEOs' incentives of improving annual report TCV (i.e., readability).

Second, for the mechanism of market share, since greater market share bring firms to have superior competitive advantages and less operating uncertainty, greater market share may alleviate outside investors' concerns about the information uncertainty perceptions of neurotic CEOs. Therefore, market share is conjectured to weaken neurotic CEOs' incentives of improving annual report TCV (i.e., readability).

Third, for the mechanism of CEOs social networks, firms with larger CEOs social network size may have (1) easier access to funding and resources (Rauch and Casella, 2001; Cohen et al., 2008; Kuhnen, 2009; Hochberg et al., 2010; Engelberg et al., 2012); (2) better information sharing (Glaeser et al., 1992; Jaffe et al., 1993); and (3) lower information asymmetry levels (Ferris et al., 2017; Hong et al., 2017). Accordingly, based upon the above discussions, CEOs social network sizes are helpful for mitigating outside investors' concerns about the information uncertainty perceptions of neurotic CEOs, which thus reduces neurotic CEOs' incentives of providing better annual report TCV (i.e., readability).

Based on the above discussions, we can reasonably hypothesize that management efficiency, market share, and CEOs social network size all weaken the positive association between CEO neuroticism and annual report TCV (i.e. readability), shown as Hypotheses 4, 4a, 4b, and 4c.

Hypothesis 4. *Management resources weaken the positive association between CEO neuroticism and annual report TCV.*

Hypothesis 4a. *Management efficiency weakens the positive association between CEO neuroticism and annual report TCV.*

Hypothesis 4b. *Market share weakens the positive association between CEO neuroticism and annual report TCV.*

Hypothesis 4c. *CEO social network size weakens the positive association between CEO neuroticism and annual report TCV.*

4. Data and Methodology

Because the purpose of this study is to investigate the determinants of annual report TCV (i.e., readability) from the CEO neuroticism perspective, this section introduces the sample selection procedures and data sources.

4.1. Sample selection and data source

For the data sources of the annual report TCV (i.e., readability) proxies used in this study (namely BOG and FRES), the BOG variable is obtained from the personal webpage of Professor Brian P. Miller (https://host.kelley.iu.edu/bpm/activities/bogindex.html) and the FRES variable is acquired from the WRDS SEC Analytics Suite. The tone variables of POS, NEG, UNC, LIT, M_STR, and M_Weak are also obtained from the WRDS SEC Analytics Suite. The SEC formats of annual reports include 10-K and 10-K405. In addition, since we investigate the association between CEO neuroticism and annual report readability using S&P 1500 component firms, those sample observations without CEO neuroticism data are excluded. After the above screening criteria, a total 11,785 firm-year sample observations during the sample period were retained, covering the period from 2006 to 2019. Table 1 shows the sample distribution of 11,785 (10,594) annual firm observations for those with a Bog index (FRES variable), and the subsamples are sorted by the Bog index for each year. The yearly trend of the average Bog index from year 2006 to 2019 is increasing (84.05 to 94.84).

[Insert Table 1 here]

We estimate CEO neuroticism (Neuro) and other big five CEO personality traits (Agree, Consc, Extra, and Openn) scores using *OLCPT* (Harrison et al., 2019) and the dialogue records of the CEO in the firm's quarterly earnings call transcripts. The data from the earnings call transcripts used in this study are obtained from the Capital IQ database. The proxies of the CEO big five personality traits used in this study are detailed in Section 2. The sample is limited to

S&P 1500 component firms (Harrison et al., 2019; Harrison et al., 2020) and the sample period in this study is from the year 2006 to 2019.

4.2. Control variables

For the control variables of annual report TCV (i.e., readability), we follow Li (2008) and Lo et al. (2017) to introduce several firm characteristics variables, such as restatement dummy variable (Restate), operating earnings per unit asset (Earnings), negative Earnings dummy variable (Loss), firm size (SIZE), market to book value ratio (MB), firm age (Fage), special item per unit asset (SPI), operating earnings volatility (Earn_Vol), equity volatility (VOL), the number of non-missing items on Compustat (DISC), Delaware state dummy variable (DLW_D), change in Net Income due to restatement scaled by total assets (NI_chg_Restate), merger and acquisition dummy variable (MA_D), and seasoned equity offering dummy variable (SEO_D). Among these control variables, Restate equals one if a firm has a restatement related to fraud or resulted in an SEC investigation in a given year and zero otherwise; Earnings is defined as operating earnings deflated by total assets; Loss equals one if the value of Earning variable is negative and zero otherwise; SIZE stands for firm size, measured by the natural logarithm of asset market value; MB is defined as the ratio of asset market value to asset book value; Fage is the number of years since the firm appeared on CRSP; SPI is defined as the ratio of special items to total assets; Earn_Vol is defined as the standard deviation of operating earnings estimated by the previous five years; VOL is defined as the standard deviation of monthly stock returns in the previous one year; DISC refers to the number of items in Compustat with non-missing values; DLW_D equals one if a firm is headquartered in Delaware state and zero otherwise; NI_chg_Restate is defined as the total dollar change in Net Income due to restatement scaled by total assets; MA_D equals one if a firm is acquirer in Capital IQ database in the given year and zero otherwise; SEO_D equals one if a firm has a seasoned equity offering according to Capital IQ database in the given year and zero otherwise.

4.3. Moderating variables

We also propose a theoretical mechanism and several potential mechanisms for the association between CEO neuroticism and annual report TCV (i.e. readability). The theoretical mechanism is "less severe management-equity agency problem", measured by CEOs' equity incentive-based compensation ratio (hereafter denoted as EI_COMP). A higher value of EI_COMP variable indicates the higher degree of the more closely aligned interests between CEOs and outside investors, namely less severe management-equity agency problem (Jensen and Meckling, 1976). The EI_COMP variable is defined as the percentage of the sum of CEOs' stock-, and option-based compensations to total compensations.

For other potential mechanisms for the association between CEO neuroticism and annual report TCV (i.e., readability), we propose three mechanisms of internal governance quality, firm profitability, and management resources. The management resources used in this study cover management efficiency (Demerjian et al., 2012), market share, and CEO social network sizes (Ferris et al., 2017). The definitions of the above moderating variables are demonstrated as follows:

First, the internal governance quality (IG) variable is defined as the sum of standardized values of Exec_Horizon and Exec_PayRatio (Cheng et al., 2016). The Exec_Horizon variable represents the average of the number of years until the age of retirement (e.g. 65) for main subordinate executives. Exec_PayRatio stands for the ratio of average annual compensation of the main subordinate executives to the CEO's annual compensation, which represents the main subordinate executives' ability to monitor the CEO[2]. Second, firm profitability is defined as return on assets (ROA), namely the ratio of net income to total sales. Third, management efficiency variable is defined as the decile ranks of MA score (MA_R; Demerjian et al.,2012; Demerjian et al., 2013), which represents a firm's management efficiency attributed to

[2] The main subordinate executives are defined as TMT members other than the CEO.

managers themselves. We follow Demerjian et al. (2012) to estimate the firm efficiency variable using Eq. (2), which presents the DEA estimation.[3]

$$\underset{v}{Max}\, E_i = \frac{Sales_i}{v_1 COGS_i + v_2 SGA_i + v_3 PPE_i + v_4 OL_i + v_5 RD_i + v_6 Goodwill_i + v_7 OInta_i} \tag{2}$$

Subject to $E_j = \frac{Sales_j}{v_1 COGS_j + v_2 SGA_j + v_3 PPE_j + v_4 OL_j + v_5 RD_j + v_6 Goodwill_j + v_7 OInta_j} \leq 1$

for j=1,2,3,……..N firms

$v_k \geq 0$ for k=1, 2, 3, 4, 5, 6, 7

$$E_{it} = \beta_0 + \beta_1 LnTA_{it} + \beta_2 MS_{it} + \beta_3 PFCF_{it} + \beta_4 LAge_{it} + \beta_5 BSC_{it} + \beta_6 FCI_{it} + Year_t + \varepsilon_{it} \tag{3}$$

In Eq.(3), *E* stands for the firm efficiency variable generated by the DEA estimation.[4] The residual (ε) from the estimation in Eq. (3) is defined as the measure of the MA score (Demerjian et al., 2012). To make the MA score be more comparable across years and industries, we also follow Demerjian et al. (2012) to introduce the decile ranks of the MA score (MA_R) by year and industry.[5]

Fourth, market share (MS) variable is defined as the percentage of revenues earned by the firm within industry with two-digit SIC code. Lastly, CEO social network size (CEO_SN) variable is defined as the natural logarithm of the average of CEOs' social network sizes (Ferris et al., 2017). The CEO's social network size is the summation of the CEO's employment ties,

[3] In Eq. (2), E is the DEA-generated firm efficiency measure. The seven input variables of COGS, SGA, PPE, OL, RD, Goodwill, and OInta represent costs of goods sold, sales, general and administrative expenses, fixed assets (property, plant, and equipment), operating leases, R&D expenditures, goodwill, and other intangible assets, respectively. *v* is the firm-specific vector of optimal weights on the seven inputs through optimization.

[4] The firm-specific characteristics variables of *LnTA, MS, PFCF, LAge, BSC, and FCI* represent firm size, market share, positive free cash flow, firm age, complex multi-segment, and international operations, respectively. The first four variables aid management while the last two variables challenge management. The *LnTA*, *LAge*, and *MS* variables are defined as the natural logarithm of a firm's total assets, the natural logarithm of the number of years the firm has been listed on Compustat at the end of year t, and the percentage of revenues earned by the firm within industry with two-digit SIC code in year t, respectively. The *BSC* variable presents the ratio of individual business segment sales to total sales, summed across all business segments for year t. The *PFCF* and *FCI* variables are dummy variables that the former equals one if a firm has nonnegative free cash flow and the latter equals one if the firm reports a nonzero value for foreign currency adjustment in year t.

[5] We thank Professor Peter Demerjian for providing their estimated managerial ability data. The data is obtained from https://peterdemerjian.weebly.com/managerialability.html

educational ties, social activity ties, and other activity ties.

Table 2 presents the summary statistics of annual report TCV (i.e., readability) variables, tone variables, CEO neuroticism and other big five personality traits variables, control variables, and moderating variables used in the empirical analyses. Average BOG is 87.50 and average *FRES* is 23.73. These results show that annual report TCV (i.e., readability) is poor on average (based on the *BOG* criteria). In addition, the averages of Neuro, Consc, Extra, Agree, and Openn are 3.2708, 5.0621, 4.6931, 4.1052, and 4.6804, respectively. These results indicate that CEOs in S&P 1500 component firms on average have higher conscientiousness, extraversion, and openness levels and lower neuroticism level.

[Insert Table 2 here]

5. Empirical Analysis

5.1. Examinations of the relation between CEO neuroticism and annual report TCV (i.e., readability)

This section proposes the methodologies used to examine the main hypothesis. For the hypothesis 1, we follow Harrison et al. (2020) and employ panel data regressions with random effect model settings to investigate the association between CEO neuroticism and annual report TCV (i.e., readability) when controlling for CEO other big five personality traits and other well-known variables identified in the literature. In addition to the random effect model settings, we also consider the fixed effect model settings (firm and year) to investigate the association between CEO neuroticism and annual report TCV (i.e., readability). Finally, we consider the firm-level clustered standard errors (Petersen, 2009) in evaluating the effectiveness of the regression coefficients estimates. Equations (4) and (5) show the model specifications for examining the hypothesis 1.

$$BOG_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 Consc_{it} + \beta_3 Extra_{it} + \beta_4 Agree_{it} + \beta_5 Openn_{it} + \sum_{j=1} \beta_{j+5} CV_{j,it} + \varepsilon_{it} \quad (4)$$

$$FRES_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 Consc_{it} + \beta_3 Extra_{it} + \beta_4 Agree_{it} + \beta_5 Openn_{it} + \sum_{j=1} \beta_{j+5} CV_{j,it} + \varepsilon_{it} \quad (5)$$

In Eq. (4) and (5), BOG variable is the adverse proxy of annual report TCV (i.e., readability) and FRES variable is the positive proxy of annual report TCV (i.e., readability). Control variables (CV) include the Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, VOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D variables. Detailed descriptions of these variables are given in section 4.2.

