



Does overconfidence pay off when things go well? CEO overconfidence, firm performance, and the business cycle

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Abstract

We investigate the moderating effect of the business cycle on the positive relationship between CEO overconfidence and firm performance. We propose that the expansion years of the business cycle enhance the positive impact of overconfident CEOs on firms' performance. However, this effect is reduced during recession periods. We analyze the effect of CEO overconfidence on the Return on Equity of publicly listed US firms from 1992 to 2015, a period that includes the bursting of the dot-com bubble in 2001 and the Great Recession of 2008–2009. The empirical findings support the hypotheses that expansion periods increase the positive relationship between overconfident CEOs and firms' performance, but this positive effect weakens during recessions.

Keywords

business cycle, CEO overconfidence, firm performance, recessions

Overconfidence is likely the most important psychological bias (Mannes and Moore, 2013). Nobel laureate Daniel Kahneman has argued that it is the one bias that he would eliminate if he had a magic wand. Werner DeBondt and another Nobel laureate, Richard Thaler (1995), went on to argue that “perhaps the most robust finding in the psychology of judgment is that people are overconfident” (p. 389). Indeed, overconfidence is widespread among executives (Heaton, 2002;

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Larwood and Whittaker, 1977), entrepreneurs (Forbes, 2005), and hiring managers (Kausel et al., 2016).

Overconfidence refers to being more confident than reality justifies (Chen et al., 2019; Moore and Healy, 2008), which leads individuals to overestimate their performance and the accuracy of their predictions (Gutierrez et al., 2020). Antecedents have identified that people in positions of power are likely to experience overconfidence (Fast et al., 2012). Perhaps as a result of their powerful positions, CEOs are especially prone to overconfidence, which has significant consequences for firm outcomes (Malmendier and Tate, 2015). For example, Malmendier and Tate (2008) found that overconfident CEOs are 55% more likely to undertake a merger than non-overconfident CEOs.

Researchers have found that CEOs tend to overestimate the success of their corporate decisions (Malmendier and Nagel, 2011; Malmendier and Tate, 2005), underestimate the variance of stock market returns and other financial signals (Ben-David et al., 2013; Gervais et al., 2011), and attribute too much of their firms' accomplishments to their own skill rather than external factors (Deshmukh et al., 2018; Hayward et al., 2004). Some scholars are more likely to consider overconfident CEOs in a negative light due to these factors. For example, in a review paper, Meikle et al. (2016) concluded, "CEO overconfidence can lead to ill-fated acquisitions, lax lending standards, and may ultimately put the firm at risk through aggressive financing decisions" (p. 128). This is consistent with a view from behavioral decision theory that states that good decision-making skills involve well-calibrated judgments (Hayward et al., 2010; Kahneman, 2011).¹

Despite this negative view, recent developments in the psychology of judgment and decision-making (JDM) and evolutionary biology tend to challenge this perspective. First, Gigerenzer and their colleagues have developed a program of research on the benefits of fast and frugal heuristics (Gigerenzer, 2018; Gigerenzer and Gaissmaier, 2011; Luan et al., 2019). For example, some authors argue that decisions based on simple heuristics can be surprisingly effective—though not optimal—in many environments (Bingham and Eisenhardt, 2011; Sull and Eisenhardt, 2012; Vitanova, 2019). Thus, overconfident CEOs, who are more likely to make bold decisions based on fewer variables, may have an edge in select situations. Second, Johnson and Fowler (2011), inspired by evolutionary biology, have developed formal models suggesting that individuals and populations tend to become overconfident over time. In particular, Johnson and Fowler argue that overconfidence triggers ambition and the credibility of generating a self-fulfilling prophecy that increases the probability of success (see also Schwarzmann and Van der Weele, 2019). This is particularly important in some facets of firm performance. For example, given that a key element of innovation is confidence in the promotion of ideas (Madrid et al., 2014; Scott and Bruce, 1994), research has found a positive relationship between CEO overconfidence and innovative success, especially in competitive industries (Galasso and Simcoe, 2011; Hirshleifer et al., 2012).

