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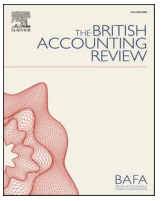

Does CEO extraversion pay off when in need? Evidence from the global financial crisis

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ABSTRACT

We examine the effect of CEO extraversion on corporate performance during the Global Financial Crisis (GFC). Contrary to the expectation that extraverted CEOs should shield firms better from GFC adversities, we document that the extraversion characteristic of CEOs places a significant, though negative, effect on corporate performance during the financial crisis. Our findings are robust to controlling for other CEO personality traits. We also perform a battery of robustness tests and validate the underperformance of firms with extraverted CEOs during the GFC using stock returns and measures of operating performance. We argue that because extraverted CEOs are associated with heightened firm risk profile, this can hurt firms when the market disciplines excessive risk-taking during the crisis.

1. Introduction

A growing body of research highlights the importance of a CEO's styles in influencing their firm's corporate policies and outcomes (see, for example, Bernile et al., 2018; Cronqvist et al., 2012; Cronqvist & Yu, 2017; Dittmar & Duchin, 2016; Schoar & Zuo, 2017). In this line of inquiry, styles of CEOs encompass a broad range of concepts, including professional experiences (Benmelech & Frydman, 2015; Dittmar & Duchin, 2016; Law & Mills, 2017; Schoar & Zuo, 2017), personal experiences (Bernile et al., 2017; Cronqvist & Yu, 2017; Malmendier & Nagel, 2011; Roussanov & Savor, 2014), and innate predispositions (Adams & Funk, 2012; Dyreng et al., 2010; Hutton et al., 2014; Levi et al., 2010; Matsa & Miller, 2013). There remain, however, two important shortcomings in the current knowledge. First, considering that personalities are central in leadership (Judge et al., 2002), it is surprising there is little systematic research on how core personality traits of CEOs influence corporate performance, especially during adverse economic situations such as the financial crisis. Second, the impact of personalities – irrespective of how personalities are defined or measured – can be easily confounded with economic and other firm-specific factors that, much like personalities, vary across firms.

The empirical analysis in this paper aims to address both limitations. First, we explore the role of CEO personalities, particularly CEO extraversion as the most important aspect of an individual's personalities (Cain, 2013; Jung, 1921), on corporate outcomes around the Global Financial Crisis (GFC hereafter). The literature on personal psychology has established "Big Five" personality traits, namely extraversion, emotional stability, agreeableness, conscientiousness, and openness to experience, and investigate if these traits relate to professional performance (Barrick & Mount, 1991). Extraversion is often considered the most important factor for job

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performance and the strongest and most consistent predictor of leadership. In this study, we employ Green et al.'s (2019) linguistic measure for personality traits of CEOs derived from their speech patterns in the Q&A portion of quarterly conference calls.[1] CEO extraversion score is measured and aggregated across all call transcripts from 2006 to 2013. To capture a CEO's extraversion component that is orthogonal to firm and other aspects of CEO characteristics, we then focus on the CEO's residual extraversion after controlling for a compressive list of CEO traits (such as gender, education, and ability) and firm fundamentals (such as returns and earnings surprises), thereby deriving extraversion score that is stable at the individual level rather than at the firm level. Next, this fine-grained dataset enables us to construct precise tests of the role of CEO stable extraversion on various firm outcomes during the crisis.

In this paper, we test whether extraverted CEOs appointed *before* the onset of the GFC are successful in navigating their firms throughout the 2008–2009 financial crisis.[2] Extant research shows that CEO extraversion is associated with several auspicious outcomes such as more favorable analyst forecasts, improvements in investor recognition, sales growth, firm efficiency, and higher acquisition returns (e.g., Becker et al., 2019; Green et al., 2019). These CEOs also earn significantly higher salaries, plausibly reflecting a labor market's demand premium for the extraversion personality trait in corporate management. If the board of director views a CEO's extraversion as important in their hiring decisions and this personality trait is associated with improved CEO career outcome, we should expect firms with extraverted CEOs to be able to better weather adversities during difficult economic conditions. From an investor perspective, if CEO extraversion is perceived as desirable, investors may place a valuation premium on these firms when the general market valuation of equity is overwhelmingly low, as in the GFC.

One the other hand, extant literature documents that CEO extraversion is strongly associated with i) high propensity of risk-taking such as pursuits of corporate acquisitions and adoptions of higher financial leverage (e.g., Adebambo et al., 2019; Harrison et al., 2020; Lartey et al., 2020; Malhotra et al., 2018). While risk-taking activities can benefit shareholders and are generally consistent with the notion of shareholder value maximization during normal times (Acharya et al., 2010; Keeley, 1990; Marcus, 1984), a heightened corporate risk profile is, however, much less desirable during extraordinary times. For example, the collapse of Lehman Brothers during the financial crisis is the consequence of a failure to safeguard against executives' excessive risk-taking (DeYoung et al., 2013; Kirkpatrick, 2009).[3] In a setting of banks as major players during the financial crisis, independent directors with financial expertise appear to encourage risk-taking activities of banks in the period before the financial crisis, but the risks taken then become detrimental during the crisis (Minton et al., 2014). Following this line of logic, if an extraverted CEO maintains high risk appetite during periods when conservatism should be preferred, such as during the GFC, this may hurt firm performance.

Given the unanticipated nature of the GFC and its fast escalation, we argue that it is unlikely that boards can predict the incoming GFC, its devastating impacts, and then appoint CEOs with low extraversion in anticipation of this event. Exploiting an exogenous market's shift towards conservatism, we then estimate a difference-in-differences regression model to examine whether CEO extraversion prior to the GFC influences firm performance during the crisis. Findings from this setting allows us to elicit a more direct identification of the impact of CEO extraversion on performance. More importantly, we offer empirical evidence to the question whether CEO extraversion pays off or hurts firms during the crisis.

Our analysis of how CEO extraversion shapes firm performance around the GFC rests on three main parts. First, we document a detectable performance effect linked to CEO extraversion during the GFC period. Specifically, we show that firms led by extraverted CEOs perform significantly worse during the financial crisis. Holding other variables constant, firms whose CEOs are in the 75th percentile of extraversion score are associated with an average 14.5% fall in Tobin's q relative to firms whose CEOs are in the 25th percentile of extraversion score. In addition, there is no evidence of a valuation rebound of firms with extraverted CEOs in the period after the GFC. This suggests that a poorer valuation during the GFC was unlikely due to market overreaction.

Second, we demonstrate that the extraversion effect is also observed in the cross-section of stock return performance. To do so, we assess the impact of CEO extraversion on stock returns in the periods both during and after the financial crisis. Evidence from this analysis shows that market participants perceive firms headed by CEOs with high extraversion scores to be poorly managed or have poor performance. Consistently, we document that the impact of CEO extraversion on stock returns in the period after the crisis is absent, confirming that the perceived poor performance of firms run by extraverted CEOs is restricted to the time period of the global financial crisis only.

The third test offers direct evidence on the CEO extraversion-operating performance nexus during the GFC. We show that CEO extraversion is negatively linked to several measurements of firm operations. Specifically, we find that firms with extraverted CEOs suffer lower revenue growth, lower ROA, lower labor productivity, and lower gross profit margin. This means that that high-CEO-

[1] We thank Green and his co-authors for making the CEO personality traits data available, http://russelljame.com/research.html.

[2] Empirical identification of the effect of CEOs' personality and, more generally, their styles on firm performance is challenging without exogenous variation in firm-level CEO's personality. Using the global financial crisis allows us to circumvent the ambiguity over whether CEOs imprint their extraversion on a firm or whether the matching between CEO extraversion and their firms is based on unobserved factors. During the financial crisis, CEOs have to make decisions to navigate their firms through unprecedented challenges. These decisions are likely to be complex, non-routine and unstructured. CEO extraversion is likely to be salient in how these CEOs make decisions and respond to such challenges.

[3] When the global financial crisis emerges, it raises the value of conservatism and corporate governance that monitor management' actions, or the penalty of managerial excessive risk-taking and moral hazard problems. The case of Lehman Brothers highlights the importance of corporate governance during the financial crisis and that governance benefits are not only confined to financial sectors (e.g., Adams, 2012; Nguyen et al., 2015). Research on financial stability also shows that firms entering crisis periods with more conservative financial policies such as higher cash holdings and lower short-term debts are much better off (Almeida et al., 2009; Campello et al., 2010; Ding et al., 2021; Duchin et al., 2010).

extraversion firms exhibit lower profitability and lower contribution of employees to sales relative to other companies. Because our analysis traces the extraversion effect to more granular corporate operating performances, our research findings further explain why and how CEO extraversion matters to firm performance during the GFC.

Furthermore, while we imply that extraverted CEOs leads to worse performance during the GFC, we further conjecture that those extraverted CEOs are more likely to experience forced turnover during the crisis. Our empirical findings confirm this conjecture and show that firms led by extraverted CEOs before the crisis exhibit a higher probability of dismissing those CEOs, and this positive relation is stronger when those firms have lower-than-median Tobin's *q*.

To the extent that the negative relation between extraverted CEOs and crisis-performance is built on the argument that investors become more concerned about moral hazard problems and expropriation by insiders, we further predict that the association is more pronounced when those CEOs are more powerful or highly entrenched. That is indeed what we document in our empirical analysis.

We also perform several additional analyses. First, we employ "*k*-means" clustering to construct clusters of CEOs with the highest within-cluster similarity and present mean value of Big Five personality scores for CEOs. This procedure allows us to establish clusters of CEOs that vary in extraversion but not in other personality scores. We continue to document an inverse relation between clusters of CEOs with high extraversion and firm performance during the financial crisis. Second, we address the possibility that other personality traits of CEOs than extraversion may explain our results. To do so, we control for the impact of other aspects of CEO personality such as openness, agreeableness, conscientiousness, and emotional stability. We find that these traits cannot eliminate the effect of CEO extraversion on corporate performance during the GFC. Next, we investigate whether CEO extraversion is related to firm performance during the period of credit supply contraction. We find that it is a shock to the importance of governance, and not the shock to the credit supply, that explains the negative impact of CEO extraversion on firm performance.

In the final avenue of inquiry, we perform a path analysis to assess the magnitude of a direct path from CEO extraversion to firm performance and that of an indirect path from CEO extraversion to firm performance via CEO overconfidence. For a sample of banks, Ho et al. (2016) document that overconfidence of bank CEOs with leads to increased risk-taking behavior by banks during non-crisis periods, which results in worse performance during the financial crisis and Hrazdil et al. (2020) show that CEO extraversion is related to CEO's risk tolerance. In this path analysis, we find that CEO extraversion directly impacts performance and that there is also a significant negative indirect effect on firm performance via the path of overconfidence during the crisis. Interestingly, the direct effect dominates that from the indirect path, indicating a unique role of extraversion, besides overconfidence, on firm performance.