Table 3 presents the empirical results of Eq. (4) for the entire sample period. Columns (1) to (3) present the results of random effect model settings and columns (4) to (6) present the results of fixed effect model settings. The results of the columns (3) and (6) both show that the Neuro variable is significantly and negatively related to the Bog variable when controlling for other big five personality traits variables and well-known determinant variables, indicating that CEO neuroticism is positively associated with annual report TCV (i.e., readability). The coefficients of the Neuro variable in columns (3) and (6) are -0.9462 and -0.5877, indicating that the Bog index decreases 0.6394 (-0.9462×0.6758) and 0.3972 (-0.5877×0.6758) per standard deviation increase in the firm's Neuro variable in the random effect model and fixed effect model settings, respectively. The results also reveal that neurotic CEOs may have incentives to improve annual report TCV (i.e. readability) to alleviate outside investors' concerns about the perceived information uncertainty resulting from the feature of neurotic CEOs' emotional instability (McCrae and John, 1992). The hypothesis 1 that CEO neuroticism is positively related to annual report TCV (i.e., readability) is thus supported.

[Insert Table 3 here]

As a robustness test, we replace the BOG variable by another TCV (i.e., readability) variable, the FRES variable, in Eq. (1), as shown in Eq. (5). The results for Eq. (5) are presented in Table 4. Columns (3) and (6) both show that the Neuro variable are both significantly and positively related to the FRES variable after controlling for other personality trait variables and well-known determinant variables of annual report TCV (i.e., readability), indicating that CEO neuroticism is positively associated with annual report TCV (i.e., readability). The coefficients of the Neuro variable in columns (3) and (6) are 0.2999 and 0.4266, indicating that the FRES variable increases 0.2027 (0.2999×0.6758) and 0.2883 (0.4266×0.6758) per standard deviation increase in the firm's Neuro variable in the random effect model and fixed effect model settings, respectively. These results are consistent with the findings in Table 3.

[Insert Table 4 here]

In addition, we also explore whether CEOs with different personality traits use different tones or sentimental words in annual reports, employing Eq. (6). Tone variables include the POS, NEG, UNC, LIT, M_STR, and M_Weak variables.

$$Tone_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 Consc_{it} + \beta_3 Extra_{it} + \beta_4 Agree_{it} + \beta_5 Openn_{it} + \sum_{j=1} \beta_{j+5} CV_{j,it} + \varepsilon_{it} \quad (6)$$

Table 5 shows that (1) neurotic CEOs are significantly and negatively associated with the POS and NEG variables; (2) conscientious CEOs are significantly and negatively associated with POS and UNC variables while having the opposite effect on LIT variable; (3) extraverted CEOs are significantly and positively associated with the POS and NEG variables; (4) agreeable CEOs are significantly and positively associated with the POS, NEG, UNC, and M_Weak variables; (5) open CEOs are significantly and positively associated with the M_STR and M_Weak variables. The above results suggest that (1) neurotic CEOs are less likely to use positive and negative words in annual reports, a finding also aligned with the their tendency to

be more risk-averse than emotionally stable individuals (Nicholson et al., 2005); (2) conscientious CEOs are less likely to use positive and uncertain words in annual reports and tend to use litigious words, consistent with the risk-averse character of conscientious CEOs; (3) extraverted CEOs are more likely to use positive and negative words in annual reports, a finding also aligned with their risk-taking attitudes.

[Insert Table 5 here]

5.2. Theoretical mechanism for the association between CEO neuroticism and annual report TCV: CEO equity incentive-based compensations

To further examine whether the positive association between CEO neuroticism and annual report TCV (i.e., readability) is through the theoretical mechanism of less severe management-equity agency problem (measured by CEO equity incentive-based compensations, EI_COMP; Jensen and Meckling, 1976), namely Hypothesis 1a, we employ an interaction term analysis model, shown in Eq. (7):

$$BOG_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 EI\_COMP_{it} + \beta_3 Neuro_{it} \times EI\_COMP_{it} + \beta_4 O\_PT_{it} + \sum_{j=1} \beta_{j+4} CV_{j,it} + \varepsilon_{it} \quad (7)$$

Where *O_PT= Extra, Consc, Agree, Openn*

BOG variable is the adverse proxy of annual report TCV (i.e., readability). Control variables (CV) include the Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, VOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D variables. Detailed descriptions of these variables are given in section 4.2.

The results of columns (3) and (6) in Table 6 show that the coefficients of the interaction terms of *Neuro* and *EI_COMP* are both significant and negative under the random effect and fixed effect model settings, respectively, when controlling other personality traits and well-known determinants variables of annual report TCV (i.e., readability). These results suggest

that CEOs' equity incentive-based compensations significantly boost the negative (positive) association between CEO neuroticism and Bog index (annual report TCV). These results support that more aligned interest between CEOs and equity holders (namely less severe management-equity agency problem) resulting from greater CEOs' equity incentive-based compensations increases neurotic CEOs' incentives of improving annual report TCV (i.e. readability) to mitigate outside investors' concerns about the information uncertainty perceptions of neurotic CEOs. Hence, the hypothesis 1a is empirically supported.

[Insert Table 6 here]

5.3. Endogeneity discussions of the relationship between CEO neuroticism and annual report TCV

Since the big five personality traits are closely related to an individual's innate traits and do not change much after the age of 40 (Roberts et al., 2006; McCrae and Costa, 1982), we view a CEO's neuroticism and other big five personality traits as exogenous. Thus, endogeneity issues such as the time-variant omitted variable and reverse causality problems should be less serious.

To further eliminate other endogeneity concerns (e.g. measurement error), we also consider the difference-in-difference model design for the relation between CEO neuroticism and annual report TCV (i.e., readability). CEO turnover is treated as an appropriate event to construct an experiment exploring the impacts of CEO neuroticism on annual report TCV (i.e. readability). Following Lin et al. (2020), the subsample observations are selected by the following criteria: (1) the firm is in the sample; (2) CEO turnover occurred during the sample period; and (3) the firm has a low level of CEO neuroticism score before the CEO turnover occurred.[6] Accordingly, we employ this screened subsample to implement the difference-in-

[6] A low level of CEO personality trait is defined as values for the CEO personality trait variables that are lower than their 25th percentiles.

difference analysis.

The treatment group is defined as firms with CEO turnover that change from a low level of CEO neuroticism scores (Neuro) to a high level. The control group is defined as firms with a CEO turnover event in which the CEO changed from a low level of neuroticism to a CEO with a low level of neuroticism score. A low (high) level of CEO personality trait scores is defined as values for the CEO personality trait variables that are lower (higher) than their 25th (75th) percentiles. Besides, we define a dummy variable, *New_Neuro_D*, that equals 1 if the joining of the new CEO moves from a low level of CEO neuroticism to a high level and 0 otherwise. *Post* is a dummy variable that equals 1 if the year of observation is after the occurrence of CEO turnover and 0 otherwise.

We employ *New_Neuro_D*×*Post* to capture the treatment effect of a firm from a low level of CEO neuroticism to a high level on annual report TCV. In addition, to avoid the distortions of other big five personality traits (conscientiousness, extraversion, agreeableness, openness), we only select the firms with CEO turnover event that the levels of the CEO's other big five personality traits are unchanged (namely remain high level or low level). The equation for the DID design is shown as Eq. (8):[7]

$$BOG_{it} = \alpha + \beta_1 New\_Neuro\_D_{it} + \beta_2 Post_{it} + \beta_3 New\_Neuro\_D_{it} \times Post_{it} + \sum_{j=4}^{N} \beta_j CV_{j,it} + \varepsilon_{it} \quad (8)$$

Where *CV= Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, VOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D*

To provide additional robustness evidence for Hypothesis 1, we replace *Neuro* with the *New_Neuro_D, Post,* and *New_Neuro_D*×*Post* variables in Eq. (4) and then employ

[7] It has to be noted that we employ staggered DID model specification for the fixed effect model setting.

New_Neuro_D×Post to capture the treatment effect of a firm shifting from a low level of CEO neuroticism to a high level on the annual report TCV. Columns (1) to (2) of Table 7 show that the coefficients of *New_Neuro_D×Post* are negative and significant (-1.9946, -2.3535) under random effect setting, indicating that firms that change from a low level of CEO neuroticism to a high level have lower Bog index (namely higher annual report TCV) than those that change from a low level of CEO neuroticism to another low level. This result is consistent with our main findings in Table 3. In addition, these results remain unchanged when replacing the random effect setting by the fixed effect setting (shown in columns (3) to (4) of Table 7: the coefficients of *New_Neuro_D×Post* are -2.4783, -2.6861). Therefore, our finding that the positive (negative) association between CEO neuroticism and annual report TCV (Bog index) is robust to endogeneity issues.

[Insert Table 7 here]

5.4. The association between CEO neuroticism and annual report TCV: The potential mechanisms of internal governance, firm profitability, and management resources

This section investigates whether corporate internal governance quality (IG; Cheng et al., 2016), firm profitability (ROA), and management resources play the potential mechanisms for the association between CEO neuroticism and annual report TCV. In addition, the proxies of management resources used in this study include management efficiency (MA_R; Demerjian et al., 2012), market share (MS), and CEO social network sizes (CEO_SN; Ferris et al., 2017). The detailed definitions of the above mentioned moderating variables are demonstrated in section 4.3. Finally, the model specifications for examining the Hypotheses 2, 3, 4a, 4b, and 4c are stated in Eq. (9):

$$BOG_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 MR_{it} + \beta_3 Neuro_{it} \times MR_{it} + \beta_4 O\_PT_{it} + \sum_{j=5}^{N} \beta_j CV_{j,it} + \varepsilon_{it}$$

(9)

Where *MR= IG, ROA, MA_R, MS, CEO_SN*

O_PT= Extra, Consc, Agree, Openn

CV=Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, VOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D

The results of columns (1) to (5) in Table 8 show that the coefficients of the interaction terms of *Neuro* and *MR* are almost significant and positive under the random effect setting, especially for the moderators of *IG, ROA, MA_R, and CEO_SN* variables. These results suggest that internal governance quality, firm profitability, and management resources (i.e. management efficiency, CEO social network sizes) significantly weaken the negative (positive) association between CEO neuroticism and Bog index (annual report TCVs). These results thus support the contention that (1) greater internal governance quality provides better monitoring mechanism on CEO decisions and thus mitigates outside investors' information uncertainty perceptions; (2) higher firm profitability alleviates outside investors' concerns about the emotional instability characteristics of neurotic CEOs and thus weakens outside investors' information uncertainty perceptions on firm value; (3) higher management efficiency leads to a higher likelihood of developing more appropriate strategies to deal with uncertainty (e.g. Chemmanur et al., 2009) and bringing greater credibility of earnings quality for outside investors (Demerjian et al., 2012); and (4) higher CEO social network size leads to a higher likelihood of providing risk-sharing mechanism (e.g. Allen and Gale, 1997; Acemoglu and Zilibotti, 1997; Ambrus et al., 2014; Ferris et al., 2017) and reducing information asymmetry level (Ferris et al., 2017; Hong et al., 2017). The above economic consequences further lead outside investors to have less concern about the uncertainty perception of neurotic CEOs, decrease the required information risk premium, and weaken the neurotic CEOs' incentives of improving annual report TCV.