A recent meta-analysis examined the relationship between CEO overconfidence and firm performance (Burkhard et al., 2018). Burkhard et al. (2018) found a small, positive relationship; however, they also found large heterogeneity across studies, suggesting that the overconfidence–performance relationship is likely moderated by other factors. As such, the objective of our study is to examine a critical, contextual variable in the positive relationship between CEO overconfidence and firm performance that has not been studied: the business cycle (Ho et al., 2016 is the only study we are aware of and focus on financial crises). It is an essential and relevant gap in the literature, given not only the importance of this cognitive bias but also the critical effect of the business cycle on firm performance. The business cycle affects the evolution of industries' competitive dynamics, altering the levels of environmental munificence and, consequently, competitive pressures. It includes periods of expansion with periods of contraction, or recessions. The periods of economic expansion reinforce the natural growth trend of industry evolution, increasing industry

munificence and reducing competitive pressures. Instead, the periods of macroeconomic recessions mitigate industry growth or even reduce it, increasing rivalry and bankruptcies (Chakrabarti et al., 2007, 2011; Garcia-Sanchez et al., 2014; Ghemawat, 1993; Latham, 2009; Mascarenhas and Aaker, 1989).

In this article, we adopt the perspective that CEO overconfidence is a trait that positively contributes to firm performance. However, we argue that the business cycle moderates the relationship between CEO overconfidence and firm performance. We posit that economic expansion years enhance the positive relationship between overconfident CEOs and firms' performance; however, this positive effect weakens during recessions. As expansion periods reinforce the natural growth trend of the industry, they also reinforce positive feedback of overconfident CEOs' decisions, amplifying the performance effect. This positive effect becomes smaller during recessions due to the increase in the importance of the negative aspects of overconfident CEOs.

To test our hypotheses, we analyzed firm performance across different industries in the United States, collecting data from publicly listed US companies from 1992 to 2015, a period that includes the bursting of the dot-com bubble in 2001 and the Great Recession of 2008–2009. We measured financial performance as Return on Equity (ROE) and measured CEO overconfidence based on the method of stock option exercise (Malmendier and Tate, 2008). This widely accepted approach relies on the fact that CEOs who choose to hold in-the-money stock options are seen as overconfident (Hirshleifer et al., 2012). The empirical analysis on a panel of data that covers 220 industries, 1712 companies, and 15,217 firm-year observations for the period under analysis supports our hypotheses.

Our research makes several contributions to the literature. First, it contributes to the long-lasting debate on the effects of overconfidence on firm performance by adopting the view that the effects are positive. Second, it expands the understanding of overconfidence on firm performance focusing on the particular context of the business cycle. Finally, it contributes to the body of research examining the impact of business cycles on firm performance. Previous studies analyzed optimal behavior during expansions and recessions; instead, we examine decisions that might not appear as optimal. Therefore, we help to reconcile a rational perspective on business cycles with a more behavioral perspective.

Theory and hypotheses

Overconfidence is among the most common and studied biases for executives (Galasso and Simcoe, 2011; Li and Tang, 2010; Malmendier and Tate, 2015; Tang et al., 2015). It has been defined as an “unwarranted belief in the correctness of one’s answers” (Koriat et al., 1980). Among executives and CEOs, overconfident leaders are those who overestimate either the future performance of their firm or their capacity to predict this performance (Cain et al., 2015; Vitanova, 2019). Indeed, overconfidence can explain firm decisions and strategies undertaken by their CEOs (Busenitz and Barney, 1997; Ho et al., 2016; Malmendier and Tate, 2005; Zacharakis and Shepherd, 2001), primarily because overconfidence is particularly prevalent in domains that have inherently high levels of uncertainty.

We note an important distinction between overconfidence and other related constructs: narcissism, core self-evaluations (CSE), and celebrity. Narcissism is a broader construct including some facets that do not apply to overconfidence. For example, an important characteristic of narcissistic individuals is a lack of concern about others, as well as selfishness (Campbell, 1999; Grijalva and Harms, 2014). Overconfident individuals do not necessarily dislike other people. CSE is also a broad construct encompassing four interrelated traits: generalized self-efficacy, self-esteem, internal locus of control, and emotional stability (Judge and Bono, 2001). Emotional

stability is not a trait that typically characterizes individuals showing overconfidence (Schaefer et al., 2004). In the case of CEO celebrity, Hayward et al. (2004) explain that it “arises when journalists broadcast the attribution that a firm’s positive performance has been caused by its CEO’s actions” (p. 649). As such, in contrast to CEO overconfidence, CEO celebrity is defined in terms of others’ attributions rather than individuals’ actions or decisions, although overconfidence can be a predictor of celebrity.