Our study contributes to several active research areas on CEO managerial styles. Extant studies generally examine characteristics of CEOs that are acquired over time or subject to CEO's endogenous selection such as their professional experience (Dittmar & Duchin, 2016), military experience (Benmelech & Frydman, 2015) or marital status (Roussanov & Savor, 2014). In contrast, we focus on CEOs' personality traits and, therefore, more accurately map into the concept of a 'manager fixed effect' compared to other learned or time-varying characteristics. Recent research on CEO personality emphasizes on extraversion and documents strong evidence that extraverted CEOs experience greater labor market success (Green et al., 2019). CEO extraversion is also significantly related to some measures of firm performance, such as eliciting better analysts forecasts (Becker et al., 2019), consistent with the notion that extraverted CEOs possessing superior management skills. Contrary to these findings, we show strong evidence that CEO extraversion is associated with poorer corporate performance during the GFC period. Our study highlights that extraverted CEOs perform differently in 'crisis' situations compared to 'normal' periods.[4]

Second, the primary contribution of this paper is to improve our understanding of what determines the crisis-period performance. Prior studies present that social capital, higher levels of financial slack, corporate diversification can give firm advantages to tide over the financial crisis (see, for example, Duchin et al., 2010; Kuppuswamy & Villalonga, 2016; Lins et al., 2017). In terms of CEO characteristics, the work closest to ours is Ho et al. (2016), which proposes that banks with overconfident CEOs are more likely to weaken lending standards and therefore face significant drops in operating and stock performance during the crisis. Our research focuses on a large sample of industrial companies, thereby presenting more generalization about executives' personality traits and their crisis performance. A recent study by Reyes et al. (2020) finds that the impact of overconfident CEOs on firms' performance is more positive during the expansion years of the business cycle, while the positive impact is largely reduced during recession periods. In our paper, we show that CEO personality, i.e., extraversion, is also an important explanation for the decline of firm performance during the crisis. Notably, the effect is independent from that of CEO overconfidence.

The remainder of the paper is organized as follows. Section 2 reviews literature. Section 3 describes the sample and variable definitions. Section 4 presents our main regression results and further evidence. Section 5 shows evidence regarding the likelihood of forced CEO turnovers and cross-sectional analysis. Section 6 addresses endogeneity concerns and discusses additional analyses. Section 7 concludes the paper.

2. Literature review and hypothesis development

From the argument of neoclassical economic theory (e.g., Bertrand & Schoar, 2003; Weintraub, 2002), idiosyncratic differences across CEOs should not affect corporate outcomes because these individuals are rational optimizers. Several archival research studies,

[4] Consistent with the implication from Green et al. (2019) and (Becker et al., 2019), we find that extraverted CEOs are actually positively associated with firm performance outside the crisis period. The relation, however, turns negative when firms operate during the crisis period. Our analyses suggest that the difference most likely arises from the fact that extraverted CEOs tend to take higher risk, which may benefit firms in normal periods but hurt firms in crisis periods when conservatism is required.

however, have challenged this view and established the role for idiosyncratic CEO attributes. The upper echelons theory argues that when CEOs decide to exert organization efforts, they have considerable discretions and may act on the basis of their personal values, thus, managerial characteristics are particularly influential in shaping corporate policies and performance (e.g., Cai et al., 2019; Chatterjee & Hambrick, 2007; Gabaix & Landier, 2008; Hambrick & Mason, 1984; Kontesa et al., 2021).

2.1. Big Five personalities in brief

The Big Five Personality Traits, also known as the Five-Factor Model, are a widely recognized framework for understanding human personality (Barrick & Mount, 1991; Judge et al., 2002; McCrae & Costa, 1985; Roberts et al., 2006). These five traits are: Openness to Experience: the extent to which a person is open-minded, creative, and curious. Conscientiousness: the degree to which a person is organized, dependable, and responsible. Extraversion: the extent to which a person is outgoing, assertive, and sociable. Agreeableness: the degree to which a person is cooperative, empathetic, and considerate of others. Emotional Stability: the extent to which a person is calm, resilient, and able to cope with stress. These traits are considered to be stable and consistent across different situations and cultures (Bleidorn et al., 2022; Hampson & Goldberg, 2006; Kajonius & Giolla, 2017). The Big Five Personality Traits have been shown to have important implications for a wide range of outcomes, including job performance (Judge & Zapata, 2015), academic achievement (Mammadov, 2022), and mental health (Lamers et al., 2012).

2.2. Extraversion and risk-taking

While extraversion is often considered the most important among the 'Big Five' personality traits in psychology research (Cain, 2013), the academic literature has only recently begun to empirically examine how extraversion of CEOs relates to economic outcomes.[5] Characteristics of extraversion include external stimulation seeking (Barrick & Mount, 1991; Eysenck, 1963; John & Srivastava, 1999), excitement seeking (Costa et al., 1984), risk-taking (Nicholson et al., 2005), positive affect and strong desire for social engagement and attention (Wilt & Revelle, 2017).

Nichoson et al. (2005) show early evidence that overall risk-taking propensity is strongly rooted in personality and positively related to extraversion. Hampson and Goldberg (2006) find that personality traits in general remain largely stable after individuals reach their adulthood. Importantly, they show that extraversion exhibits the highest stability coefficient compared to the other four personality traits. In addition, Hampson et al. (2006) document that higher levels of extraversion are related to health-related risky behavior 40 years after childhood. The extraversion – risk-taking association is reportedly driven by the general propensity for sensation seeking and impulsivity (Demaree et al., 2008; Nicholson et al., 2005). Extraverted individuals are also found to be more optimistic and confident in their ability to perform (Judge et al., 2002; Kam & Meyer, 2012; Schaefer et al., 2004; Sharpe et al., 2011), which may lead them to perceive risks as less threatening and more manageable. These studies' evidence implies that extraversion and its associated risk-taking behavior are essentially stable over time and across different situations.

There exists empirical evidence on the link between extraversion and financial risk-taking. For example, at the individual level, Oehler et al. (2018) find that extraversion is positively related to the prices that individuals are willing to pay for financial assets. Studies in corporate finance document that extraverted CEOs are more likely to take risk such as engaging in merger and acquisition activities (Malhotra et al., 2018) and using greater financial leverage (Lartey et al., 2020). Adebambo et al. (2019) report that firms with extraverted CEOs incur a higher cost of equity due to their risk-taking propensity. In a similar vein, Harrison et al. (2020) argue that market participants perceive firms run by extraverted CEOs as riskier and these firms are less able to translate risk into returns.

The collapse of Lehman Brothers underscores the importance in safeguarding against executives' excessive risk-taking (DeYoung et al., 2013; Kirkpatrick, 2009; Minton et al., 2014).[6] Since boards would not expect ex-ante an incoming GFC, the crisis provided a shock that shifted upwards the importance of corporate governance and managerial conservatism. It is likely that the market assigned a penalty for excessive risk-taking and moral hazard problems during the crisis.[7] Following this logic, extraverted CEOs that implemented high risk-taking activities may destroy firm performance during the crisis. For instance, firms may choose suboptimal investing strategies, which in turn harm firms' profitability (e.g., Doukas & Petmezas, 2007). Moral hazard problems arising from manager's personality traits can also affect creditor's opinions about the firm's financial capacity to meet its debt obligations, especially when the financial crisis undermines creditors' confidence in the firm's or its management team's overall creditworthiness.

2.3. Extraversion and leadership effectiveness

Extraverted individuals tend to be sociable, ambitious, assertive, bold, optimistic, talkative, energetic, decisive, and gregarious (Barrick & Mount, 1991; John & Srivastava, 1999; Watson & Clark, 1997; Wilt & Revelle, 2017). Judge et al. (2002) employ a meta-analysis and document that extraversion is the most consistent predictor of leadership emergence and leadership effectiveness.

[5] A majority of research on CEOs' traits has focused on measurements of overconfidence and related over-optimism proxies (Banerjee et al., 2018; Gervais et al., 2011; Graham et al., 2013; Hirshleifer et al., 2012; Malmendier et al., 2011; Malmendier & Tate, 2005, 2008).

[6] The importance of governing managers' misbehavior during the financial crisis is not confined to financial sectors (e.g., Adams, 2012; Nguyen et al., 2015).

[7] There is evidence that firms with conservative financial strategies were much better shielded from the negative impact of the crisis (e.g., Duchin et al., 2010).

Leaders with high extraversion scores are more likely to possess charisma, encourage intellectual stimulation, hold strong future visions, and support followers' development (Bono & Judge, 2004; Do & Minbashian, 2014). These characteristics make extraverted leaders effective during crisis situations and key to business success (Grant et al., 2011; Hoffman et al., 2011).

In assessing extraversion of CEOs as leaders, Green et al. (2019) show that extraverted CEOs receive higher salaries, experience less turnover, and serve on more outside boards, plausibly reflecting a labor market's demand premium for extraverted CEOs. Extraversion may, therefore, be considered a highly desirable attribute of CEOs (Bono & Judge, 2004; Judge et al., 2002). Hence, we expect that extraverted CEOs' desire for social interactions, their ability to deal with stress and cravings for achievements lead to a better performance during an adverse economic situation such as the financial crisis.

2.4. Hypothesis development

Given that extraversion is the strongest and most consistent predictor of leadership (Judge et al., 2002) and that extraverted individuals can handle work stress well (Jackson & Schneider, 2014), it is imperative that we should investigate the role of extraversion in a crisis period when there is a high level of stress and when leadership is of utmost importance. In addition, while the labor market exhibits a demand premium for the extraversion personality trait in corporate management (Green et al., 2109), it is not yet clear if this premium is justified. In this context, the financial crisis offers a unique setting where any effect of CEO extraversion on performance is much clearly observed than in other periods.[8]

Our first discussion supports the conjecture that CEO extraversion is associated with a high level of risk taking. While risk taking may benefit firms in normal periods, it can be value-destructing when firms enter a crisis period, thereby resulting in poorer firm performance. The second line of argument, however, suggests the opposite in that CEO extraversion is associated with effective leadership, which could be projected to generate higher firm performance during adverse economic conditions. Considering both arguments, we propose the main hypothesis in our study in the null form as:

H0. CEO extraversion does not affect firm performance during the global financial crisis period.