Furthermore, the results of columns (6) to (10) in Table 5 also show that the interaction terms of *Neuro* and *MR* almost have similar results in the fixed effect setting. Therefore, the above results support the arguments of Hypotheses 2, 3, 4a, 4b, and 4c that internal governance quality, firm profitability, and management resources (management efficiency, market share, and CEO social capital) all play the potential mechanisms for the association between CEO neuroticism and annual report TCV.

[Insert Table 8 here]

5.5. The moderator of the association between CEO neuroticism and annual report TCV: Subprime mortgage crisis perspective

This section additionally investigates whether subprime mortgage crisis changes the association between CEO neuroticism and annual report TCV. Since subprime mortgage crisis may bring about greater economic uncertainty, outside investors have greater perceptions of information uncertainty on firm values during the subprime mortgage crisis period. Therefore, during the subprime mortgage crisis period, neurotic CEOs' incentives of improving annual report TCV may become stronger. The model specification is stated as Eq. (10). The proxy of subprime crisis period is a dummy variable (FC) that equals 1 if the firm observation is at the period from 2007 to 2009 and 0 if elsewise.

$$BOG_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 FC_{it} + \beta_3 Neuro_{it} \times FC_{it} + \beta_4 O\_PT_{it} + \sum_{j=5}^{N} \beta_j CV_{j,it} + \varepsilon_{it} \quad (10)$$

Where *O_PT= Extra, Consc, Agree, Openn*

CV=Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, VOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D

The results of columns (1) and (2) in Table 9 show that the coefficient of the interaction

terms of *Neuro* and *FC* are both significant and negative under the fixed effect and random effect model settings. These results suggest that subprime mortgage crisis significantly enhances the negative (positive) association between CEO neuroticism and Bog index (annual report TCV). These results support that neurotic CEOs have greater incentives of improving annual report TCV since outside investors have greater perceptions of information uncertainty on firm values during the subprime mortgage crisis period.

[Insert Table 9 here]

5.6. Robustness checks: Additionally controlling for CEO narcissism

To provide more convincing evidence for the negative (positive) association between CEO neuroticism and Bog index (annual report TCV), we additionally control other personality traits similar to neuroticism, such as CEO narcissism. Following the definitions of Olsen et al. (2014), Ham et al. (2018), and Chen et al. (2022), we introduce CEO narcissism variables (measured by Nar_Def1, Nar_Def2) into Eq. (4), shown as Eq. (11). Nar_Def1 (Nar_Def2) equals 1 if Nar_Comp1 (Nar_Comp2) is larger than its average and 0 if otherwise. Nar_Comp1 (Nar_Comp2) variable is defined as the average of the standardized values of P_CEO and PSIZE_CEO (P_CEO, PSIZE_CEO, and SSIZE_CEO) variables. It has to be noted that: (1) P_CEO is defined as the average of the score of the prominence of the CEO's photograph during the second and third year of the CEO's tenure;[8] (2) PSIZE_CEO is a CEO's photograph size in annual reports, measured by the square area of CEO photo image; (3) SSIZE_CEO is the CEO signature size in annual reports, measured by the square area of CEO signature image. In addition, we also control several CEO characteristics, such as CEO tenure (CEO_TEN), CEO age (CEO_Age), CEO gender (CEO_GEN; 1: female; 0: male), and CEO overconfidence

[8] As defined in Olsen et al. (2014), the prominence of the CEO's photograph in annual reports (P_CEO) is measured as follows: the score of the prominence of the CEO's photograph is 1 when there is no photograph of the CEO in annual reports, 2 when the CEO is photographed with other executives, 3 when the CEO's photograph is presented alone and its illustration covers less than half the page, 4 when the CEO's photograph is presented alone and its illustration covers more than half the page with some space below the photograph, and 5 when the CEO's photograph is presented alone and its illustration covers the whole page.

(OC; 1: overconfidence; 0: non-overconfidence).[9]

$$BOG_{it} = \alpha + \beta_1 Neuro_{it} + \beta_2 Nar_{it} + \beta_3 O\_PT_{it} + \beta_4 CEO\_Char_{it} + \sum_{j=5}^{N} \beta_j CV_{j,it} + \varepsilon_{it} \quad (11)$$

Where *O_PT= Extra, Consc, Agree, Openn; Nar=Nar_Def1, Nar_Def2*

CEO_Char= CEO_TEN, CEO_Age, CEO_GEN, OC

CV= Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, VOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D

The results of columns (1) to (4) in Table 10 show that *Neuro* is still significantly and negatively (positively) related to the Bog index (annual report TCV) under the random effect and fixed effect model settings when additionally controlling for CEO other big five personality traits (*Extra, Consc, Agree, Openn*), narcissism, and overconfidence. These results are consistent with our main findings in Table 3. In particular, the coefficient on *Neuro* is negative while the coefficients on *Nar variables* (*Nar_Def1, Nar_Def2*) are positive, consistent with that there are obvious psychological and behavioral differences between neuroticism and narcissism, especially from the perspectives of emotional instability and negative emotions and behaviors. Accordingly, neurotic CEOs and narcissistic CEOs thus have different incentives of manipulating the text-based communicative value of annual reports. Therefore, our finding that the negative (positive) association between CEO neuroticism and Bog index (annual report TCV) is robust to CEO narcissism issue.

[Insert Table 10 here]

[9] The CEO overconfidence variable is defined as an indicator variable that equals one when a CEO defers the exercise of 100% in-the-money options at least twice during the CEO's tenure period and zero otherwise (Lin et al., 2020; Campbell et al., 2011). The data of the above CEO characteristics are obtained Execucomp database.

6. Concluding Remarks

This study is the first study to investigate the association between CEO neuroticism and annual report TCV (i.e. readability) by employing S&P 1500 component firm data. We follow Harrison et al. (2019) and estimates a CEO's neuroticism and other big five personality traits scores using the dialogue records of the CEO in the firm's quarterly earnings call transcripts and *OLCPT*. The findings of this study include: (1) CEO neuroticism is significantly and positively related to annual report TCV (i.e. readability); (2) less severe management-equity agency problem (measured by CEO equity incentive-based compensation ratio) is a theoretical mechanism for the association between CEO neuroticism and annual report TCV (i.e. readability); (3) internal governance quality, firm profitability, and management resources all weaken the association between CEO neuroticism and annual report TCV (i.e., readability) due to stronger internal monitoring mechanism and less concern about the emotional instability characteristics of neurotic CEOs; (4) subprime mortgage crisis enhances association between CEO neuroticism and annual report TCV (i.e., readability) due to the outside investors' greater perceptions of information uncertainty on firm values during the subprime crisis period; and (5) the negative (positive) association between CEO neuroticism and Bog index (annual report TCV) is still significant when additionally controlling for CEOs' other big five personality traits, narcissism, and overconfidence. In sum, we conclude that CEO neuroticism plays critical roles in determining the firm's annual report TCV (i.e., readability). This work provides new insights for the annual report TCV (i.e., readability) literature by examining the effect of CEO neuroticism, one of a manager's most important idiosyncratic features.

This study contributes to the literature in four ways. This study is the first to demonstrate the importance and implications of CEO neuroticism (one of the big five personality traits that more easily detected by external observers and less likely to be hidden by CEOs) for the text-based communicative value of annual reports (i.e. readability; managers' strategically textual

reporting behaviors in annual reports). Different from previous studies which focus on the effects of corporate decision outcomes on annual report readability (Li, 2008; Lo et al., 2017), we demonstrate the incentives of manipulating annual report TCV (i.e. readability) from the perspective of CEO innate characteristics, which contributes to the literature on annual report TCV (i.e. readability) determinants. Second, we show that the positive association between CEO neuroticism and annual report TCV (i.e. readability) is primarily boosted by the theoretical mechanism of the less severe management-equity agency problem (measure by CEO equity incentive-based compensation). Third, we also discuss several cases in which the association between CEO neuroticism and annual report TCV (i.e. readability) exhibit changes, from the perspectives of internal governance quality, firm profitability, management resources, and subprime mortgage crisis. Fourth, we also provide evidences showing how specific personality traits of CEOs are linked to the tone of annual reports. The above mentioned contributions suggest that this study not only contributes to the annual report TCV (i.e. readability) literature but also the CEO personality trait literature.

References

Abernathy, J.L., Guo, F., Kubick, T.R., Masli, A. (2019). Financial statement footnote readability and corporate audit outcomes. *Auditing: A Journal of Practice & Theory* 38 (2), 1-26.

Acemoglu, D., F. Zilibotti (1997). Was Prometheus unbound by chance? Risk, diversification, and growth. *Journal of Political Economy* 105, 709-751.

Allen, F., D. Gale (1997). Financial Markets, Intermediaries, And Intertemporal Smoothing, *Journal of Political Economy* 105, 523-546.

Ambrus, A., M. Mobius, A. Szeidl (2014) Consumption Risk-Sharing in Social Networks, *American Economic Review* 104, 149-182.

American Psychiatric Association (APA) (2000). Diagnostic and Statistical Manual of Mental Disorders. 4th edition. Washington, DC: APA.

Asay, H. S., Elliott, W.B., Rennekamp, K. (2017). Disclosure readability and the sensitivity of investors' valuation judgments to outside information. *The Accounting Review* 92, 1-25.

Biddle, G.C., Hilary, G., Verdi, R.S. (2009). How does financial reporting quality relate to investment efficiency? *Journal of Accounting and Economics* 48, 112-131.

Bloomfield, R.J. (2002). The "incomplete revelation hypothesis" and financial reporting. *Accounting Horizons* 16, 233-243.

Bonsall IV, S.B., Holzman, E.R., Miller, B.P. (2017a). Managerial ability and credit risk assessment. *Management Science* 63 (5), 1271-1656.

Bonsall IV, S.B., Leone, A., Miller, B., Rennekamp, K. (2017b). A plain English measure of financial reporting readability. *Journal of Accounting and Economics* 63 (2-3), 329-357.

Bonsall IV, S.B., Miller, B.P. (2017). The impact of narrative disclosure readability on bond ratings and the cost of debt capital. *Review of Accounting Studies* 22, 608-643

Brown, S.V, Tucker, J.W. (2011). Large-sample evidence on firms' year-over-year MD&A modifications. *Journal of Accounting Research* 49 (2), 309-346.

Chan, S. W., Goodwin, G. M., Harmer, C. J. (2007). Highly neurotic never-depressed students have negative biases in information processing. *Psychological Medicine*, *37*(9), 1281-1292.

Chakrabarty, B., Seetharaman, A., Swanson, Z., Wang, X. (2018). Management risk incentives and the readability of corporate disclosures. *Financial Management* 47, 583-616.

Chemmanur, T.J., I. Paeglis, K.Simonyan (2009). Management quality, financial and investment policies, and asymmetric information. *Journal of Financial and Quantitative Analysis* 44, 1045–1079.