We also note that hubris is typically used interchangeably with overconfidence in management research (Hayward and Hambrick, 1997; Hayward et al., 2006; Li and Tang, 2010). For example, Hiller and Hambrick (2005) argue that hubris refers to “exaggerated self-confidence,” which is equivalent to the idea of overconfidence (p. 306). Li and Tang (2010) use these constructs interchangeably throughout their paper. Some authors (e.g. Hayward et al., 2006) propose a more specific operationalization of overconfidence, as the overestimation of return on investment, or overestimation of the success of future projects. However, even Hayward et al. (2006: 169) use hubris and overconfidence interchangeably (e.g. “a hubris theory (of entrepreneurship) examines the role of founders’ overconfidence in starting and managing ventures”).

Research on CEO overconfidence and its effect on firm outcomes have adopted two perspectives. On one hand, CEO overconfidence may have potentially negative effects. Some studies have suggested that overconfidence has adverse effects on investing in projects, making acquisitions, and forecasting a firm’s outcomes (Chen et al., 2015; Ho et al., 2016; Hribar and Yang, 2016; Hsieh et al., 2014; Malmendier and Tate, 2005, 2008; Roll, 1986; Schrand and Zechman, 2012). Hribar and Yang (2016) found that forecasts made by overconfident CEOs were more likely to be misleading and have an optimistic bias due to their overestimation of future returns. CEO overconfidence also comes with an underestimation of downside risk, an overestimation of the probability of a positive state, and the likelihood of returns (Gervais et al., 2011; Hirshleifer and Luo, 2001; Malmendier and Tate, 2008).

On the other hand, more recent research has suggested that overconfident leaders tend to make more persuasive arguments and are perceived as particularly competent, especially under uncertainty (Anderson et al., 2012). Indeed, evolutionary biologists conceptualize overconfidence as an evolved adaptation. As Schwardmann and Van der Weele (2019) recently stated, overconfidence emerges as “an adaptive cognitive technology with important social benefits, rather than some deficiency or bias” (p. 12). Likely because of these reasons, recent studies have shown that overconfident CEOs can also help firms, especially concerning innovation processes. CEO overconfidence is positively related to firm innovation (Galasso and Simcoe, 2011; Hirshleifer et al., 2012) and innovation performance is stronger in firms led by overconfident CEOs (Tang et al., 2015). CEOs could obtain more support from resource providers and could foster their firm’s competitive advantage by convincing competitors that their firm’s quality is higher than it really is (Heifetz et al., 2007).

Vitanova (2019) advances an important mechanism regarding overconfidence, which can counter its potentially adverse effects described above. Vitanova argues that CEO overconfidence has “signaling value,” both externally and internally. Externally (i.e. outside the firm), overconfident CEOs, because of their optimism, are more likely to receive funding (Eckhardt et al., 2006). Similarly, they tend to capture better credit accessibility and lower the costs of financing (Dai et al., 2017). Overconfidence also has positive signaling internally (i.e. inside the firm). Van den Steen (2005) argues that CEOs’ overconfidence has coordination benefits because these CEOs attract other executives with similar views and beliefs. Perhaps more importantly, CEO overconfidence encourages employees’ commitment by making them more confident about the firm’s persistence in accomplishing its strategic direction (see also Bolton et al., 2012). Thus, CEO overconfidence mitigates the underinvestment problem; as a result, it “diminishes underinvestment and increases firm value” (Goel and Thakor, 2008: 2740).

Consistent with this positive view of overconfidence, a recent meta-analysis found a small, but significant, positive relationship ($r = .04$) between CEO overconfidence and firm performance (Burkhard et al., 2018). However, the authors found wide heterogeneity in this relationship across studies. Although Burkhard and colleagues did not test for specific mechanisms (i.e. mediators), they did find a stronger effect when CEOs had more managerial discretion. In other words, when CEOs had more power relative to other directors and when firms were newer and smaller, they had more positive effects on firm performance.

In sum, CEO overconfidence can positively affect firm performance because of its signaling value among employees. This is consistent with existing evidence showing the (small) benefits of CEO overconfidence on firm performance. These are exacerbated when the CEOs have the freedom to make managerial decisions. However, the relationship between overconfidence and firm performance is heterogeneous and subject to fundamental moderating effects.