3. Data and descriptive statistics

3.1. Data sample

Our sample includes Standard & Poor's (S&P) 1500 firms between 2007Q1 and 2013Q4. We identify firm CEOs based on ExecuComp's classification (data item CEOANN=CEO). We exclude financial firms (SIC code between 6000 and 6999) as these firms received extensive amounts of government subsidies during the financial crisis. Given our study aims to examine the effects of CEO extraversion as the most important traits of a leader (Judge et al., 2002), we obtain CEOs' personality traits from Green et al. (2019). Scores of personality traits are based on CEOs' speech patterns from the Q&A portion of quarterly conference calls.

We focus on the residual extraversion of CEOs, which is computed as the weighted average of all residual components of call-level extraversion after controlling for firm fundamentals.[9] According to Green et al. (2019, p. 181), CEO extraversion score is measured and aggregated across all call transcripts from 2006 to 2013 for each CEO.[10] This measure of CEO extraversion largely captures a CEO's extraversion personality that is stable and orthogonal to firm and CEO characteristics. Our variable of interest is residual extraversion for CEOs who have been appointed by the company as of year-end 2006 (see Lins et al., 2017), since we are interested in whether an extraverted CEO before the onset of the crisis can be a better leader to navigate his/her firm during the financial crisis. We obtain quarterly financial and accounting information from Compustat Fundamentals Quarterly and monthly stock return data from the Center for Research in Security Prices (CRSP).

3.2. Variables construction

Our paper employs a widely used measure for firm performance in corporate finance, accounting, and corporate governance literature, i.e., Tobin's q or market-to-book ratio (e.g., Ahern & Dittmar, 2012; Bebchuk et al., 2009; Buchanan et al., 2018; Fang et al., 2009; Gompers et al., 2003). Tobin's q is a forward-looking measure for firm growth (Collins et al., 2017) and reflects market participants' opinions about firm value. Moreover, Tobin's q is less of a concern for measurement error problems when it is treated as a

[8] In examining the role of trust, Lins et al. (2017) highlight that the trust between a firm and both its stakeholders and investors, built through investments in social capital, pays off when the overall level of trust in capital markets suffers a negative shock. In our study, building on the same logic, CEO qualities are most likely to be salient to firm performance and investors during the crisis period because CEOs' decisions can become especially critical when firms face adversity.

[9] Our main result stays robust if we use the unadjusted average extraversion in lieu of the weighted average of all residual components of call-level extraversion.

[10] According to Green et al. (2019), the data used to measure CEO extraversion is based on a sample that includes 37,735 CEO-call observations from 2006 to 2011 for 2464 unique CEOs. Accordingly, there should be around 15 call transcripts being used per CEO to measure his/her extraversion score.

dependent variable (Roberts & Whited, 2013).[11]

Given that it is scaled by book value of total assets, Tobin's *q* evaluates how much investors are willing to pay for every dollar of a firm's assets. Tobin's *q* is computed as the market value of assets, which is the sum of market value of common stock plus total assets minus book value of common equity minus deferred taxes, divided by total value of book assets.[12] We also employ alternative measures of corporate accounting performance. Specifically, we assess the firm's stock market performance and operating performance as captured by sales growth, returns on assets, labor productivity, and gross profit margins.

Closely following Lins et al. (2017), we define the financial crisis period as the fourth quarter of 2008 and the first quarter of 2009 since Lehman Brothers declared bankruptcy on September 2008, and the S&P 500 index reached its milestone low on March 2009. Prior research has demonstrated that firms entering a crisis with conservative financial strategies are more resilient (e.g., Duchin et al., 2010) and better-performed (e.g., Ding et al., 2021). Hence, the crisis represents a shock that raises the value of curbing managerial risk-taking and moral hazard problems.

To capture the change in the attitudes about governance problems, we construct a dummy variable (*Crisis*) which is equal to one for 2008Q4 and 2009Q1, and zero otherwise. To examine whether there is a reversal of firm performance after the crisis, we create a dummy variable (*PostCrisis*) which is equal to one from 2009Q2 to 2013Q4, and zero otherwise (Buchanan et al., 2018; Lins et al., 2017).

3.3. Summary statistics

Table 1 presents summary statistics for the variables used in our study. After deleting missing values for our main regression variables, we have 28,191 firm-quarter observations in our sample period. After removing observations with missing values in our key variables (controls as discussed in Section 4.1 and Tobin's *q*), we have 1150 unique CEOs (firms) in the year of 2006 with available extraversion score to evaluate in our sample periods.[13] All continuous variables are winsorized at the 1% and 99% levels to eliminate the effects of outliers.

We focus on the residual extraversion for CEOs employed in 2006, denoted by *ResidExtra*, and this variable displays a large variation as shown by its standard deviation. Because this extraversion is measured after controlling for firm fundamentals, its mean value is lower than that of the weighted average call-level measure of CEO extraversion, *AveExtra*.

We also present summary statistics for the average call-level measures of CEO's other personality traits, which are openness, agreeableness, conscientiousness, and emotional stability (the opposite of neuroticism). Compared to other call-level measure of CEO personality traits, *AveExtra* displays a larger mean level. Tobin's *q* displays a close-to-normal distribution with a mean of 1.807 and a median of 1.479, showing that the market-to-book ratio in our S&P 1500 sample may be less subject to measurement error issues.[14]

4. Main results

4.1. The baseline model

We assess the effect of CEO extraversion on a firm's performance during and after the financial crisis using the baseline model as follows:

$$y_{it} = \beta_0 + \beta_1 ResidExtra_i + \beta_2\ ResidExtra_i \times Crisis + \beta_3 Crisis + \beta_4 ResidExtra_i \times PostCrisis + \beta_5\ PostCrisis + \gamma\ X_{it-1} + \varepsilon_{it} \quad (1)$$

where y_{it} refers to our performance measures for firm *i* in year-quarter *t*. $ResidExtra_i$ measures residual extraversion for CEOs appointed by firm *i* at year-end 2006. *Crisis* and *PostCrisis* are used to identify our crisis and post-crisis periods. X_{it} represents the set of control variables that may explain a firm's financial performance, which includes sales growth, leverage, firm size, returns on assets, fixed assets ratio, and R&D. The control variables are measured in the previous quarter. Sales growth (*Sales_Growth*) are change in sales from year-quarter *t* - 1 to year-quarter *t*. Leverage (*Leverage*) is sum of long-term debt plus debt in current liabilities, divided by assets. Firm size (*Log_AT*) is the natural logarithm of total assets. For operating income, the Compustat quarterly file provides the year-to-date operating income before depreciation, *oibdpy*. We set quarterly operating income to be *oibdpy* in the first fiscal quarter and change in *oibdpy* in the second, third, and fourth fiscal quarters. Returns on assets (*ROA*) is the ratio of quarterly operating income before depreciation to total assets at the end of that quarter. Fixed assets ratio (*Fixed_Assets*) is gross property, plant and equipment divided by assets. R&D is research and development expenditures scaled by assets.

Our baseline regressions also include firm fixed effects to account for time-invariant firm-specific heterogeneity and year-quarter dummies to control for the effects of aggregate macroeconomic conditions. Note that the impact of the dummy variable *Crisis* is subsumed by year-quarter fixed effects, and *ResidExtra* is subsumed by firm fixed effects since it is measured once per firm. Standard

[11] According to Roberts and Whited (2013), measurement errors in the dependent variable are similar to omitted variables biases, and it does not produce inconsistent estimates as long as they are uncorrelated with explanatory variables.

[12] Our results remain similar when we use two-digit SIC industry-adjusted Tobin's *q* for a given year.

[13] Note that CEOs can work for more than one companies during some sample periods.

[14] Bartlett and Partnoy (2018) caution that Tobin's *q* could be significantly skewed upward since researchers substitute replacement cost of intangible capital with book value of capital, causing possible measurement error problems (Millimet & Parmeter, 2021). This issue is much less relevant in our sample given a smaller difference between mean and median values.

Table 1
Descriptive statistics.

Variables	N	Mean	SD	p25	p50	p75
Key regression variables						
ResidExtra	28,191	0.177	0.753	−0.315	0.168	0.664
Tobin's q_t	28,191	1.807	1.047	1.143	1.479	2.092
Crisis	28,191	0.075	0.263	0.000	0.000	0.000
PostCrisis	28,191	0.546	0.498	0.000	1.000	1.000
AveOpen	28,191	3.728	0.133	3.646	3.728	3.806
AveAgre	28,191	3.645	0.142	3.565	3.648	3.738
AveCons	28,191	3.672	0.235	3.539	3.671	3.813
AveEmoS	28,191	3.221	0.196	3.094	3.222	3.354
AveExtra	28,191	4.140	0.402	3.882	4.142	4.397
$Sales\_Growth_{t-1}$	28,191	0.024	0.170	−0.046	0.017	0.084
$Leverage_{t-1}$	28,191	0.214	0.176	0.056	0.201	0.324
Log_AT_{t-1}	28,191	7.759	1.597	6.611	7.631	8.844
ROA_{t-1}	28,191	0.034	0.026	0.021	0.033	0.047
$Fixed\_Assets_{t-1}$	28,191	0.410	0.419	0.000	0.289	0.706
$R\&D_{t-1}$	28,191	0.007	0.014	0.000	0.000	0.010
Other variables						
$Sales\_Growth_t$	28,182	0.028	0.253	−0.046	0.017	0.083
$Gross\_Margin_t$	28,116	0.393	0.221	0.237	0.363	0.540
ROA_t	28,191	0.034	0.031	0.021	0.033	0.047
$Labor\_Productivity_t$	28,044	0.135	0.365	0.049	0.077	0.132
Ret_t	85,704	0.011	0.125	−0.052	0.011	0.070

The table shows the number of observations, mean, standard deviation, median, 25th and 75th percentiles for *ResidExtra* (CEO residual extraversion), Tobin's *q* (market-to-book ratio) and dummy variables that identify crisis periods, i.e., *Crisis* and *PostCrisis*. Summary statistics are presented for the average call-level measures of CEO's extraversion and other personality traits, which are extraversion (*AveExtra*), openness (*AveOpen*), agreeableness (*AveAgre*), conscientiousness (*AveCons*), and emotional stability (*AveEmoS*). The table also presents the descriptive statistics for quarterly sales growth, leverage, log total assets, fixed assets ratio, R&D, gross margin, ROA, labor productivity, and monthly stock returns. Variable definitions can be found in the main text.

errors allow for two-way clustering of both firm and year-quarter.