Chen, T.K., Tseng, Y. (2020). Pension plan characteristics and narrative disclosure readability in annual reports. *Working Paper*, National Yang Ming Chiao Tung Universty.

Chen, T.K., & Tseng, Y. (2021). Readability of notes to consolidated financial statements and corporate bond yield Spread. *European Accounting Review* 30(1), 83-113.

Chen, T.K., Y. Tseng, Y.C. Lin (2022). CEO narcissism, management team characteristics, and corporate credit risk. *Working Paper*, National Yang Ming Chiao Tung University.

Chen, T.K., Liao, H.H., Chen, G.D., Kang, W.H., & Lin, Y.C. (2023). Bankruptcy prediction using machine learning models with the text-based communicative value of annual reports. *Expert Systems with Applications* 233*,* 120714

Cheng, M., Lee, J., Shevlin, T. (2016). Internal governance and real earnings management. *Accounting Review* 91, 1051-1085.

Cohen, L., A. Frazzini, C. Malloy (2008). The small world of investing: board connections and mutual fund returns. *Journal of Political Economy*, 116, 951-979.

Demerjian, P., Lev, B., McVay, S. (2012). Quantifying managerial ability: A new measure and validity tests. *Management Science*, 58(7), 1229-1248.

Demerjian, P., Lev, B., Lewis, M.F., McVay, S. (2013). Managerial Ability and Earnings Quality. *Accounting Review* 88, 463-498.

De Franco, G., Kothari, S.P., Verdi, R.S. (2011). The benefits of financial statement comparability. *Journal of Accounting Research* 49, 895-931.

Engelberg, J., P. Gao, C. Parsons (2012). Friends with money. *Journal of Financial Economics*, 103, 169-188.

Ertugrul, M., Lei, J., Qiu, J., Wan, C. (2017). Annual report readability, tone ambiguity, and the cost of borrowing. *Journal of Financial and Quantitative Analysis* 52, 811-836.

Eysenck, H.J. (1967). *The biological basis of personality*. Thomas: Spring-field, Ill.

Ferris, S. P., D. Javakhadze, T. Rajkovic (2017). CEO social capital, risk-taking and corporate policies. *Journal of Corporate Finance*, 47, 46-71.

Flesch, R., (1948). A new readability yardstick. *Journal of Applied Psychology* 32, 221-233.

Glaeser, E. L., H. D. Kallal, J. A. Scheinkman, A. Shleifer (1992). Growth in Cities. *Journal of Political Economy*, 100, 1126-1152.

Ham, C., N. Seybert, S. Wang (2018) Narcissism is a bad sign: CEO signature size, investment, and performance. *Review of Accounting Studies* 23 (1), 234–264.

Harrison, J. S., Thurgood, G. R., Boivie, S., Pfarrer, M. D. (2019). Measuring CEO personality: Developing, validating, and testing a linguistic tool. *Strategic Management Journal*, *40*(8), 1316-1330.

Harrison, J. S., Thurgood, G. R., Boivie, S., Pfarrer, M. D. (2020). Perception is reality: How ceos' observed personality influences market perceptions of firm risk and shareholder returns. *Academy of Management Journal*, *63*(4), 1166-1195.

Herrmann, P., Nadkarni, S. (2014). Managing strategic change: The duality of CEO personality. *Strategic Management Journal* 35(9), 1318-1342.

Hirsh, J. B., Inzlicht, M. (2008). The devil you know: Neuroticism predicts neural response to uncertainty. *Psychological Science*, *19*(10), 962-967.

Hoberg, G., Phillips, G. (2010). Product market synergies and competition in mergers and acquisitions: A text-based analysis. *Review of Financial Studies* 23, 3773-811.

Hochberg, Y., A. Ljungqvist, Y. Lu (2010). Whom you know matters: venture capital networks and investment performance. *Journal of Finance,* 62, 251-301.

Hong, H.A., Lee, S., Matsunaga, S.R., Oh, P. SH. (2017). CEO Networks and Information Aggregation: Evidence from Management Forecast Accuracy. *Working Paper*.

Jaffe, A. B., M. Trajtenberg, R. Henderson (1993). Geographic localization of knowledge spillovers as evidenced by patent citations. *The Quarterly Journal of Economics* 108: 577-598.

Jensen, M.C. & Meckling, W.H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3 (4), 305-360.

John, O. P., & Robins, R. W. (1993). Determinants of interjudge agreement on personality traits: The Big Five domains, observability, evaluativeness, and the unique perspective of the self. *Journal of Personality, 61*(4), 521–551.

Judge, T. A., Bono, J. E., Ilies, R., Gerhardt, M. W. (2002). Personality and leadership: a qualitative and quantitative review. *Journal of Applied Psychology*, *87*(4), 765-780.

Judge, T.A., Locke, E.A., Durham, C.C., & Kluger, A.N. (1998). Dispositional effects on job and life satisfaction: The role of core self-evaluations. *Journal of Applied Psychology*, 83, 17-34.

Kuhnen, C. (2009). Business networks, corporate governance, and contracting in the mutual fund industry. *Journal of Finance,* 64, 2185-2220.

Lambert, R., Leuz, C., & Verrecchia, R. E. (2007). Accounting information, disclosure, and the cost of capital. *Journal of Accounting Research* 45(2), 385 – 420.

Lang, M., Stice-Lawrence, L. (2015). Textual analysis and international financial reporting:

Large sample evidence. *Journal of Accounting and Economics* 60, 110-135.

Lehavy, R., Li, F., Merkley, K. (2011) The effect of annual report readability on analyst following and the properties of their earnings forecasts. *The Accounting Review* 86, 1087-1115.

Li, F. (2008). Annual report readability, current earnings, and earnings persistence. *Journal of Accounting and Economics* 45, 221–247.

Lin, C.Y., Chen, Y., Ho, P.H., Yen, J.F. (2020). CEO overconfidence and bank loan contracting, *Journal of Corporate Finance* 64, 101637.

Lo, K., Ramos, F., Rogo, F. (2017). Earnings management and annual report readability. *Journal of Accounting and Economics* 63, 1–25.

Loughran, T., McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *Journal of Finance*, 66(1), 35-65.

McCrae, R. R., Costa, P. T. (1982). Self-concept and the stability of personality: Cross-sectional comparisons of self-reports and ratings. *Journal of Personality and Social Psychology* 43(6), 1282–1292.

McCrae, R. R., John, O.P. (1992). An introduction to the five-factor model and its applications. *Journal of Personality* 60(2), 175-215.

Nicholson, N., Soane, E., Fenton-O'Creevy, M., Willman, P. (2005). Personality and domain-specific risk taking. *Journal of Risk Research*, *8*(2), 157-176.

Olsen, K.J., K.K. Dworkis, S.M. Young (2014). CEO narcissism and accounting: A picture of profits. *Journal of Management Accounting Research* 26 (2), 243-267.

Petersen, M., (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies, 22*(1), 435-480.

Peterson, K., Schmardebeck, R., Wilks, T.J. (2015). The earnings quality and information processing effects of accounting consistency. *The Accounting Review* 90 (6), 2483-2514.

Rauch, J., A. Casella (2001). Overcoming informational barriers to international resource allocation: prices and group ties. *Economic Journal* 113, 21-42.

Roberts, B. W., Walton, K. E., Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin* 132(1), 1-25.

Schrand, C.M., Walther, B.R. (2000). Strategic benchmarks in earnings announcement: the selective disclosure of prior-period earnings components. *The Accounting Review* 75, 151-177.

Seebeck, A. & Kaya, D. (2022). The power of words: An empirical analysis of the communicative value of extended auditor reports. *European Accounting Review*, forthcoming.

Subramanian, R., Insley, R.G., Blackwell, R.D. (1993). Performance and readability: A comparison of annual reports of profitable and unprofitable corporations. *International Journal of Business Communication* 30, 49-61.

Table 1. Sample Distribution

The sample period is yearly between 2006 and 2019. There are totally 11,785 yearly firm observations with available data of CEO personality traits and annual reporting readability (measured by Bog index, denoted as BOG). The higher value of Bog index indicates more poor readability. Table 1 reports the numbers of pooled observations for firms in the given years and Bog index. The relationship between text readability and the Bog index is as follows: excellent ($20 \geq BOG \geq 0$), good ($40 \geq BOG \geq 21$), average ($70 \geq BOG \geq 41$), poor ($100 \geq BOG \geq 71$), bad ($130 \geq BOG \geq 101$) and dreadful ($1000 \geq BOG \geq 131$). The yearly subsamples are sorted by Bog index of annual report estimated by Bonsall et al. (2017).

Year/Group	Average (41-70)	Poor (71-100)	Bad (101-130)	Dreadful (>130)	Total	Avg_BOG
2006	1	272	0	0	273	84.05
2007	6	734	13	0	753	84.93
2008	5	792	10	0	807	85.64
2009	6	818	7	0	831	85.61
2010	5	833	7	0	845	85.56
2011	5	841	8	0	854	85.66
2012	3	825	12	0	840	85.75
2013	3	858	24	0	885	86.40
2014	3	888	24	0	915	86.86
2015	2	933	25	0	960	87.61
2016	1	955	24	0	980	87.53
2017	1	953	34	0	988	88.27
2018	5	854	110	1	970	92.49
2019	2	744	131	7	884	94.84
Total	48	11,300	429	8	11,785	87.50

Table 2. Summary Statistics of Major Variables

This table presents the mean, median standard deviation (S.D.), minimum, and maximum of major variables used in empirical analyses. In panel A, BOG and FK_ease represent the measures of a firm's annual report TCV (i.e. readability, measured by Bog index and Flesch reading ease readability variables). Bonsall et al. (2017) define the Bog index (BOG) as the sum of *Sentence Bog* and *Word Bog* minus *Pep*. *Sentence Bog* is defined as the standardized average sentence length, which identifies readability issues stemming from sentence length; *Word Bog* is defined as the sum of plain English style problems and word difficulty multiplied by 250 and divided by the number of words; *Pep* suggests the writing attributes that facilitate understanding of texts by readers, defined as the sum of the usage of items such as names and interesting words. A higher values of BOG (FRES) variable represent a lower (higher) readability of annual report. POS, NEG, UNC, LIT, M_STR, M_Weak are tone variables of positive, negative, uncertainty, litigious, strong modal, and weak modal words, respectively. These tone variables are measured by the ratio of word counts of each tone to total word counts. Panel B shows summary statistics of CEO personality traits variables, including agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), neuroticism (Neuro), and openness (Openn). Panel C shows control variables of annual report readability (Li, 2008; Lo et al, 2017), including restatement dummy variable (Restate), operating earnings per unit asset (Earnings), negative Earnings dummy variable (Loss), firm size (SIZE), market to book value ratio (MB), firm age (Fage), special item per asset value (SPI), operating earnings volatility (Earn_Vol), equity volatility (VOL), the number of non-missing items on Compustat (DISC), Delaware state dummy variable (DLW_D), change in Net Income due to the restatement scaled by Total Assets (NI_chg_Restate), merger and acquisition dummy variable (MA_D), and seasoned equity offering dummy variable (SEO_D). Panel D shows moderating variables, covering internal governance quality (IG, Cheng et al., 2016), firm profitability (ROA), managerial ability rank variable (MA_R, Demerjian et al., 2012), market share (MS), and CEO social network size (CEO_SN).