The study of the business cycle in management literature

Business cycles are deviations of real aggregate output of the economy from its long-term growth trend, alternating between recessions and recovery or expansion periods (Kydland and Prescott, 1990; Lucas, 1977). According to the National Bureau of Economic Research (NBER), a recession is defined as a period between a peak and a trough, and an expansion is a period between a trough and a peak. During a recession, a significant decline in economic activity spreads across the economy and can last from a few months to more than a year. Similarly, during an expansion, economic activity rises substantially, spreads across the economy, and usually lasts for several years.²

The business cycle is relevant to firms' strategies due to the effect on competition. Recessions, for example, not only imply transitory contractions of the level of economic activity but also involve changes in absolute prices, as well as relative prices among inputs and outputs (Mascarenhas and Aaker, 1989). These changes transitorily increase rivalry and reduce resource munificence, affecting the competitive dynamics between rivals and firms' sustainable advantages (Chakrabarti et al., 2007, 2011; Garcia-Sanchez et al., 2014). Most years in the business cycle are expansionary (Claessens et al., 2009). Perhaps because recessions represent a relatively minor period in the business cycle, most strategic management research has focused on periods of expansion or, alternatively, has seen the business cycle as being fixed and having an exogenous effect. However, the temporary nature of recessions might generate permanent competitive changes (Garcia-Sanchez et al., 2014).

The study of the effect of the business cycle on firm strategy has lacked a unified theory to explain the varied effects across industries and organizations, and it has rarely undergone empirical testing (Bromiley et al., 2008). Nevertheless, an extensive amount of literature explores strategies for improving performance during and after recessions (Bishop et al., 1984; Chakrabarti et al., 2007; Flammer and Ioannou, 2015; Greer and Ireland, 1992; Meyer, 1982; Vassolo et al., 2017; Wan and Yiu, 2009), yet the effect of psychological biases on making decisions along the business cycle remains unexplored. This is a fundamental shortcoming of both theories due to the importance of the business cycle's impact and psychological biases' effect on performance.

The effect of overconfident CEOs on firm performance in expansion years

In expansion years, credit booms generally coincide with large cyclical fluctuations in economic activity—real output, consumption, and investment rise above trend during the buildup phase of credit booms, while large capital inflows are associated with accelerated GDP growth and credit

expansion. Expansionary periods also come with increases in asset prices. These increases improve a firm's (or a household's) net worth, enhancing its capacity to borrow, invest, and spend (Claessens et al., 2010).

There are reasons to expect a positive effect of CEO overconfidence on firm performance during expansion years. Overconfident individuals tend to adopt an independent decision-making style. They seldom ask others about the decision-making process because they believe that others in the organization cannot make the same high-quality decisions that they believe they make (Kausel et al., 2015; Owen and Davidson, 2009). Also, as noted above, overconfident CEOs tend to attract other executives who are similar in terms of values and beliefs (Van den Steen, 2005). Because of this, overconfident CEOs adopt centralized decision-making processes, which minimize coordination effort (Alonso et al., 2008). This type of decision-making process requires less time in negotiation and communication (Robert Baum and Wally, 2003), resulting in faster decisions. In an expansionary economy phase, making quick decisions can help in launching more and new products, and consequently, help in gaining market share (Markant et al., 2018). For example, Judge and Miller (1991) found that decision-making speed strongly correlates with sales growth and profitability in the biotechnology industry. Being an early mover can bring benefits to different dimensions such as market share, technology leadership, preemption of scarce assets, and switching costs to buyers.

Overconfident CEOs tend to make risky choices (Engelen et al., 2015), which in periods of economic expansion can have positive returns. For example, Ho et al. (2016) argued that overconfident CEOs tend to increase their leverage compared to other CEOs, due to their overestimation of future returns and underestimation of downside risk when making investments. As a result, CEO overconfidence forces firms to explore innovative ways of obtaining favorable outcomes, which in turn helps firm performance. Ho et al. (2016) conclude that CEO overconfidence has a positive impact on lending standards during expansion years.

Overall, our argumentation is also consistent with Burkhard et al. (2018), the meta-analysis that we mentioned above, in which the authors found that CEO overconfidence was especially beneficial when CEOs had managerial discretion. Expansionary periods likely give CEOs more discretion to make unrestrained strategic firm decisions. Therefore, we hypothesize the following:

H1. In expansionary periods, firms with overconfident CEOs will outperform those with non-overconfident CEOs.