Table 2 reports the regression output for the relation between CEO extraversion and firm performance during and after the financial crisis. Column 1 shows that there is a significant decline in firms' Tobin's *q* at the onset of the financial crisis. Our variable of interest is the interaction term between the extraversion score measured for the firm's CEO and *Crisis*. Column 2 shows that compared to the pre-crisis period, firms led by extraverted CEOs perform significantly worse during the financial crisis as the coefficient of *Crisis*ResidExtra* is negative and statistically significant at the 1% level.

Columns 3 and 4 display our estimation output of Eq. (1) for the entire sample period without and with time fixed effects, respectively. The coefficient estimate on *Crisis*ResidExtra* in column 3 is negative and statistically significant at the 1% level, and the magnitude of this coefficient estimate is economically large. The coefficient estimate on *Crisis*ResidExtra* indicates that one standard deviation increase in CEO extraversion leads to a 0.423 (= 0.054*0.753 + 0.382) unit drop in Tobin's *q* during the financial crisis. While firms with less extraverted CEOs (assuming a CEO extraversion score of zero) experience a drop in Tobin's *q* of only 0.382, it implies a 10% (= 0.423/0.382–1) decrease in performance during the crisis for one standard deviation increase in CEO extraversion.

Alternatively, consider two otherwise similar firms in terms of economic conditions except that one firm is headed by an extraverted CEO with an extraversion score at the 75th percentile and the other firm is headed by an extraverted CEO with an extraversion score at the 25th percentile. Holding other variables constant, the coefficient estimate implies that Tobin's *q* of the high CEO-extraversion firm would fall by 14.5% more than the other firm (= (−0.382 - 0.054*(0.664))/(−0.382 - 0.054*(−0.315)) - 1). In column 4, we further control for year-quarter fixed effects and the coefficient estimate on *Crisis*ResidExtra* stays negative and statistically significant.

An inclusion of firm fixed effects allows us to evaluate time-series variation in firm performance. To identify cross-sectional differences of firm performance during the GFC, we include industry by year-quarter fixed effects in column 5 and compare firm performance across firms within the same industry (based on Fama-French 49 industry classifications) at the same time (e.g., firms in normal periods and firms in the GFC). Interesting, we find that firms with high CEO extraversion deliver better performance before the crisis,[15] but the coefficient on *Crisis*ResidExtra* remains negative and statistically significant. The positive relation between CEO extraversion and firm performance is consistent with the implication from Green et al. (2019) that CEO extraversion should be positively correlated with firm performance in normal periods. This relation, however, turns negative when firms operate in the crisis period, highlighting clear opposite impacts of CEO extraversion on firm performance between normal periods and crisis periods. Lastly, we

[15] Specifically, the coefficient on *ResidExtra* is positive and significant, thereby implying that CEO extraversion is positively correlated with firm performance in normal periods. It thus is consistent with the implication of Green et al. (2019) that extraverted CEOs lead to improvements in sales growth. The effect only turns negative when it is situated in the crisis period, as shown by the negative and significant coefficient on *Crisis*ResidExtra*.

Table 2
CEO Extraversion and Tobin's *q* around the Crisis.

	(1)	(2)	(3)	(4)	(5)	(6)
	2007Q1–2009Q1	2007Q1–2009Q1	2007Q1–2013Q4	2007Q1–2013Q4	2007Q1–2013Q4	2007Q1–2013Q4
ResidExtra					0.102***	
					(3.06)	
Crisis	−0.454***		−0.382***			
	(-8.20)		(-25.25)			
*Crisis*ResidExtra*		−0.061**	−0.054***	−0.053***	−0.075***	−0.053***
		(-2.94)	(-2.78)	(-3.63)	(-7.88)	(-3.34)
PostCrisis			−0.049***			
			(-2.89)			
*PostCrisis*ResidExtra*			0.010	0.010	0.025	0.035
			(0.38)	(0.37)	(1.08)	(1.30)
$Sales\_Growth_{t-1}$	−0.003	−0.017	−0.099***	−0.111***	−0.411***	−0.115***
	(-0.06)	(-0.72)	(-3.19)	(-3.18)	(-5.92)	(-3.43)
$Leverage_{t-1}$	−0.235	−0.038	−0.356**	−0.281*	−0.298*	−0.214
	(-0.91)	(-0.15)	(-2.20)	(-1.73)	(-2.04)	(-1.41)
Log_AT_{t-1}	−0.967***	−0.729***	−0.390***	−0.419***	−0.043***	−0.451***
	(-8.03)	(-5.88)	(-7.45)	(-5.85)	(-2.81)	(-6.23)
ROA_{t-1}	3.964***	3.943***	8.474***	7.908***	20.198***	7.907***
	(4.31)	(4.35)	(12.46)	(7.70)	(13.90)	(7.90)
$Fixed\_Assets_{t-1}$	−0.059	−0.023	0.009	−0.011	−0.196***	−0.004
	(-0.60)	(-0.87)	(0.44)	(-0.42)	(-3.96)	(-0.14)
$R\&D_{t-1}$	−1.136	−0.001	6.729***	6.131**	20.407***	7.869**
	(-0.60)	(-0.00)	(2.97)	(2.26)	(6.60)	(2.57)
Constant	9.279***	7.311***	4.622***	4.804***	1.429***	5.025***
	(10.15)	(7.90)	(11.41)	(8.72)	(10.65)	(9.02)
*(PostCrisis - Crisis)*ResidExtra*			0.064**	0.063**	0.101***	0.088**
p value			0.031	0.032	0.000	0.002
Firm_FE	Yes	Yes	Yes	Yes	No	Yes
YearQuarter_FE	No	Yes	No	Yes	No	No
Industry by YearQuarter	No	No	No	No	Yes	Yes
Obs.	9685	9685	28,191	28,191	28,191	28,191
Adj. R^2	0.844	0.857	0.780	0.799	0.421	0.811

The table reports our regression output for the relation between CEO extraversion, *ResidExtra*, and firm performance during and after the financial crisis. Columns 1 and 2 use the sample period of 2007Q1 – 2009Q1 and compare firm performance before and during the crisis period. Columns 3 to 6 use the sample period of 2007Q1 – 2013Q4 and compare firm performance before, during, and after the crisis period. *ResidExtra* is residual extraversion of CEOs leading the firm from 2006. The dependent variable is Tobin's *q*, measured as the quarterly market-to-book ratio. *Crisis* is a dummy variable equal to one for 2008Q4 and 2009Q1, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of 2009Q2 – 2013Q4, and zero otherwise. Definitions of all other variables can be found in the main text. *t*-statistics based on robust standard errors adjusted for firm- and quarter-level clustering are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

add both firm fixed effects and *Industry*×*YearQuarter* fixed effects in column 6 to allow identification to come from both time-series and within-industry cross-sectional variations, and the result stays robust.

Our model also provides information on the reversal of firm performance after the financial crisis by including the dummy variable *PostCrisis* for 2009Q2 to 2013Q4. The coefficient estimates on *PostCrisis*ResidExtra* in columns 3 and 4 are positive but statistically insignificant. This suggests that a poorer valuation of firms headed by extraverted CEOs during the GFC is unlikely due to market overreaction. When we compare the difference in the coefficient estimates between *PostCrisis*ResidExtra* and *Crisis*ResidExtra*, we find that firms with high CEO extraversion recover more from the performance deterioration at the onset of the crisis.[16]

In general, the result indicates that underperformance of extraverted CEOs is solely limited to the crisis period. It demonstrates that extraverted CEOs lead to poor firm performance only when an unanticipated shock hits the corporate governance system.

4.2. Stock market reactions

We also study how stock market reactions to the crisis differ by the extent of CEO extraversion. When investors and the overall economy face a catastrophic collapse in trust and confidence during the financial crisis (Tonkiss, 2009), the reward from stock markets for reliable and conservative executives should rise substantially.

On a monthly basis, we assess the impact of *ResidExtra* on monthly stock returns during and after the financial crisis. As in Lins et al.

[16] We also conduct a robustness test to show that CEO changes during the crisis do not qualitatively alter our results. In total, there are 262 (518) unique firms out of 1150 firms in our sample that dismiss their CEOs during (during and after) the crisis. We re-estimate the effect of extraversion score for CEOs appointed before the crisis on the crisis performance (baseline regression) after removing firms that change CEOs during (during and after) the crisis. As shown in Appendix Table A1, the coefficient on *Crisis*ResidExtra* continues to be negative and significant, indicating that the underperformance is less likely to be driven by the change of CEO.

(2017), we define *Crisis* as a dummy variable equal to one for the period of August 2008 to March 2009, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of April 2009 to December 2013, and zero otherwise. All regressions include firm fixed effects and year-month fixed effects.[17] The control variables remain the same as those used in Table 2 and measured on a quarterly basis.

Table 3 presents the regression results of this analysis. The coefficient estimates on *Crisis*ResidExtra* are negative and statistically significant. It shows that, right after the bankruptcy of Lehman Brothers, market participants perceive firms headed by CEOs with high extraversion scores to be poorly managed. The difference in the impact of CEO extraversion on stock returns after the crisis is, however, absent. Based on the insignificant coefficient on *PostCrisis*ResidExtra*, we can confirm that the negative market perceptions for firms run by extraverted CEOs are restricted to the time of crisis.[18]

Given that the overall risk premium is higher during the crisis, it is plausible that investors would discount risk-taking activities more heavily during the crisis period. The documented negative stock returns associated with extraverted CEOs during the crisis period are well in line with this explanation.

4.3. Operating performance

We previously focus on investor perceptions and examine whether investors' reward for low-CEO-extraversion firms increase markedly when the financial crisis weakens their confidence on extraverted CEOs. In this section, we turn our attention to the impact on firms' operating performance. We continue to use quarterly accounting and financial data and anatomize firms' operating outcomes during the financial crisis.

There are many possible ways that CEO characteristics matter for firm operating performance during the financial crisis. According to Botelho et al. (2017), even though charismatic extraverts are more favored by boards, "*introverts are slightly more likely to surpass the expectations of their boards and investors*." These authors study the relation between CEO personality and firm outcomes and discover that CEO extraversion negatively impacts firm's contemporaneous and future performance measured by return on assets and cash flow. Extraverted CEOs also result in higher firms' expected cost of equity capital due to their propensity to take more risk (Adebambo et al., 2019). Harrison et al. (2020) argue that investors consider firms run by extraverted CEOs as riskier, which may translate into higher costs of equity. Moral hazard problems arising from manager's personality traits can also affect debt holders' opinions about the firm's financial capacity to meet its debt obligations, especially when the financial crisis undermines creditors' confidence in firms' or their management team's overall creditworthiness. Given that operating performance is negatively related to costs of equity (e.g., Mitton, 2006) and that firms headed by extraverted CEOs are riskier and associated with higher costs of capital,[19] we predict that those firms will experience lower profitability during the crisis period when conservatism is preferred.