Variable	Obs	Mean	Std. dev.	Min	Max
Panel A. Readability & Tone Variables					
BOG	11,785	87.5039	7.3308	54.0000	163.0000
FRES	10,594	23.7271	3.3903	-8.8624	38.4834
POS	10,594	0.0084	0.0016	0.0014	0.0180
NEG	10,594	0.0180	0.0040	0.0038	0.0480
UNC	10,594	0.0158	0.0028	0.0015	0.0310
LIT	10,594	0.0112	0.0049	0.0025	0.0521
M_STR	10,594	0.0025	0.0007	0.0004	0.0087
M_Weak	10,594	0.0067	0.0020	0.0007	0.0197
Panel B. CEO Personality Traits Variables					
Neuro	11,785	3.2708	0.6758	1.5700	6.5915
Agree	11,785	4.1052	0.8681	1.0000	7.0000
Consc	11,785	5.0621	0.5467	3.0599	7.0000
Extra	11,785	4.6931	0.8625	1.0000	7.0000
Openn	11,785	4.6804	0.6182	2.2738	6.6796
Panel C. Control Variables					
Restate	11,785	0.0031	0.0559	0.0000	1.0000
Earnings	11,785	0.0927	0.1200	-3.1439	0.9093
Loss	11,785	0.0798	0.2709	0.0000	1.0000
SIZE	11,785	7.9118	1.7101	-0.2741	13.8863
MB	11,785	2.0678	1.3882	0.2279	19.5490
Fage	11,785	30.3335	18.5910	3.6712	69.5507
SPI	11,785	-0.0144	0.0665	-1.6995	2.5298
Earn_Vol	11,785	273.2951	941.2274	0.5103	19760.8000
EVOL	11,785	0.3543	0.2547	0.0000	13.4539
DISC	11,785	260.5381	14.7113	195.0000	310.0000
DLW_D	11,785	0.0036	0.0596	0.0000	1.0000
NI_chg_Restate	11,785	0.0018	0.3873	-4.8605	40.2499
MA_D	11,785	0.3485	0.4765	0.0000	1.0000
SEO_D	11,785	0.0552	0.2285	0.0000	1.0000
Panel D. Moderating Variables					
IG	11,626	0.0244	1.4553	-4.2082	10.8485
MA_R	9,877	0.5700	0.2933	0.1000	1.0000
MS	11,785	0.0255	0.0637	0.0000	0.8218
ROA	11,785	0.0448	0.1265	-3.1504	1.8429
CEO_SN	11,540	1869.7070	1060.7580	58.4000	8758.9000

Table 3. CEO Neuroticism and Annual Report Text-based Communicative Value

This table shows the results regarding the association between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, measured by bog index, BOG). The other big five personality traits variables are agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models for the association between CEO neuroticism (Neuro) and annual report readability. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect			Fixed Effect		
	(1)	(2)	(3)	(1)	(2)	(3)
	BOG	BOG	BOG	BOG	BOG	BOG
Neuro	**-1.2779*** **	**-1.1994*** **	**-0.9462*** **	**-0.6157** **	**-0.6131** **	**-0.5877** **
	(-5.34)	**(-4.70)**	**(-3.62)**	**(-2.32)**	**(-2.30)**	**(-2.18)**
Consc		-0.9722***	-1.5299***		-0.7250*	-0.8076**
		(-2.97)	(-4.59)		(-1.87)	(-2.04)
Extra		0.5095***	0.2721		0.1120	0.0898
		(2.71)	(1.39)		(0.56)	(0.44)
Agree			1.0303***			0.1433
			(4.85)			(0.63)
Openn			0.3949			0.1138
			(1.14)			(0.30)
Restate	-0.6026	-0.6555	-0.6341	-0.7454	-0.7456	-0.7467
	(-1.25)	(-1.35)	(-1.27)	(-1.48)	(-1.48)	(-1.47)
Earnings	-2.5458***	-2.6165***	-2.5532***	-0.2171	-0.2550	-0.2528
	(-2.96)	(-3.03)	(-2.98)	(-0.35)	(-0.40)	(-0.40)
Loss	0.0837	0.0863	0.0810	-0.0300	-0.0262	-0.0260
	(0.41)	(0.41)	(0.39)	(-0.17)	(-0.15)	(-0.15)
SIZE	0.4712***	0.4807***	0.4639***	0.0709	0.0787	0.0761
	(4.03)	(4.13)	(4.00)	(0.54)	(0.61)	(0.59)
MB	-0.2759***	-0.2797***	-0.2984***	-0.3333***	-0.3340***	-0.3343***
	(-3.75)	(-3.79)	(-4.05)	(-4.73)	(-4.74)	(-4.74)
Fage	0.1642***	0.1616***	0.1595***	0.6059***	0.6047***	0.6037***
	(14.61)	(14.39)	(14.28)	(28.80)	(28.69)	(28.49)
SPI	-2.8297***	-2.8139***	-2.7984***	-1.5786***	-1.5741***	-1.5736***
	(-4.58)	(-4.61)	(-4.59)	(-3.20)	(-3.21)	(-3.21)
Earn_Vol	-0.0001	-0.0001	-0.0001	-0.0000	-0.0000	-0.0000
	(-0.83)	(-0.83)	(-0.77)	(-0.15)	(-0.14)	(-0.13)
EVOL	1.2475***	1.2375***	1.2450***	1.3574***	1.3559***	1.3570***
	(3.19)	(3.19)	(3.18)	(3.34)	(3.34)	(3.34)
DISC	-0.0901***	-0.0901***	-0.0901***	0.0060	0.0061	0.0062
	(-16.63)	(-16.67)	(-16.77)	(1.05)	(1.06)	(1.08)
DLW_D	4.5942**	4.1971**	4.7591**	0.0000	0.0000	0.0000
	(2.42)	(2.13)	(2.55)	(0.00)	(0.00)	(0.00)
NI_chg_Restate	-0.0397	-0.0328	-0.0373	-0.0537*	-0.0508	-0.0513*
	(-1.11)	(-0.87)	(-1.04)	(-1.78)	(-1.62)	(-1.65)
MA_D	1.3821***	1.3755***	1.3469***	0.0733	0.0730	0.0714
	(11.89)	(11.84)	(11.48)	(0.64)	(0.64)	(0.62)
SEO_D	0.0166	0.0209	0.0178	0.4002**	0.3963**	0.3934**
	(0.09)	(0.11)	(0.10)	(2.27)	(2.24)	(2.23)
Constant	106.9200***	109.2115***	106.4661***	69.1822***	72.2736***	71.6246***
	(56.23)	(40.75)	(37.50)	(30.09)	(24.12)	(21.94)
Observations	11785	11785	11785	11785	11785	11785
chi^2	967.4461	980.6211	1037.1328			
rho	0.6980	0.6943	0.6849			
Adjusted R^2				0.2807	0.2813	0.2813

Table 4. CEO Neuroticism and Annual Report Text-based Communicative Value (Case of FRES)

This table shows the results regarding the association between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, measured by Flesch reading ease variable, FRES). The other big five personality traits variables are agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models for the association between CEO neuroticism (Neuro) and annual report readability. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect			Fixed Effect		
	(1) FRES	(2) FRES	(3) FRES	(1) FRES	(2) FRES	(3) FRES
Neuro	**0.4599*** **	**0.4119*** **	**0.2999** **	**0.5818*** **	**0.5244*** **	**0.4266** **
	(4.08)	**(3.23)**	**(2.24)**	**(3.84)**	**(3.20)**	**(2.54)**
Consc		0.1905	0.4002**		0.4605**	0.6393***
		(1.30)	(2.47)		(2.24)	(2.89)
Extra		-0.1825*	-0.0809		-0.3299***	-0.2150*
		(-1.90)	(-0.81)		(-2.79)	(-1.74)
Agree			-0.3493***			-0.4061***
			(-3.29)			(-3.06)
Openn			-0.1851			0.0320
			(-1.08)			(0.15)
Restate	-0.6790	-0.6514	-0.6460	-0.7182	-0.6535	-0.6975
	(-1.51)	(-1.46)	(-1.43)	(-1.19)	(-1.08)	(-1.15)
Earnings	0.9198***	0.9450***	0.8999***	1.8686***	1.8227***	1.7022***
	(2.92)	(2.96)	(2.87)	(3.51)	(3.44)	(3.36)
Loss	-0.1404	-0.1391	-0.1355	-0.2701	-0.2568	-0.1746
	(-1.29)	(-1.27)	(-1.25)	(-1.41)	(-1.33)	(-0.94)
SIZE	-0.3156***	-0.3175***	-0.3117***	-0.4323***	-0.4209***	-0.4164***
	(-6.79)	(-6.86)	(-6.74)	(-7.12)	(-6.95)	(-6.92)
MB	-0.0120	-0.0098	0.0003	0.0529	0.0561	0.0866*
	(-0.32)	(-0.26)	(0.01)	(0.99)	(1.05)	(1.65)
Fage	-0.0124***	-0.0119**	-0.0133***	0.0147***	0.0139***	0.0127***
	(-2.64)	(-2.55)	(-2.87)	(3.18)	(3.00)	(2.75)
SPI	0.4977**	0.4888**	0.4811**	0.7530**	0.6874*	0.6771*
	(2.03)	(2.00)	(1.97)	(2.13)	(1.95)	(1.93)
Earn_Vol	0.0001	0.0001	0.0001	0.0002***	0.0002***	0.0002***
	(1.37)	(1.34)	(1.35)	(3.56)	(3.60)	(3.66)
EVOL	-0.0846	-0.0813	-0.0871	-1.0715***	-1.0072***	-0.9830***
	(-0.48)	(-0.46)	(-0.49)	(-4.51)	(-4.21)	(-4.08)
DISC	-0.0066**	-0.0065**	-0.0067**	-0.0022	-0.0013	-0.0009
	(-2.25)	(-2.21)	(-2.28)	(-0.32)	(-0.20)	(-0.13)
DLW_D	-1.8448**	-1.7554**	-1.9226**	-1.6048	-1.4072	-1.5874
	(-2.40)	(-2.25)	(-2.52)	(-1.56)	(-1.37)	(-1.58)
NI_chg_Restate	0.0103	0.0089	0.0106	0.0852***	0.0778***	0.0819***
	(0.94)	(0.81)	(0.98)	(4.25)	(3.92)	(4.16)
MA_D	-0.4533***	-0.4516***	-0.4358***	-0.3961***	-0.3846***	-0.3611***
	(-7.01)	(-6.94)	(-6.71)	(-3.45)	(-3.37)	(-3.18)
SEO_D	0.2434**	0.2396**	0.2410**	0.1967	0.1749	0.1714
	(2.48)	(2.43)	(2.44)	(1.41)	(1.26)	(1.24)
Constant	26.8110***	26.8242***	27.9756***	23.3175***	22.4316***	22.6853***
	(27.79)	(19.27)	(19.12)	(9.88)	(8.26)	(8.21)
Observations	10594	10594	10594	10594	10594	10594
chi^2	208.8525	212.7151	238.7153			
rho	0.5945	0.5863	0.5834			
Adjusted R^2				0.2226	0.2273	0.2314