Table 4 presents the regression output concerning the impact of CEO extraversion on firm's sales growth, returns on assets, labor productivity, and gross margin. *Sales growth* is defined as percentage change in sales from year-quarter t - 1 to year-quarter t. Returns on assets, *ROA*, is quarterly operating income before depreciation scaled by total assets at the end of that quarter. *Labor productivity* is captured by the ratio of quarterly sales divided by year-end employees. *Gross margin* is calculated as sales minus cost of goods sold divided by sales, all measured on a quarterly basis.

The coefficient on *Crisis*ResidExtra* of sales growth is negative and statistically significant, indicating that firms with extraverted CEOs suffer lower revenue growth amid the financial crisis. The interaction term between *ResidExtra* and *Crisis* is negative and highly significant for ROA and labor productivity, indicating that high-CEO-extraversion firms exhibit lower profitability and lower contribution to employees' sales relative to other companies at the end of 2008 and the beginning of 2009. Last but not the least, the negative and significant coefficient on *Crisis*ResidExtra* of gross margin shows that firms with higher CEO extraversion are less able to sell their products at a higher mark-up when the financial crisis strikes the economy. The coefficients on *PostCrisis*ResidExtra* are insignificant for sales growth, ROA, and gross margin, though positive and weakly significant for labor productivity. This finding again reveals that the negative impact of CEO extraversion does not persist into the post-crisis period.

5. CEO dismissal and entrenchment

5.1. Forced CEO turnover during the crisis

In the crisis periods, companies may replace CEOs because of their poor performances. While we show that firms enter the crisis

[17] Since we control for year-month fixed effects, the market-adjusted return (subtracting monthly market return from raw return) becomes unnecessary and produces the same results as the monthly raw return reported in Table 3.

[18] As a robustness test, we also control for Hrazdil et al.'s (2020) risk tolerance measure, the results for *Crisis*ResidExtra* and *PostCrisis*ResidExtra* are qualitatively similar. We thank an anonymous referee for suggesting this.

[19] We argue that GFC provides a shift for the importance of managerial conservatism, hence an extraverted CEO with high risk-taking potential is less well-received during the financial crisis. To verify extraverted CEOs' risk-taking disposition, we test whether firms managed by extraverted CEO display higher tendency to take risk. Appendix Table A2 indicates that CEO extraversion is positively correlated with firm risk across pre-, during, and post-crisis periods. It is interesting to note that the associated between CEO extraversion and risk taking is even higher during the crisis-period. The results in Table A2 are apparently consistent with the literature that extraversion-associated risk-taking is a general trait-level tendency rather than specific to particular situations (Hampson et al., 2006; Nicholson et al., 2005).

Table 3
CEO extraversion and firm performance using monthly stock returns.

	(1)	(2)
	2007Q1–2009Q1	2007Q1–2013Q4
*Crisis*ResidExtra*	−0.005***	−0.006***
	(-3.06)	(-2.79)
*PostCrisis*ResidExtra*		−0.000
		(-0.27)
$Sales\_Growth_{t-1}$	0.023***	0.014***
	(3.43)	(2.76)
$Leverage_{t-1}$	0.059	0.057***
	(1.51)	(3.74)
Log_AT_{t-1}	−0.042**	−0.031***
	(-2.54)	(-7.46)
ROA_{t-1}	0.152	0.107*
	(1.22)	(1.80)
$Fixed\_Assets_{t-1}$	0.016*	0.006
	(2.02)	(1.51)
$R\&D_{t-1}$	−0.175	−0.183*
	(-0.97)	(-1.79)
Constant	0.282**	0.231***
	(2.30)	(7.33)
Firm_FE	Yes	Yes
YearMonth_FE	Yes	Yes
Obs.	29,439	85,704
Adj. R^2	0.263	0.289

The table reports our regression output for the relation between CEO extraversion, *ResidExtra*, and monthly stock returns during and after the financial crisis. Column 1 use the sample period of 2007Q1 – 2009Q1 while columns 3 uses the sample period of 2007Q1 – 2013Q4. *ResidExtra* is CEO residual extraversion. Dependent variable is monthly stock returns. *Crisis* is a dummy variable equal to one for the period of August 2008 to March 2009, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of April 2009 to December 2013, and zero otherwise. Definitions of all other variables can be found in the main text. *t*-statistics based on robust standard errors adjusted for firm- and month-level clustering are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

with extraverted CEOs underperform compared to counterparts with less extraverted CEOs, we further conjecture that firms headed by extraverted CEOs should be more apt to dismiss those CEOs. We obtain forced CEO turnover data based on Peters and Wagner (2014),[20] in which turnovers of CEOs for the reason of death, poor health, or acceptance of another position are not included in the forced CEO turnover data.

The following probit model is estimated to investigate the effects of residual extraversion for CEOs on the probability of being dismissed over the crisis period:

$$Dismiss_{it} = \beta_0 + \beta_1 ResidExtra_i + \gamma X_{it} + \varepsilon_{it} \quad (2)$$

where $ResidExtra_i$ is the residual extraversion score for CEO leading firm i from the pre-crisis year of 2006. $Dismiss_{it}$ is a binary variable which is equal to one when the board of a firm i dismisses that CEO in year t. We focus on the dismissal rate during the crisis from 2008 to 2010.[21] X_{it} is a vector of firm-level control variables that may correlate with the forced CEO turnover decisions. In our sample period, around 2% of firm-years have experienced forced CEO turnovers. Table 5 presents the regression results for Eq. (2) with (Fama-French 49 industry classification) industry and year fixed effects. Column 1 of Table 5 shows that the coefficient estimates for β_1 is positive and statistically significant, implying that extraverted CEOs have a higher probability of being discharged during the crisis. To further show that the forced dismissal is primarily driven by poorer firm performances, we interact *ResidExtra* with ΔQ and show our results in column 2. ΔQ is the change of Tobin's q, which is the difference between Tobin's q in the year of 2006 (before the crisis) and that in current year t (Crisis period). The positive and significant coefficient on *ResidExtra*ΔQ suggests that firms are more likely to replace CEOs when they face a steeper decline in their firm performances (i.e., larger ΔQ) after the crisis.

5.2. Split by CEO power or entrenchment

The connection between CEO extraversion and firm performance during the crisis is built on the argument that investors or financiers grow more concerned about moral hazard problems and expropriation by insiders after the collapse of Lehman Brothers due

[20] We thank Dr. Peters Florian for sharing the data of forced CEO turnover with us.
[21] We include the year of 2010 (though not defined as the crisis period in our baseline regression) since firm may make CEO turnover decision based on performance in the previous year.

Table 4
CEO extraversion and operating performance during the crisis.

	(1)	(2)	(3)	(4)
	Sales Growth	*ROA*	*Labor Productivity*	*Gross Margin*
*Crisis*ResidExtra*	−0.015*	−0.001**	−0.005**	−0.012*
	(-1.77)	(-2.14)	(-2.15)	(-1.84)
*PostCrisis*ResidExtra*	0.008	0.001	0.012*	−0.001
	(1.02)	(1.16)	(1.88)	(-0.60)
Sales_Growth	−0.139***	0.004	0.043***	−0.021***
	(-3.89)	(1.22)	(3.82)	(-2.84)
$Leverage_{t-1}$	0.066**	0.007	0.171	0.053**
	(2.28)	(1.39)	(1.03)	(2.26)
Log_AT_{t-1}	−0.075***	−0.007***	−0.054	−0.010
	(-8.19)	(-3.99)	(-0.72)	(-1.16)
ROA_{t-1}	−3.004***	0.428***	1.030***	1.030***
	(-7.20)	(9.75)	(6.92)	(6.92)
$Fixed\_Assets_{t-1}$	0.007	−0.001	0.002	0.002
	(0.48)	(-0.55)	(0.27)	(0.27)
$R\&D_{t-1}$	−1.188***	−0.133*	0.232	0.232
	(-2.91)	(-1.97)	(0.77)	(0.77)
Constant	0.706***	0.074***	0.422***	0.422***
	(8.89)	(5.53)	(6.42)	(6.42)
Firm_FE	Yes	Yes	Yes	Yes
YearQuarter_FE	Yes	Yes	Yes	Yes
Obs.	28,220	28,226	28,151	28,151
Adj. R^2	0.116	0.560	0.833	0.833

The table reports our regression output for the relation between CEO extraversion, *ResidExtra*, and firm operating performance during and after the financial crisis period of 2007Q1 – 2013Q4. *ResidExtra* is CEO residual extraversion. Dependent variable is *Sales Growth*, return on assets *ROA*, *Labor Productivity* or *Gross Margin*. *Crisis* is a dummy variable equal to one for 2008Q4 and 2009Q1, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of 2009Q2 – 2013Q4, and zero otherwise. Definitions of all other variables can be found in the main text. *t*-statistics based on robust standard errors adjusted for firm- and quarter-level clustering are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

to excessive risk taking. This concern is more pertinent when some CEOs possess more power due to their formal position and titles, or status as founders, or because CEO possess more comprehensive knowledge of the company's operating environment (Firstenberg & Malkiel, 1994). CEOs with more power over the board and other top executives have greater influence on firm decisions and outcomes (e.g., Adams et al., 2005; Lewellyn & Muller-Kahle, 2012). Powerful CEOs also negatively impact corporate governance practices by influencing board nomination process (Baldenius et al., 2014), discouraging monitoring (Onali et al., 2016), and decoupling boards from their strategic resource provision roles (Haynes & Hillman, 2010). In addition, firms' entrenchment provisions provide incumbents with protection from removal or the consequences of removal (Bebchuk et al., 2009). Therefore, CEOs who are insulated from the disciplinary threat of dismals are more likely to design self-serving firm policies.

We therefore expect the negative firm valuation of extraverted CEOs during the crisis to be more pronounced if these CEOs are powerful or protected from the threat of removal. To test this proposition, we repeat our main estimation, but now allow the effect of CEO extraversion on firm performance during the crisis to depend on whether the CEOs are powerful or highly entrenched. We measure CEO power using the status of being a founder (Li et al., 2019), being the chairman of the board of directors (D'Aveni & Kesner, 1993; Lewellyn & Muller-Kahle, 2012), and CEO entrenchment using the E-index developed by Bebchuk et al. (2009). *HighE* is a dummy variable equal to one if the E-index at year-end 2006 is higher than 3, which is the median of the sample distribution, and zero otherwise (the E-index lower than or equal to 3). *FOUNDER* is a dummy variable equal to one if the incumbent CEO at year-end 2006 is the same CEO 5 years before the IPO date reported by Compustat or before the first trading date reported by CRSP (Bebchuk et al., 2009; Li et al., 2019). *Chair* is a dummy variable equal to one if the incumbent CEO at year-end 2006 is also the chairman of the board.

Table 6 presents our regression results for whether the CEO extraversion-performance relation during the crisis is more prominent for powerful or entrenched CEOs. Even though the coefficient estimates on *Crisis*ResidExtra* are negative and statistically significant for all subsamples, the economic magnitude of the coefficient for the high E-index subsample is twice as large as that for the low E-index subsample. At the same time, the economic magnitude of the coefficient for the founder CEO subsample is almost three times higher than that for the non-founder CEO subsample. The same order of magnitude applies to the difference between chair CEO and non-chair CEO subsamples. To test whether the differences are significant, we run a pooled regression with a triple interaction term and present our findings in Panel B. It shows that the differences of *Crisis*ResidExtra* between high E-index and low E-index, between founder CEO and non-founder CEO, and between chair CEO and non-chair CEO subsamples are statistically significant at the 5% level.

Overall, the analysis in Table 6 shows that the influence of CEO extraversion on corporate performance during the crisis is more pronounced when these CEOs are powerful or entrenched.

Table 5
CEO extraversion and forced turnover during the crisis.

	(1)	(2)
	Dismissal	Dismissal
ResidExtra	0.160**	0.080
	(2.01)	(0.87)
Δq		0.164**
		(2.53)
*ResidExtra*Δq*		0.118**
		(2.13)
Log_AT	−0.060	−0.046
	(-1.32)	(-1.02)
Sales_Growth	−0.061	−0.146
	(-0.21)	(-0.49)
Fixed_Assets	0.046	0.081
	(0.36)	(0.62)
R&D	3.202***	3.111***
	(2.71)	(2.71)
ROA	−1.170	−1.513**
	(-1.52)	(-2.00)
Leverage	0.489	0.471
	(1.38)	(1.31)
Cash	−0.950**	−1.059**
	(-1.99)	(-2.17)
q	−0.547***	−0.546***
	(-3.79)	(-3.84)
Constant	−0.570	−0.746*
	(-1.31)	(-1.70)
Industry_FE	Yes	Yes
Year_FE	Yes	Yes
Obs.	2900	2754
Pseudo R^2	0.122	0.151

The table reports the probit regression results for the effects of residual extraversion for CEOs leading the firms from 2006 on the probability of being dismissed during the crisis. The regression period is from 2008 to 2010 on an annual basis. The dependent variable is a binary variable equal to one if there is forced CEO dismissal, and zero otherwise in a given year. *Δq* is the change of Tobin's *q*, which is the difference of the firm's Tobin's *q* in the year of 2006 (before the crisis) and current year *t* (Crisis period). Definitions of all other variables can be found in the main text. *t*-statistics based on robust standard errors are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

6. Robustness check and additional analyses

6.1. Clustered analysis

To investigate personality prototypes at the individual level, we perform clustered analysis using '*k*-means' clustering based on the similarity of CEOs' five personality traits. We start with the average call-level measures of CEO's extraversion, openness, agreeableness conscientiousness and emotional stability. We first standardize all CEOs' personality scores and compute all '*k*-means' solutions with different numbers of groups *k* (*k* is from 1 to 20). We then calculate the within sum of squares (WSS) or its logarithm (log(WSS)) for all cluster solutions (for all *k*). In order to determine the optimal cluster structure, we look for a 'kink' (i.e., smaller marginal change of WSS) in the plots of WSS and log(WSS) where the marginal reduction of WSS or log(WSS) is small enough.

Panel A of Table 7 shows a reduction of the WSS by 3.9% when $k = 5$ versus a reduction of 8.4% when $k = 4$. We, therefore, choose $k = 5$ as our optimal number of clusters.[22] We employ '*k*-means' clustering to achieve clusters with the highest within-cluster similarity and show the mean value of Big Five personality scores for CEOs in Panel B of Table 7. The results show that Group 1 displays relatively low scores while Group 2 displays modest scores for all personality traits. Group 3 comprises of CEOs with high conscientiousness. Group 5 has the highest score in extraversion but also displays high values in other four personality traits. Group 4 has a relatively high score in extraversion and displays relatively low scores in other four personality traits. We examine firm performance during and after the financial crisis if they are managed by CEOs that belong to Group 4 or Group 5 before the crisis.

Panel C of Table 7 presents the regression output. *Group4* (*Group5*) indicates CEO belonging to the Group 4 (Group 5) CEOs, as shown in Panel B. The coefficient estimate on *Group4*Crisis* in column 1 is both negative and statistically significant. The finding

[22] Even though there is a reduction of the WSS by 1.2% when $k = 14$ and a reduction by 0.5% when $k = 18$, we prefer a smaller number of clusters due to the limitation of our CEO samples.

Table 6
Sample split by CEO entrenchment and CEO power.

Panel A. Regressions for subsamples						
	(1)	(2)	(3)	(4)	(5)	(6)
	High E-index	Low E-index	Founder	Non-founder	Chair	Non-Chair
*Crisis*ResidExtra*	−0.107***	−0.046***	−0.146***	−0.045***	−0.076***	−0.021
	(-4.42)	(-6.68)	(-3.59)	(-2.83)	(-14.05)	(-0.72)
*PostCrisis*ResidExtra*	−0.044	0.016	0.067	0.004	0.033	0.024
	(-1.29)	(0.33)	(0.38)	(0.18)	(0.73)	(0.63)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm_FE	Yes	Yes	Yes	Yes	Yes	Yes
YearQuarter_FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3950	13,674	1867	26,323	13,662	14,352
Adj. R^2	0.837	0.816	0.762	0.802	0.835	0.801

Panel B. Tests of significant differences	
(1) Differences between 'High E-index' and 'Low E-index'	
*Crisis*ResidExtra*HighE*	−0.059**
t-statistic	(-2.69)
*PostCrisis*ResidExtra*HighE*	−0.054
t-statistic	(-0.94)
(2) Differences between 'Founder' and 'Non-founder'	
*Crisis*ResidExtra*Founder*	−0.099**
t-statistic	(-2.61)
*PostCrisis*ResidExtra*Founder*	−0.067
t-statistic	(-0.80)
(3) Differences between 'Chair' and 'Non-Chair'	
*Crisis*ResidExtra*Chair*	−0.062**
t-statistic	(-2.36)
*PostCrisis*ResidExtra*Chair*	−0.004
t-statistic	(-0.08)

Panel A reports our regression output for the relation between CEO extraversion, *ResidExtra*, and crisis firm performance by dividing the sample based on CEO entrenchment and CEO power (indicated by whether CEO is the founder or is the chairman of the board). Column 1 (2) presents the results when the E-index at year-end 2006 is higher than (lower or equal to) 3, which is the median of the sample distribution. Column 3 (4) presents the results when the CEO at year-end 2006 is (not) a founder. Column 5 (6) presents the results when the CEO at year-end 2006 is (not) a chairman of the board of director. *ResidExtra* is residual extraversion for CEO. The dependent variable is *Tobin's q*, measured as the quarterly market-to-book ratio. *Crisis* is a dummy variable equal to one for 2008Q4 and 2009Q1, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of 2009Q2 – 2013Q4, and zero otherwise. Panel B shows the tests of significant differences in the interaction coefficients. *HighE* is a dummy variable equal to one if E-index at year-end 2006 is above the sample median, and zero otherwise. *Founder* (*Chair*) is a dummy variable equal to one if the CEO at year-end 2006 is also a founder (a chair of the board). *t*-statistics based on robust standard errors adjusted for firm- and quarter-level clustering are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

suggests that firms with high CEO extraversion in 2006 perform worse during the crisis, and the effect is not confounded by other CEO personality patterns such as emotional stability or conscientiousness.[23]

6.2. Additional controls

Extraversion is long considered as the strongest and the most consistent predictor of leadership (e.g., Judge et al., 2002). However, psychological profiles can display unique patterns of association and cluster geographically.[24] To rule out the possibility that other personality traits of CEO than extraversion drive our results, we control for the impact of other aspects of CEO personality.

Table 8 presents the regression results of this analysis. The coefficient on *Crisis*ResidExtra* remains negative and statistically significant when we add all interaction terms between other aspects of CEO personality and *Crisis* (*PostCrisis*) into the regression (column 1), consistent with the theory of CEO extraversion being the most important trait of leaders.

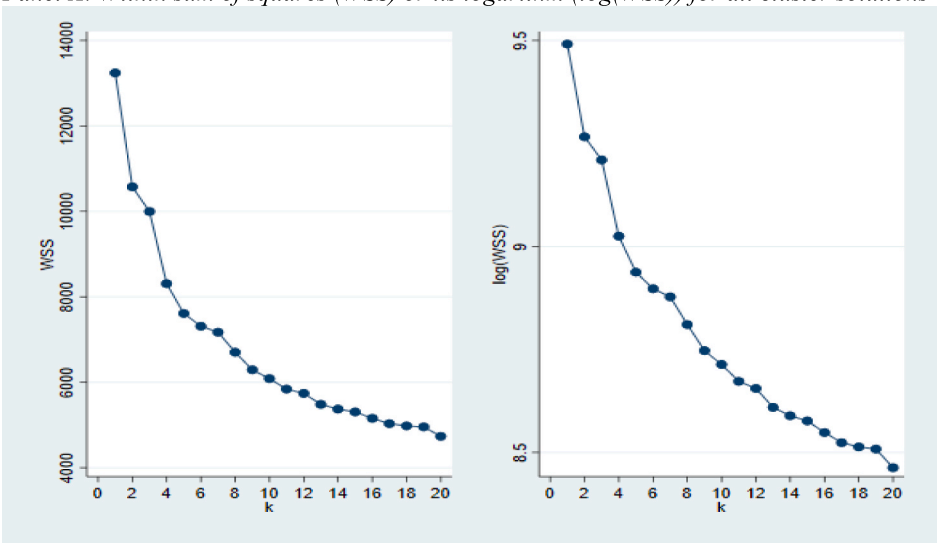
Moreover, company-wide stock and option plans can exert a substantial impact on CEOs' risk-taking incentives and risk

[23] The coefficient estimate on *Group5*Crisis* in column 5 is also significantly negative. It shows that firms managed by the group of CEOs that score the highest in extraversion witness their value fall by more during the crisis. The coefficient estimates on *Group4*Crisis* and *Group5*Crisis* remain negative and statistically significant when both are included in the regression. Again, the negative valuation for CEO extraversion is only confined to the crisis period as manifested by the loss of significance on *Group4*PostCrisis* and *Group5*PostCrisis*, that is because investors may begin to restore confidence due to regulatory responses to the financial crisis such as the Dodd-Frank Act to improve financial stability (Haddon, 2015).