Table 5. CEO Neuroticism and Annual Report Tone Variables

This table shows the results regarding the association between CEO neuroticism (Neuro) and annual report tone variables, including POS, NEG, UNC, LIT, M_STR, M_Weak variables. POS, NEG, UNC, LIT, M_STR, M_weak are tone variables of positive, negative, uncertainty, litigious, strong modal, and weak modal words, respectively. The other big five personality traits variables are agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect						Fixed Effect					
	(1) POS	(2) NEG	(3) UNC	(4) LIT	(5) M_STR	(6) M_Weak	(1) POS	(2) NEG	(3) UNC	(4) LIT	(5) M_STR	(6) M_Weak
Neuro	**-0.0003*** **	**-0.0006*** **	0.0001	-0.0000	0.0000	-0.0000	**-0.0001** **	**-0.0004** **	0.0002	-0.0001	-0.0000	0.0001
	(-4.84)	**(-3.22)**	(1.05)	(-0.19)	(0.47)	(-0.35)	**(-2.12)**	**(-2.12)**	(1.64)	(-0.46)	(-0.58)	(1.03)
Consc	-0.0001*	-0.0003	-0.0003**	0.0005*	0.0000	-0.0001	-0.0002	0.0001	-0.0003*	0.0005	0.0000	-0.0000
	(-1.77)	(-0.98)	(-2.54)	(1.78)	(0.87)	(-1.34)	(-1.61)	(0.25)	(-1.92)	(1.26)	(0.24)	(-0.04)
Extra	0.0001***	0.0003*	0.0000	0.0000	-0.0000	0.0001	0.0001	0.0001	-0.0000	0.0000	-0.0000	0.0000
	(3.07)	(1.81)	(0.48)	(0.06)	(-0.04)	(1.13)	(1.19)	(0.40)	(-0.07)	(0.25)	(-0.17)	(0.21)
Agree	0.0002***	0.0004***	0.0002***	-0.0002	0.0000	0.0002***	0.0002***	0.0001	0.0001	-0.0002	-0.0000	0.0000
	(3.86)	(2.71)	(3.01)	(-1.18)	(1.62)	(4.00)	(2.89)	(0.52)	(0.60)	(-1.07)	(-0.10)	(0.60)
Openn	-0.0001	0.0002	0.0002	-0.0000	0.0001*	0.0002***	-0.0000	-0.0000	0.0001	-0.0000	0.0000	0.0000
	(-0.74)	(1.07)	(1.22)	(-0.10)	(1.88)	(2.75)	(-0.44)	(-0.11)	(0.70)	(-0.08)	(0.62)	(0.47)
Restate	0.0001	0.0015**	-0.0007*	0.0008	-0.0001	0.0000	0.0001	0.0016**	-0.0007*	0.0007	-0.0001	0.0000
	(0.38)	(1.97)	(-1.85)	(0.95)	(-0.74)	(0.03)	(0.45)	(2.07)	(-1.88)	(0.86)	(-0.79)	(0.12)
Earnings	0.0000	-0.0016***	0.0004*	-0.0014**	-0.0002***	-0.0002	0.0000	-0.0008	0.0005**	-0.0006	-0.0002***	0.0002
	(0.22)	(-2.99)	(1.73)	(-2.14)	(-3.11)	(-1.22)	(0.05)	(-1.56)	(2.27)	(-0.86)	(-3.07)	(1.61)
Loss	-0.0001*	0.0012***	-0.0001	0.0002	0.0000	0.0000	-0.0001*	0.0011***	-0.0001	0.0002	0.0000	-0.0000
	(-1.77)	(7.13)	(-1.18)	(1.28)	(0.09)	(0.18)	(-1.90)	(6.50)	(-1.26)	(1.17)	(0.09)	(-0.21)
SIZE	-0.0000	-0.0001	-0.0000	0.0004***	-0.0001***	-0.0000	-0.0000	-0.0004***	0.0000	0.0001	-0.0001***	-0.0000
	(-1.29)	(-0.96)	(-0.42)	(5.70)	(-4.91)	(-0.22)	(-1.42)	(-3.97)	(0.46)	(1.13)	(-3.71)	(-0.94)
MB	0.0000*	-0.0001***	-0.0001**	-0.0000	0.0000**	0.0000	0.0000	-0.0002***	-0.0001***	0.0000	0.0000***	-0.0000
	(1.84)	(-2.80)	(-2.02)	(-0.30)	(2.50)	(1.62)	(1.35)	(-2.94)	(-3.65)	(0.45)	(2.70)	(-0.49)
Fage	0.0000	0.0000***	-0.0000***	0.0001***	-0.0000***	-0.0000	-0.0000**	0.0002***	-0.0000*	0.0002***	-0.0000***	0.0001***
	(1.07)	(6.92)	(-10.39)	(7.65)	(-10.30)	(-0.04)	(-1.98)	(15.34)	(-1.88)	(10.32)	(-11.71)	(12.73)
SPI	0.0005***	-0.0025***	-0.0000	-0.0010**	0.0001	-0.0000	0.0005***	-0.0019***	-0.0000	-0.0005	0.0000	0.0001
	(3.54)	(-4.38)	(-0.19)	(-2.24)	(0.67)	(-0.20)	(3.45)	(-4.05)	(-0.21)	(-1.23)	(0.22)	(0.93)

Earn_Vol	0.0000	0.0000	0.0000	-0.0000	-0.0000*	0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000***	0.0000
	(0.18)	(0.22)	(0.25)	(-1.02)	(-1.83)	(0.38)	(0.78)	(0.02)	(1.32)	(-1.08)	(-2.78)	(1.08)
EVOL	-0.0000	0.0012***	-0.0002*	0.0003	0.0001**	-0.0002***	-0.0000	0.0012***	-0.0001	0.0004	0.0000	-0.0001*
	(-0.15)	(6.59)	(-1.68)	(1.08)	(2.07)	(-3.59)	(-0.72)	(6.29)	(-1.18)	(1.19)	(0.63)	(-1.87)
DISC	-0.0000**	0.0000	-0.0000	0.0000	0.0000***	-0.0000***	-0.0000***	0.0000***	0.0000	0.0000***	0.0000	0.0000***
	(-2.34)	(1.57)	(-0.50)	(0.34)	(6.99)	(-8.58)	(-5.73)	(9.67)	(0.50)	(6.58)	(1.04)	(2.72)
DLW_D	0.0002	0.0025*	-0.0005	0.0032	0.0000	-0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.39)	(1.73)	(-0.65)	(1.53)	(0.31)	(-0.58)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
NI_chg_Restate	-0.0000*	0.0000	-0.0000***	0.0001***	-0.0000***	-0.0000	-0.0000	0.0000	-0.0000***	0.0001***	-0.0000**	-0.0000*
	(-1.72)	(0.28)	(-4.98)	(5.43)	(-2.64)	(-1.63)	(-1.29)	(0.09)	(-4.52)	(5.84)	(-2.22)	(-1.79)
MA_D	-0.0001***	-0.0000	0.0003***	0.0001	-0.0000***	0.0002***	-0.0000*	-0.0005***	0.0002***	-0.0003**	0.0000*	-0.0000
	(-3.41)	(-0.33)	(5.78)	(1.25)	(-2.84)	(6.18)	(-1.65)	(-7.53)	(4.22)	(-2.45)	(1.86)	(-1.39)
SEO_D	0.0000	-0.0005***	-0.0001	-0.0001	0.0000	-0.0001*	0.0000	-0.0003***	-0.0001	0.0000	0.0000	-0.0000
	(0.34)	(-4.71)	(-0.80)	(-0.61)	(1.31)	(-1.94)	(0.31)	(-3.08)	(-0.75)	(0.22)	(0.01)	(-0.79)
Constant	0.0097***	0.0150***	0.0167***	0.0049**	0.0014***	0.0083***	0.0118***	0.0035	0.0161***	-0.0063*	0.0036***	0.0029***
	(14.65)	(6.50)	(15.20)	(2.06)	(4.49)	(11.36)	(13.57)	(1.11)	(11.68)	(-1.86)	(8.27)	(3.41)
Observations	10594	10594	10594	10594	10594	10594	10594	10594	10594	10594	10594	10594
chi^2	141.8004	403.9730	230.7842	208.5086	350.5790	217.4889						
rho	0.6792	0.6738	0.6342	0.4934	0.5177	0.7741						
Adjusted R^2							0.0154	0.1300	0.0096	0.0278	0.0747	0.0852

Table 6. Mechanism of Less Severe Management-Equity Agency Problem for the Association between CEO Neuroticism and Annual Report Text-based Communicative Value

This table shows the results regarding the mechanism of less severe management-equity problem (proxied by CEO equity incentive-based compensation ratio) for the relation between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, measured by bog index, BOG). The other big five personality traits variables are agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. The CEO equity incentive-based compensation structure is proxied by the equity incentive-based compensation ratio (measured by the percentage of the sum of CEO's bonus-, stock-, and option-based compensations to total compensations, EI_COMP). Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect			Fixed Effect		
	(1) BOG	(2) BOG	(3) BOG	(4) BOG	(5) BOG	(6) BOG
Neuro	**-1.2826*** **	**-1.2052*** **	**-0.9506*** **	**-0.6120** **	**-0.6097** **	**-0.5852** **
	(-5.34)	**(-4.71)**	**(-3.63)**	**(-2.29)**	**(-2.28)**	**(-2.17)**
EI_COMP	0.0043***	0.0043***	0.0040***	0.0041***	0.0040***	0.0040***
	(3.15)	(3.31)	(3.20)	(3.89)	(3.69)	(3.68)
Neuro*EI_COMP	**-0.0016*** **	**-0.0016*** **	**-0.0015*** **	**-0.0015*** **	**-0.0015*** **	**-0.0015*** **
	(-3.15)	**(-3.32)**	**(-3.20)**	**(-3.89)**	**(-3.70)**	**(-3.69)**
Consc		-0.9882***	-1.5455***		-0.7314*	-0.8130**
		(-3.02)	(-4.63)		(-1.89)	(-2.05)
Extra		0.5129***	0.2775		0.1133	0.0919
		(2.72)	(1.42)		(0.57)	(0.45)
Agree			1.0353***			0.1457
			(4.85)			(0.64)
Openn			0.3854			0.1055
			(1.11)			(0.28)
Restate	-0.6016	-0.6546	-0.6330	-0.7457	-0.7460	-0.7470
	(-1.25)	(-1.35)	(-1.27)	(-1.48)	(-1.48)	(-1.47)
Earnings	-2.5748***	-2.6502***	-2.5881***	-0.2138	-0.2544	-0.2525
	(-2.97)	(-3.04)	(-3.00)	(-0.34)	(-0.40)	(-0.40)
Loss	0.0767	0.0782	0.0689	-0.0436	-0.0400	-0.0402
	(0.37)	(0.37)	(0.33)	(-0.24)	(-0.22)	(-0.22)
SIZE	0.4744***	0.4839***	0.4669***	0.0678	0.0757	0.0732
	(4.05)	(4.16)	(4.03)	(0.52)	(0.58)	(0.56)
MB	-0.2679***	-0.2709***	-0.2896***	-0.3322***	-0.3325***	-0.3326***
	(-3.61)	(-3.66)	(-3.91)	(-4.69)	(-4.70)	(-4.69)
Fage	0.1621***	0.1595***	0.1573***	0.6072***	0.6059***	0.6049***
	(14.43)	(14.21)	(14.10)	(28.61)	(28.49)	(28.30)
SPI	-2.7971***	-2.7735***	-2.7518***	-1.6120***	-1.6046***	-1.6027***
	(-4.53)	(-4.56)	(-4.54)	(-3.24)	(-3.25)	(-3.25)
Earn_Vol	-0.0001	-0.0001	-0.0001	-0.0000	-0.0000	-0.0000
	(-0.86)	(-0.86)	(-0.80)	(-0.19)	(-0.18)	(-0.16)
EVOL	1.2415***	1.2298***	1.2350***	1.3577***	1.3555***	1.3563***
	(3.18)	(3.18)	(3.17)	(3.33)	(3.33)	(3.33)
DISC	-0.0902***	-0.0902***	-0.0902***	0.0066	0.0067	0.0067
	(-16.62)	(-16.66)	(-16.76)	(1.15)	(1.16)	(1.17)
DLW_D	4.6232**	4.2205**	4.7847***	0.0000	0.0000	0.0000
	(2.46)	(2.17)	(2.59)	(0.00)	(0.00)	(0.00)
NI_chg_Restate	-0.0397	-0.0327	-0.0372	-0.0539*	-0.0509	-0.0514*
	(-1.11)	(-0.87)	(-1.04)	(-1.78)	(-1.63)	(-1.65)
MA_D	1.3804***	1.3736***	1.3453***	0.0691	0.0689	0.0672
	(11.87)	(11.82)	(11.46)	(0.60)	(0.60)	(0.58)
SEO_D	0.0288	0.0340	0.0315	0.4058**	0.4021**	0.3995**
	(0.16)	(0.18)	(0.17)	(2.29)	(2.27)	(2.25)
Constant	106.9810***	109.3420***	106.6232***	68.9886***	72.1106***	71.4876***
	(56.16)	(40.75)	(37.53)	(29.92)	(24.02)	(21.86)
Observations	11748	11748	11748	11748	11748	11748
chi^2	.	.	.			
rho	0.6966	0.6929	0.6832			
Adjusted R^2				0.2795	0.2801	0.2800