[24] For example, people in the north central Great Plains and in the South are found to have both high extraversion and low neuroticism, low openness, high agreeableness, and high conscientiousness (Rentfrow et al., 2013). According to Rentfrow et al. (2013), the profile for Cluster 1 predominantly comprises states in the north central Great Plains and in the South. Thus, an extraverted individual can also be more emotionally stable and more conscientious.

Table 7
CEO Extraversion and Tobin's *q*, a Clustered Analysis.

Panel A: Within sum of squares (WSS) or its logarithm (log(WSS)) for all cluster solutions



Panel B: Average Big Five scores by cluster profile

Group	Extraversion	Emotional Stability	Conscientiousness	Openness	Agreeableness
1	3.92	3.10	3.49	3.64	3.53
2	3.48	3.08	3.63	3.74	3.61
3	4.07	3.27	3.85	3.81	3.71
4	4.37	3.22	3.55	3.67	3.62
5	4.71	3.38	3.84	3.79	3.77

Panel C: High-extraversion groups and Tobin's q during crisis

	(1)	(2)	(3)
*Group4*Crisis*	-0.087***		-0.110***
	(-3.24)		(-3.97)
*Group4*PostCrisis*	0.003		-0.013
	(0.07)		(-0.28)
*Group5*Crisis*		-0.079**	-0.108***
		(-2.40)	(-3.20)
*Group5*Postcrisis*		-0.067	-0.071
		(-1.43)	(-1.41)
Controls	Yes	Yes	Yes
Firm_FE	Yes	Yes	Yes
YearQuarter_FE	Yes	Yes	Yes
Obs.	85,834	85,834	85,834
Adj. R^2	0.803	0.803	0.804

Panel A plots the within sum of squares (WSS) or its logarithm (log(WSS)) for all number of clusters. Panel B displays the mean values of Big Five scores for CEOs for groups generated using '*k*-means' clustered analysis based on the similarity of the five personality traits. Group 5 has the highest score in average extraversion and displays high values in other four personality traits. Group 4 has high score in average extraversion but displays relatively low

Table 8
Controlling for other aspects of personality traits and risk-taking incentives.

	(1)	(2)	(3)
*Crisis*ResidExtra*	−0.043***	−0.046***	−0.031**
	(-3.03)	(-3.55)	(-2.33)
*PostCrisis*ResidExtra*	0.002	0.018	0.010
	(0.06)	(0.63)	(0.30)
*Crisis*AveEmoS*	−0.011		−0.034
	(-0.19)		(-0.37)
*PostCrisis*AveEmoS*	0.193*		−0.103
	(1.78)		(-1.04)
*Crisis*AveAgre*	−0.151		−0.029
	(-1.50)		(-0.44)
*PostCrisis*AveAgre*	−0.039		0.145
	(-0.25)		(1.34)
*Crisis*AveOpen*	0.226**		−0.211*
	(2.54)		(-1.94)
*PostCrisis*AveOpen*	−0.034		0.003
	(-0.19)		(0.02)
*Crisis*AveCons*	−0.044		0.233**
	(-0.53)		(2.34)
*PostCrisis*AveCons*	−0.153		−0.077
	(-1.55)		(-0.44)
*Crisis*Vega*		−0.089**	−0.100**
		(-2.07)	(-2.28)
*PostCrisis*Vega*		−0.144**	−0.137**
		(-2.69)	(-2.46)
*Crisis*Delta*		0.000	0.000
		(0.09)	(0.43)
PostCrisis Delta*		−0.001	−0.001
		(-0.61)	(-0.73)
Controls	Yes	Yes	Yes
Firm_FE	Yes	Yes	Yes
YearQuarter_FE	Yes	Yes	Yes
Obs.	28,191	26,824	26,824
Adj. R^2	0.800	0.795	0.796

The table reports our regression output for the relation between CEO extraversion, *ResidExtra*, and firm performance during and after the financial crisis, after controlling for the effects of other CEO personality traits during 2007Q1 – 2013Q4. *ResidExtra* is residual extraversion for CEOs. The dependent variable is Tobin's *q*, measured as the quarterly market-to-book ratio. *Crisis* is a dummy variable equal to one for 2008Q4 and 2009Q1, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of 2009Q2 – 2013Q4, and zero otherwise. *AveAgre* (*AveCons*, *AveEmoS*, *AveOpen*) is the weighted average call-level measure of CEO's agreeableness (conscientiousness, emotional stability, openness) for CEOs. *Vega* (*Delta*) are risk incentive measures for CEOs. All regressions include controls from Table 2 *t*-statistics based on robust standard errors adjusted for firm- and quarter-level clustering are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

preferences, which as a result have a meaningful effect on firm outcomes (Chava & Purnanandam, 2010; Coles et al., 2006). Following Core and Guay (2002), we employ the aggregate value of the options and stocks held in the CEO's portfolio to measure sensitivity of the CEO's wealth to the firm's stock price or stock price volatility. We utilize both the sensitivity to stock price (delta)[25] and the sensitivity to stock-return volatility (vega).[26] We include the interaction term between CEO risk-taking incentives (*Delta* and *Vega*) and *Crisis* (*PostCrisis*) in column 2 and add both interaction terms with risk-taking incentives and other personality traits of CEO in column 3. The coefficients on *Crisis*ResidExtra* continue to be negative and significant, implying that the effects of extraversion do not simply capture the impact of CEO's holdings of equity incentives. [27]

6.3. Shocks to the credit supply

We have so far examined the costs of having an extraverted CEO with a shock to the corporate governance or trust system (Kirkpatrick, 2009; Tonkiss, 2009) when investors or the economy lost faith in firms employing high risk-taking managers. It is also

[25] This is the change in the equity portfolio value (in thousands) for a 1% change in the stock price.
[26] This is the change in the equity portfolio value (in thousands) for a 0.01 change in the annualized standard deviation of stock returns.
[27] For other CEO personality traits, we find that the effects of CEO openness, emotional stability, and conscientiousness on firm performance are sensitive to the presence of risk-taking incentives. While both openness and extraversion motivate risk taking (Nicholson et al., 2005), openness and conscientiousness are related with innovation (Judge & Zapata, 2015; Lee, 2017). After controlling for risk-taking incentives, the effect of openness turns negative whereas conscientiousness shows a significantly positive impact on firm performance. The latter result seems consistent with Lee (2017) and suggests that innovation through hard work is valuable during crisis.

possible that high-CEO-extraversion firms underperform in general, irrespectively of the shock to governance or trust.[28]

Table 9 presents our regression results on the tests whether CEO extraversion is related to firm performance during the period of the credit supply contraction. *Credit_Supply* is a dummy variable equal to one for the period of 2007Q3 - 2008Q2.[29] The coefficient estimate on *Credit_Supply*ResidExtra* is statistically insignificant in column 1 and even turns significantly positive in column 2 when one controls for post-crisis performance. It hence shows that the negative impact of CEO extraversion is only present when there is a shock to the importance of governance, and not the shock to credit supply. Quite the contrary, firms managed by extraverted CEOs are beneficial during the credit contraction in part because the sociability of extraverted CEOs allow them to maintain or develop good social interactions with financiers or governments (Nadkarni & Herrmann, 2010).

6.4. CEO overconfidence

Schaefer et al. (2004) find that extraversion, holding other Big Five scores constant, is a significant preditor for overconfidence. In turn, CEO overconfidence is associated with judgmental errors in which CEOs overestimate their own accuracy.[30] To the extent that an extraverted CEO is also prone to be an overconfident CEO, firms with high CEO extraversion may be reluntant to terminate ongoing negative NPV projects due to an underestimation of the project uncertainty in a crisis environment.[31] In this section, we aim to answer this question by performing a path analysis to better understand the mechanisms through which CEO extraversion affects firm performance during the crisis.

Table 10 presents the results of the path analysis. Column 1 of Panel A shows the impact of CEO extraversion after controlling for the effects of CEO overconfidence.[32] Column 2 shows the cross-sectional regression results of CEO overconfidence on CEO extraversion in the year of 2006. Panel B shows the results of path analysis in which a direct path is captured by the coefficient on *Crisis*ResidExtra* in column 1 of Panel A, and an indirect path is measured by the product of *Crisis*Confidence* in column 1 and *ResidExtra* in column 2 of Panel A. We assess the significance of the indirect path using the Sobel (1982) test statistics.

Overall, we find that CEO extraversion has a significant and negative indirect effect on firm performance as a result of overconfidence during the crisis, with a *t*-statistic of −2.64. More importantly, CEO extraversion also directly impacts firm performance during the crisis beyond the effect of CEO overconfidence, as demonstrated by a *t*-statistic of −3.45 shown in Panel B. The magnitude of the direct effect is nearly ten times of that for the indirect effect. This finding shows that the relation between CEO extraversion and corporate performance is mostly a direct one, rather than a mediated path of overconfidence.

7. Conclusions

There has been a strong and continuing interest in the dispositional foundations of leadership. Given extraversion is the most important personality trait that is consistently associated with leadership emergence and effectiveness (Judge et al., 2002) and professional performance (e.g., Becker et al., 2019; Green et al., 2019), we seek to investigate whether the extraversion of CEOs is associated with corporate performance during the global financial crisis.

We trace CEO extraversion from Green et al. (2019) and employ a difference-in-difference analysis surrounding the onset of the global financial crisis (GFC). Contrary to the expectation that extraverted CEOs should help firms navigate the financial crisis better, we document findings that CEO extraversion is consistently associated with several poorer corporate outcomes during the financial crisis. Specifically, we show that CEO extraversion is negatively associated with Tobin's *q* during the crisis. And we posit that negative relation between crisis-performance and CEO extraversion can be explained by the risk-taking propensity of CEO. We also provide empirical support that those extraverted CEOs are more likely to experience forced turnover during the crisis. Such relation is robust to tests using stock returns. We also show that CEO extraversion is linked to several poorer measurements of firm operations. Our results are economically significant and survive a battery of robustness and identification tests. Finally, in a path analysis, we find that CEO extraversion directly impacts firm performance during the crisis after controlling for overconfidence, aside from a significant negative

[28] For example, firms run by extraverted CEOs can perform poorly because extraverted CEOs are more optimistic about firms' economic standings and pursue aggressive (but not suboptimal) corporate policies before the crisis, and such aggressive investment or financial policies may be detrimental to the firm when there is a significant decline in the credit supply (e.g., Duchin et al., 2010). We hence investigate whether our results could be driven by the deterioration in the supply of credit that firms face during the financial crisis.