Table 7. Endogeneity Discussions on the Relation between CEO Neuroticism and Annual Report Text-based Communicative Value: Difference-in-Difference Design

This table shows the results of difference-indifference model design for the relation between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, BOG). This study employs CEO turnover as an event to form a quasi-natural experiment and then discusses the impacts of CEO neuroticism (Neuro) on annual report TCV (i.e. readability). This study defines the treatment group as the firms with CEO turnover that change from a low level of CEO neuroticism to a high level. The control group is defined as the firms with CEO turnover event that change from a low level of CEO neuroticism to another low level. The other big five personality traits cover agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). Besides, this research defines a dummy variable, *New_Neuro_D*, that equals 1 if the joining of the new CEO moves from a low level of CEO neuroticism trait to a high level and other four personality traits remain unchanged levels and 0 otherwise. *Post* is a dummy variable that equals 1 if the year of observation is after the occurrence of CEO turnover and 0 otherwise. We employ *New_Neuro_D×Post* to capture the treatment effect of a firm from a low level of CEO neuroticism to a high level on annual report TCV (i.e. readability). Control variables include Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect		Fixed Effect	
	(1) BOG	(2) BOG	(3) BOG	(4) BOG
New_Neuro_D	2.8488	3.7233		
	(1.08)	(1.39)		
Post	1.4914***	1.2757***		
	(6.48)	(5.52)		
New_Neuro_D*Post	**-1.9946*** **	**-2.3535*** **	**-2.4783*** **	**-2.6861*** **
	(-3.22)	**(-3.00)**	**(-3.70)**	**(-4.39)**
Agree		0.8839***		-0.0760
		(3.11)		(-0.22)
Consc		-1.7190***		-0.7792
		(-3.83)		(-1.30)
Extra		0.8117***		0.3347
		(2.78)		(1.03)
Openn		0.7315		0.3857
		(1.60)		(0.77)
Restate	-1.3047*	-1.4139*	-1.5612**	-1.6094**
	(-1.85)	(-1.94)	(-2.37)	(-2.44)
Earnings	-8.6568***	-8.4117***	-1.7887	-1.8533
	(-5.45)	(-5.31)	(-1.43)	(-1.48)
Loss	-0.2438	-0.3376	-0.4105	-0.4329
	(-0.61)	(-0.85)	(-1.39)	(-1.48)
SIZE	1.0500***	1.0019***	0.0992	0.1003
	(6.79)	(6.61)	(0.55)	(0.55)
MB	-0.1492*	-0.1795**	-0.2882***	-0.2892***
	(-1.71)	(-2.05)	(-3.60)	(-3.61)
Fage	0.0988***	0.1061***	1.0786***	1.0755***
	(6.64)	(7.16)	(26.31)	(26.10)
SPI	-4.5989***	-4.4103***	-1.3503	-1.3421
	(-3.86)	(-3.83)	(-1.37)	(-1.37)
Earn_Vol	-0.0005***	-0.0006***	-0.0003*	-0.0003*
	(-2.88)	(-3.37)	(-1.82)	(-1.84)
EVOL	4.7343***	4.5864***	2.4880***	2.4787***
	(6.58)	(6.42)	(4.02)	(4.02)
DISC	-0.0956***	-0.0971***	0.0513***	0.0515***
	(-14.19)	(-14.49)	(6.67)	(6.71)
DLW_D	5.7447**	5.9526**	0.0000	0.0000
	(2.13)	(2.36)	(0.00)	(0.00)
NI_chg_Restate	0.5628	0.5562	0.2920	0.3116
	(1.21)	(1.36)	(1.38)	(1.56)
MA_D	1.2016***	1.1756***	0.0881	0.0959
	(6.75)	(6.62)	(0.52)	(0.57)
SEO_D	-0.2677	-0.2650	0.3272	0.3097
	(-0.75)	(-0.75)	(0.96)	(0.92)
Constant	100.6182***	98.7803***	41.5277***	42.4055***
	(43.80)	(30.97)	(13.11)	(9.47)
Observations	5435	5435	5435	5435
chi^2	794.3680	865.8128		
rho	0.7271	0.7112		
Adjusted R^2			0.3510	0.3514

Table 8. CEO Neuroticism and Annual Report Text-based Communicative Value: The Moderating Roles of Internal Governance, Profitability, and Management Resources

This table shows the results of the moderating effects of corporate internal governance, profitability, and management resources for the relation between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, BOG). The internal governance variable (IG; Cheng et al., 2016) is defined as the sum of standardized values of Exec_Horizon and Exec_PayRatio. Exec_Horizon stands for the number of years until the age of retirement and Exec_PayRatio presents the key subordinate executives' ability to monitor the CEO. The firm profitability is measured by return on assets (ROA), defined as the ratio of net income to total assets. Management resources include managerial ability rank (MA_R; Demerjian et al., 2012), market share (MS), and CEO social network size (CEO_SN; Ferris et al., 2017). The CEO's social network size is the summation of the CEO's employment ties, educational ties, social activity ties, other activity ties. The other big five personality traits cover agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect					Fixed Effect				
	(1) BOG	(2) BOG	(3) BOG	(4) BOG	(5) BOG	(6) BOG	(7) BOG	(8) BOG	(9) BOG	(10) BOG
Neuro	-0.8889***	-1.0500***	-0.9265***	-0.9675***	-1.6788***	-0.5324*	-0.7370***	-0.5455*	-0.5974**	-0.9735**
	(-3.30)	(-3.81)	(-2.84)	(-3.71)	(-4.10)	(-1.93)	(-2.62)	(-1.65)	(-2.22)	(-2.26)
IG	-0.5000*					-0.3720				
	(-1.66)					(-1.37)				
Neuro*IG	**0.2038****					**0.1572***				
	(2.15)					**(1.86)**				
MS		-18.7650*					-8.1296			
		(-1.80)					(-0.79)			
Neuro*MS		**4.6870**					**5.4365***			
		(1.48)					**(1.94)**			
MA_R			-1.9802**					-1.0017		
			(-2.00)					(-1.08)		
Neuro*MA_R			**0.5733***					**0.3180**		
			(1.93)					**(1.15)**		
ROA				-0.4124					-0.4016	
				(-0.29)					(-0.31)	
Neuro*ROA				**1.6692*****					**1.1011*****	
				(5.34)					**(3.57)**	
CEO_SN					-0.0012**					-0.0008
					(-2.09)					(-1.36)
Neuro*CEO_SN					**0.0005*****					**0.0003***
					(3.02)					**(1.70)**
Agree	1.0848***	1.0272***	0.8967***	0.9962***	0.9432***	0.1878	0.1270	0.0694	0.1285	0.0561
	(5.14)	(4.84)	(4.32)	(4.69)	(4.46)	(0.84)	(0.56)	(0.31)	(0.56)	(0.25)
Consc	-1.5504***	-1.5186***	-1.3977***	-1.5288***	-1.3415***	-0.7859**	-0.7844**	-0.6261	-0.8243**	-0.6464*

	(-4.66)	(-4.56)	(-4.15)	(-4.59)	(-4.05)	(-1.98)	(-1.98)	(-1.55)	(-2.06)	(-1.65)
Extra	0.2201	0.2744	0.1685	0.2716	0.2433	0.0112	0.0983	-0.1026	0.0921	0.0813
	(1.12)	(1.40)	(0.86)	(1.39)	(1.25)	(0.05)	(0.49)	(-0.49)	(0.45)	(0.40)
Openn	0.4113	0.3846	0.4034	0.4127	0.4084	0.1726	0.0665	0.0616	0.1323	0.1397
	(1.18)	(1.11)	(1.22)	(1.19)	(1.18)	(0.46)	(0.18)	(0.17)	(0.35)	(0.37)
Restate	-0.8833*	-0.6345	-0.2889	-0.6523	-0.6677	-1.1669**	-0.7643	-0.3437	-0.7615	-0.8762*
	(-1.75)	(-1.27)	(-0.72)	(-1.29)	(-1.27)	(-2.45)	(-1.50)	(-0.88)	(-1.50)	(-1.66)
Earnings	-2.6498***	-2.6046***	-1.2890*	-8.3165***	-3.1263***	-0.2672	-0.2263	0.2374	-3.9848***	-0.5120
	(-3.09)	(-3.04)	(-1.91)	(-7.63)	(-3.17)	(-0.42)	(-0.36)	(0.45)	(-4.19)	(-0.69)
Loss	0.0966	0.0874	0.1477	-0.0862	-0.0004	-0.0279	-0.0203	0.0411	-0.1388	-0.0278
	(0.46)	(0.42)	(0.77)	(-0.42)	(-0.00)	(-0.15)	(-0.11)	(0.23)	(-0.74)	(-0.15)
SIZE	0.4771***	0.4964***	0.2944***	0.4380***	0.4726***	0.0340	0.0305	0.0343	0.0562	0.1073
	(4.06)	(4.19)	(2.81)	(3.72)	(3.87)	(0.26)	(0.23)	(0.27)	(0.42)	(0.77)
MB	-0.3016***	-0.3056***	-0.2113***	-0.2252***	-0.2688***	-0.3407***	-0.3193***	-0.2710***	-0.2841***	-0.3224***
	(-4.03)	(-4.14)	(-2.84)	(-3.20)	(-3.54)	(-4.79)	(-4.53)	(-3.62)	(-4.05)	(-4.41)
Fage	0.1590***	0.1587***	0.1117***	0.1577***	0.1483***	0.6266***	0.6038***	0.4314***	0.5995***	0.5881***
	(14.18)	(14.23)	(10.14)	(14.20)	(13.25)	(29.52)	(28.46)	(19.81)	(28.28)	(26.34)
SPI	-2.7179***	-2.8242***	-1.9924***	-7.6024***	-2.8442***	-1.5367***	-1.5163***	-1.4326***	-4.6304***	-1.5931***
	(-4.43)	(-4.60)	(-3.38)	(-7.37)	(-4.56)	(-3.11)	(-3.12)	(-2.78)	(-5.14)	(-2.81)
Earn_Vol	-0.0001	-0.0001	0.0001	-0.0001	-0.0002	-0.0000	-0.0000	0.0001	-0.0000	-0.0001
	(-0.95)	(-0.66)	(0.72)	(-0.68)	(-1.56)	(-0.34)	(-0.31)	(1.16)	(-0.06)	(-0.66)
EVOL	1.2870***	1.2613***	1.1078***	1.2961***	1.2844***	1.4283***	1.3350***	1.3346***	1.3860***	1.4220***
	(3.15)	(3.17)	(5.33)	(3.20)	(3.08)	(3.30)	(3.33)	(6.06)	(3.35)	(3.21)
DISC	-0.0903***	-0.0904***	-0.0561***	-0.0910***	-0.0898***	0.0097*	0.0056	0.0032	0.0049	0.0041
	(-16.70)	(-16.79)	(-11.29)	(-16.86)	(-16.97)	(1.70)	(0.98)	(0.61)	(0.84)	(0.72)
DLW_D	4.8750***	4.6779**	4.4857***	4.7513**	5.7547***	0.0000	0.0000	0.0000	0.0000	0.0000
	(2.66)	(2.53)	(3.99)	(2.54)	(3.19)	(.)	(.)	(.)	(.)	(.)
NI_chg_Restate	-0.0409	-0.0385	-0.0356	-0.0358	-0.0279	-0.0556*	-0.0540*	-0.0445	-0.0501	-0.0464
	(-1.14)	(-1.09)	(-1.05)	(-1.03)	(-0.72)	(-1.80)	(-1.74)	(-1.40)	(-1.64)	(-1.42)
MA_D	1.3442***	1.3454***	1.2222***	1.3494***	1.3051***	0.0471	0.0687	0.3104***	0.0826	0.0711
	(11.50)	(11.47)	(11.08)	(11.53)	(11.06)	(0.41)	(0.60)	(2.83)	(0.72)	(0.61)
SEO_D	0.0062	0.0133	-0.0605	-0.0353	-0.0117	0.3931**	0.4036**	0.1676	0.3570**	0.3314*
	(0.03)	(0.07)	(-0.39)	(-0.19)	(-0.06)	(2.21)	(2.29)	(1.14)	(2.04)	(1.84)
Constant	106.3152***	106.7401***	99.5220***	107.1586***	107.6400***	69.9854***	72.4928***	77.4464***	72.3857***	72.7926***
	(37.36)	(37.11)	(35.32)	(37.40)	(35.63)	(21.49)	(22.20)	(23.51)	(21.84)	(20.99)
Observations	11611	11785	9877	11785	11540	11611	11785	9877	11785	11540
chi^2	1067.2221	1041.1151	566.5881	1049.0907	1026.7421					
rho	0.6813	0.6820	0.7398	0.6836	0.6886					
Adjusted R^2						0.2857	0.2824	0.2064	0.2832	0.2802

Table 9. CEO Neuroticism and Annual Report Text-based Communicative Value: The Moderating Role of Financial Crisis

This table shows the results of the moderating effects of financial crisis for the relation between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, measured by bog index, BOG). The proxy of subprime crisis period is a dummy variable (FC) that equals 1 if the firm observation is at the period from 2007 to 2008 and 0 if elsewise. The other big five personality traits variables are agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. We consider two model specifications of random effect and fixed effect (firm and year) models. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random effect	Fixed effect
	(1)	(1)
	BOG	BOG
Neuro	-0.8706***	-0.5032*
	(-3.36)	(-1.91)
FC	0.8629	3.2425***
	(1.44)	(5.85)
Neuro*FC	**-0.3381***	**-0.3992****
	(-1.91)	**(-2.48)**
Agree	1.0170***	0.1260
	(4.80)	(0.56)
Consc	-1.5195***	-0.7244*
	(-4.56)	(-1.85)
Extra	0.2695	0.0576
	(1.38)	(0.29)
Openn	0.4163	0.1367
	(1.20)	(0.37)
Restate	-0.6456	-0.5680
	(-1.30)	(-1.09)
Earnings	-2.4646***	-0.1256
	(-2.91)	(-0.21)
Loss	0.0684	-0.0473
	(0.33)	(-0.27)
SIZE	0.4556***	0.1356
	(3.93)	(1.06)
MB	-0.2996***	-0.3308***
	(-4.06)	(-4.78)
Fage	0.1574***	0.7170***
	(14.12)	(31.16)
SPI	-2.8538***	-0.9000**
	(-4.65)	(-1.98)
Earn_Vol	-0.0001	0.0000
	(-0.88)	(0.05)
EVOL	1.2538***	1.3768***
	(3.17)	(3.48)
DISC	-0.0888***	0.0180***
	(-16.71)	(3.13)
DLW_D	4.7995***	0.0000
	(2.61)	(0.00)
NI_chg_Restate	-0.0392	-0.0560**
	(-1.08)	(-1.97)
MA_D	1.3083***	0.1209
	(11.16)	(1.07)
SEO_D	0.0239	0.4262**
	(0.13)	(2.42)
Constant	105.9567***	63.7603***
	(37.59)	(19.39)
Observations	11785	11785
chi^2	1047.5977	
rho	0.6886	
Adjusted R^2		0.2976

Table 10. Robustness Check: The Relation between CEO Neuroticism and Annual Report Text-based Communicative Value When Controlling for CEO Narcissism

This table shows the results regarding the association between CEO neuroticism (Neuro) and annual report TCV (i.e. readability, measured by bog index, BOG) when additionally controlling for CEO narcissism and other CEO characteristics (e.g. overconfidence, tenure, age, and gender). The other big five personality traits variables are agreeableness (Agree), conscientiousness (Consc), extraversion (Extra), and openness (Openn). For the estimations of these five personality traits, this study follows Harrison et al. (2019) to facilitate the Open Language Chief Executive Personality Tool (*OLCPT*) developed by Harrison et al. (2019) to analyzes the dialogue records of the CEO in the firm's quarterly earnings call transcripts and then calculates the CEO's five personality traits scores, which ranges from 1 to 7 points. Control variables include the other big five personality traits variables (Agree, Consc, Extra, Openn), Restate, Earnings, Loss, SIZE, MB, Fage, SPI, Earn_Vol, EVOL, DISC, DLW_D, NI_chg_Restate, MA_D, and SEO_D. The variables of CEO characteristics include CEO tenure (CEO_TEN), CEO gender (CEO_GEN), CEO age (CEO_Age), CEO overconfidence (OC), and CEO narcissism (Nar_Def1, Nar_Def2). Nar_Def1 (Nar_Def2) equals 1 if Nar_Comp1 (Nar_Comp2) is larger than its average and 0 if otherwise. Nar_Comp1 (Nar_Comp2) variable is defined as the average of the standardized values of P_CEO and PSIZE_CEO (P_CEO, PSIZE_CEO, and SSIZE_CEO) variables. P_CEO is defined as the average of the score of the prominence of the CEO's photograph during the second and third year of the CEO's tenure. PSIZE_CEO is a CEO's photograph size in annual reports, measured by the square area of CEO photo image; SSIZE_CEO is the CEO signature size in annual reports, measured by the square area of CEO signature image. We consider two model specifications of random effect and fixed effect (firm and year) models for the association between CEO neuroticism (Neuro) and annual report readability. This table presents the regression coefficients. The t-statistics calculated by firm-level clustered standard errors (Petersen, 2009) for each coefficient appears immediately underneath. The signs of "*, **, ***" represent the significance of 10%, 5%, and 1%, respectively.

	Random Effect		Fixed Effect	
	(1)	(2)	(3)	(4)
	BOG	BOG	BOG	BOG
Neuro	**-0.9891*** **	**-0.9911*** **	**-0.5352** **	**-0.5382** **
	(-3.81)	**(-3.81)**	**(-1.99)**	**(-2.00)**
Consc	-1.6769***	-1.6787***	-0.8298**	-0.8285**
	(-4.93)	(-4.94)	(-2.07)	(-2.07)
Extra	0.1884	0.1860	0.0311	0.0289
	(0.97)	(0.96)	(0.15)	(0.14)
Agree	1.0803***	1.0783***	0.1085	0.1054
	(5.02)	(5.01)	(0.47)	(0.46)
Openn	0.4302	0.4345	0.0881	0.0951
	(1.22)	(1.23)	(0.23)	(0.25)
Nar_Def1	0.3331		0.4616**	
	(1.51)		(2.10)	
Nar_Def2		0.3593		0.4613*
		(1.44)		(1.82)
OC	-1.2164***	-1.2160***	-0.4901***	-0.4912***
	(-6.48)	(-6.50)	(-2.58)	(-2.60)
CEO_TEN	-0.0111**	-0.0111**	-0.0131**	-0.0131**
	(-2.32)	(-2.31)	(-2.54)	(-2.54)
CEO_Age	0.0634***	0.0635***	0.0099	0.0098
	(4.94)	(4.95)	(0.81)	(0.80)
CEO_GEN	0.5522	0.5533	-0.0289	-0.0275
	(1.14)	(1.15)	(-0.06)	(-0.06)
Restate	-0.6359	-0.6356	-0.7378	-0.7375
	(-1.30)	(-1.30)	(-1.46)	(-1.46)
Earnings	-2.3938***	-2.3953***	-0.2045	-0.2047
	(-2.86)	(-2.86)	(-0.33)	(-0.33)
Loss	0.0096	0.0098	-0.0530	-0.0531
	(0.05)	(0.05)	(-0.30)	(-0.30)
SIZE	0.4840***	0.4842***	0.1003	0.1000
	(4.25)	(4.25)	(0.77)	(0.77)
MB	-0.2669***	-0.2669***	-0.3202***	-0.3203***
	(-3.78)	(-3.78)	(-4.59)	(-4.59)
Fage	0.1408***	0.1407***	0.5933***	0.5933***
	(12.83)	(12.82)	(27.26)	(27.32)
SPI	-2.5850***	-2.5865***	-1.4980***	-1.4982***

	(-4.36)	(-4.36)	(-3.03)	(-3.03)
Earn_Vol	-0.0001	-0.0001	-0.0000	-0.0000
	(-1.13)	(-1.14)	(-0.37)	(-0.39)
EVOL	1.2891***	1.2892***	1.3698***	1.3691***
	(3.21)	(3.21)	(3.32)	(3.32)
DISC	-0.0862***	-0.0863***	0.0062	0.0061
	(-15.96)	(-15.96)	(1.09)	(1.08)
DLW_D	5.3453***	5.3448***	0.0000	0.0000
	(3.09)	(3.09)	(.)	(.)
NI_chg_Restate	-0.0491	-0.0488	-0.0559**	-0.0558**
	(-1.58)	(-1.57)	(-1.99)	(-1.98)
MA_D	1.3395***	1.3395***	0.1077	0.1070
	(11.53)	(11.54)	(0.94)	(0.93)
SEO_D	0.0743	0.0748	0.3927**	0.3932**
	(0.40)	(0.41)	(2.22)	(2.23)
Constant	103.5276***	103.5300***	71.5987***	71.6217***
	(35.69)	(35.64)	(21.41)	(21.47)
Observations	11779	11779	11779	11779
chi^2	1111.2402	1114.9069		
rho	0.6836	0.6833		
Adjusted R^2			0.2830	0.2830