[29] The timeline is close to the setup of Lins et al. (2017) which uses the period of July 2007 through July 2008 to study a shock to the credit supply.

[30] Extant literature also shows that CEO overconfidence is an important leadership attribute that could lead to suboptimal investment decisions (Doukas & Petmezas, 2007; Malmendier & Tate, 2005, 2008), greater financial leverage (Malmendier et al., 2011), higher propensity to crash (Kim et al., 2016), and lower dividend payments (Deshmukh et al., 2013). A recent study by You et al. (2020) also presents a direct negative effect of overconfidence on stock returns.

[31] It thus results in a negative relation between CEO extraversion and crisis performance via the effect of CEO overconfidence. While CEO overconfidence leads to an irrational estimation on the uncertainty of project returns, a natural question that arises is whether CEO extraversion, aparting from representing decision-making biases or judgmental errors, harms firm valuation by serving as a catalyst for managerial value-destroying risk-taking behavior, or by directly impacting investors' and other market participants' (such as creditors, consumers or analysts) perceived likelihood of managerial misconduct during the financial crisis.

[32] We follow Kim et al. (2016) and measure CEO overconfidence with a continous variable. CEO overconfidence is defined as the average value per vested option scaled by the average strike price of those options. We assess the magnitude of a direct path from CEO extraversion to firm performance during the crisis and that of an indirect path from CEO extraversion to firm performance via CEO overconfidence.

Table 9
CEO Extraversion and Tobin's *q*, and Shocks to the Credit Supply.

	(1)	(2)
*Credit_Supply*ResidExtra*	0.010	0.031*
	(0.44)	(2.00)
*Crisis*ResidExtra*	−0.054*	−0.038***
	(-2.00)	(-2.81)
*PostCrisis*ResidExtra*		0.026
		(0.95)
Sales_Growth $_{t-1}$	−0.018	−0.111***
	(-0.73)	(-3.19)
Leverage $_{t-1}$	−0.039	−0.281*
	(-0.16)	(-1.73)
Log_AT $_{t-1}$	−0.730***	−0.419***
	(-5.88)	(-5.85)
ROA $_{t-1}$	3.937***	7.906***
	(4.35)	(7.71)
Fixed_Assets $_{t-1}$	−0.023	−0.011
	(-0.88)	(-0.42)
R&D $_{t-1}$	−0.004	6.129**
	(-0.00)	(2.25)
Constant	7.313***	4.803***
	(7.91)	(8.72)
Firm_FE	Yes	Yes
YearQuarter_FE	Yes	Yes
Obs.	9685	28,191
Adj. R^2	0.857	0.799

The table reports our regression output for the relation between CEO extraversion, *ResidExtra*, and crisis firm performance when a shock to the credit supply hits the economy. Column 1 uses the sample period of 2007Q1 – 2009Q1 and compare firm performance before and during the crisis period. Column 2 uses the sample period of 2007Q1 – 2013Q4 and compare firm performance before, during, and after the crisis period. *ResidExtra* is CEO residual extraversion. The dependent variable is *Tobin's q*, measured as the quarterly market-to-book ratio. *Credit_Supply* is a dummy variable equal to one for the period of 2007Q3 – 2008Q2. *Crisis* is a dummy variable equal to one for 2008Q4 and 2009Q1, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of 2009Q2 – 2013Q4, and zero otherwise. Definitions of all other variables can be found in the main text. *t*-statistics based on robust standard errors adjusted for firm- and quarter-level clustering are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

indirect effect on firm performance via the path of overconfidence.

A large body of research is interested in understanding what shapes CEOs in determining corporate policy and performance. While prior research has focused on professional and education background (Custodio & Metzger, 2014; Kalelkar & Khan, 2016), a rising set of studies investigate personal experiences and predispositions (Green et al., 2019; Ho et al., 2016; Srinidhi et al., 2011). Our study demonstrates the importance of CEO extraversion, a novel and exogenous personal predisposition, in shaping corporate outcomes. Most importantly, we show that the extraversion characteristic of CEOs is associated with contrasting corporate outcomes in 'stressed' periods as compared to 'normal' periods.

Our study also offers implications for future research avenues. First, research should investigate whether the relation between CEO attributes and corporate performance is conditional on economic conditions. This is especially important when the CEO is powerful and has influence over crucial corporate decisions. The exogeneity of the GFC and the unprecedented challenges that corporate leaders had to face during this period offer a strong setting to identify how leadership influences corporate performance. Second, while extraversion of CEO is arguably the most important characteristic because CEOs set the tone at the top, other studies may also explore the effect of extraversion of the board of directors or other key personnel in influencing corporate outcomes, especially when decision making is the product of group consensus.

Data availability

Data will be made available on request.

Table 10
The impact of extraversion via overconfidence.

Panel A: Two-stage regressions			
	(1)		(2)
	Tobin's q		*Confidence*
*Crisis*ResidExtra*	−0.050***	*ResidExtra*	0.155***
	(-3.45)		(3.22)
*PostCrisis*ResidExtra*	0.013		
	(0.45)		
*Crisis*Confidence*	−0.019***		
	(-4.54)		
*PostCrisis*Confidence*	−0.011***		
	(-2.83)		
Constant	4.792***		0.955***
	(8.76)		(16.87)
Controls	Yes		No
Firm_FE	Yes		No
YearQuarter_FE	Yes		No
Obs.	28,191		4597
Adj. R^2	0.800		0.001

Panel B: Path analysis		
	Coef.	*t* stats.
Direct effect (*Crisis*ResidExtra*)	−0.050***	−3.45
Indirect effect of Extraversion through overconfidence (the product of *Crisis*Confidence* and *ResidExtra*)	−0.003***	−2.64

This table presents the results of a two-stage regression analysis that examines the relation between CEO extraversion, *ResidExtra*, and crisis firm performance via the channel of CEO overconfidence. CEO overconfidence is defined as the average value per vested option scaled by the average strike price of those options. Column 1 of Panel A shows the impact of CEO extraversion after controlling for the effect of CEO overconfidence. Column 2 of Panel A shows the cross-sectional regression results of CEO overconfidence on CEO extraversion in the year of 2006. Panel B shows the results of a path analysis that measures the magnitude of a direct path from *Crisis*ResidExtra* to *Tobin's q* and an indirect path from *Crisis*ResidExtra* to Tobin's *q* via CEO overconfidence based on the coefficient of *ResidExtra* shown in column 2 of Panel A. *ResidExtra* (*Confidence*) is CEO residual extraversion (CEO overconfidence). *Crisis* is a dummy variable equal to one for 2008Q4 and 2009Q1, and zero otherwise. *PostCrisis* is a dummy variable equal to one for the period of 2009Q2 – 2013Q4, and zero otherwise. *t*-statistics based on robust standard errors adjusted for firm- and quarter-level clustering are given in brackets in Panel A. *t* statistics in Panel B is computed using the "Sobel" test statistics (Sobel, 1982). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix

Table A1
CEO Extraversion and Tobin's *q* with consistent CEOs

	(1)	(2)
	2007Q1-2013Q4	2007Q1-2013Q4
*Crisis*ResidExtra*	−0.060***	−0.062***
	(-4.20)	(-3.42)
*PostCrisis*ResidExtra*	−0.026	−0.005
	(-0.95)	(-0.16)
Controls	Yes	Yes
Firm_FE	Yes	Yes
YearQuarter_FE	Yes	Yes
Obs.	21,386	14,334
Adj R^2	0.800	0.806

The table reports our baseline regression output for the effects of CEO *ResidExtra* on crisis firm performance, focusing on the sample of firms run by the same CEO before and during (before, during, and after) the financial crisis. In column 1, we present our results for the sample of same CEOs before and during the crisis, and in column 2 we show the results for the sample of same CEOs before, during and after the crisis. The sample period is 2007Q1 – 2013Q4. *t*-statistics based on robust standard errors are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A2
CEO Extraversion and Firm Risk Taking in the Pre-, During, and Post-Crisis Periods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Volatility	Leverage	Investment	Volatility	Leverage	Investment	Volatility	Leverage	Investment
	Pre-crisis (2006)			Crisis (07–08)			Post-crisis (09–13)		
ResidExtra	0.000*	0.010***	0.000	0.001***	0.013***	0.001***	0.001***	0.017***	0.001***
	(1.75)	(2.92)	(1.20)	(3.09)	(5.33)	(3.58)	(5.33)	(9.95)	(4.41)
Fixed_Assets	−0.001***	0.036***	0.013***	0.000	0.034***	0.014***	0.001***	0.024***	0.011***
	(-2.99)	(5.19)	(16.34)	(0.36)	(6.18)	(24.65)	(3.83)	(7.02)	(35.19)
ROA	−0.030***	−0.851***	0.096***	−0.087***	−0.690***	0.105***	−0.083***	−0.438***	0.068***
	(-5.48)	(-8.83)	(10.73)	(-15.07)	(-8.86)	(17.69)	(-17.85)	(-6.17)	(12.93)
Sale_growth	0.001	0.020	−0.002***	0.000	0.004	−0.003***	0.001	0.009*	−0.002***
	(1.28)	(1.56)	(-3.39)	(0.16)	(0.66)	(-5.72)	(1.62)	(1.65)	(-3.79)
Log_AT	−0.002***	0.025***	−0.001***	−0.003***	0.025***	−0.001***	−0.003***	0.028***	−0.000***
	(-32.28)	(15.21)	(-8.36)	(-33.28)	(20.60)	(-11.49)	(-53.06)	(34.32)	(-8.76)
Industry_FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs.	4325	4340	4330	8602	8655	8634	19,489	19,562	19,536
Adj. R^2	0.366	0.188	0.300	0.187	0.157	0.320	0.221	0.176	0.314

The table reports the cross-sectional regression results for the effects of residual CEO extraversion on firm risk in the pre-crisis period (the year of 2006), during the crisis (the years of 2007 and 2008), and the post-crisis period (2009–2013). Firm risk is measured by volatility (*Volatility*), financial leverage (*Leverage*), and investment (*Investment*), respectively. Definitions of all other variables can be found in the main text. *t*-statistics based on robust standard errors are given in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

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