The effect of overconfident CEOs on firm performance during recessions

Recessions are characterized by sharp declines in (residential) investment, industrial production, imports, housing and equity prices, modest reductions in consumption and exports, and an increase in the unemployment rate (Claessens et al., 2009). Recessions tend to be highly synchronized across countries and often coincide with contractions in credit and declines in asset prices. During a recession, alternative sources of financing become scarce as stock markets crash, and foreign lenders and investors pull out their money. That is, as all the potential sources of funds dry up, there may be nothing left to redistribute through trade credit (Love et al., 2007). Credit contractions have especially strong adverse effects on investment (Claessens et al., 2009). Firms with more vulnerable financial positions are more likely to be (negatively) affected by crisis events and are thus more likely to reduce their supply of credit to customers.

The effect of overconfident CEOs on performance during recessions is less favorable than in expansion periods due to the existence of opposing mechanisms. On one side, several of the

positive effects of overconfident CEOs during expansionary periods are also positive during recession periods. However, recessions amplify the negative aspects of overconfident CEOs' decisions, complicating how these CEOs successfully manage recessions. We address the positive and negative effects separately.

The positive effects of managing recessions. Several of the positive effects of overconfidence observed during expansion periods remain during recessions. For instance, the "signaling value" generates two critical positive effects. First, during recessions, the signaling value increases the importance of capturing credit. We highlighted that, due to the external signaling, overconfident CEOs are particularly prepared to obtain credit. Second, during recessions, the morale within the organization tends to decrease. Due to the internal signaling, overconfident CEOs are particularly well prepared to have positive effects on organizational morale (Vitanova, 2019).

Besides, recessions imply sudden contractions in demand, requiring rapid organizational adjustments. We stated above that overconfident CEOs tend to make faster decisions. Making swift decisions can be a significant predictor of firm survival (Bingham and Eisenhardt, 2011).

The negative effects of decisions made before recessions. The positive aspects of overconfident CEOs managing recessions tend to diminish due to negative decisions they make during expansion periods. High expectations of future performance drive overconfident CEOs to pursue behaviors such as the overestimation of returns, the underestimation of risk, and consequent overinvestment (Gervais et al., 2011; Hirshleifer and Luo, 2001; Malmendier and Tate, 2008). CEO overinvestment has two negative implications during recessions. First, it leads firms to participate in multiple projects simultaneously, which threatens firms' organizational flexibility, a term that derives from organizational change and refers to the ability to modify and adapt the functioning of an organization. Although overconfident CEOs tend to make faster decisions, these centralized choices are often made without much upward communication, which in turn makes firms less organic and flexible to adapt to dynamic environments (Mintzberg, 1980; Sine et al., 2006). During a recession, firms that are engaged in various projects lack organizational flexibility due to their greater architectural complexity (Chakrabarti et al., 2007). Being engaged in multiple projects during recessions jeopardizes effective coordination within the firm and communication becomes more difficult, especially when demand decreases. This leads to facing organizational, resource, information, and management challenges that threaten a firm's performance (Chakrabarti et al., 2007). In hostile environments, such as recessions, firms tend to be more prone to making errors; therefore, they require a greater ability to adapt to substantial organizational changes (Chen and Hambrick, 2012). In addition, the lack of organizational flexibility causes firms to face more threats stemming from the decisions undertaken by their CEOs (Tang et al., 2018).

Overinvestment also threatens a firm's financial flexibility. To be able to overinvest, firms seek external funds. Overconfident CEOs tend to choose debt over equity, as they believe their shares are undervalued (Malmendier and Tate, 2005). This leads overconfident CEOs to increase their leverage in the face of a recession, compared to their peers. Indeed, Ho et al. (2016) show that market leverage for banks with overconfident CEOs is on average approximately 5.37% higher than that of other banks, due to the debt incurred from financing their more aggressive investment policies.

An increase in leverage in the lead-up to an economic crisis increases the exposure of firms led by overconfident CEOs, which may eventually cause their exit from the industry (Garcia-Sanchez et al., 2014). Changing environments requires executives to find the right balance between investing in good projects and committing resources (Shimizu and Hitt, 2004) without threatening financial flexibility. However, recessions find firms with overconfident CEOs in an unfavorable

position due to their overinvestment in multiple projects and high leverage, and consequently, strike firms harder than their peers.

In sum, the effect of overconfident CEOs on performance during recessions has divergent directions. The existence of adverse effects during recessions partially reduces the positive effects of being overconfident. Henceforth, we hypothesize the following:

H2. The business cycle moderates the effect between CEO overconfidence and firm performance such that, during recessionary periods of the business cycle, the positive effects of CEO overconfidence will be lower than during expansionary periods of the business cycle.

Data and methods

Sources of information and sample selection

We gathered data from five different sources: The Center for Research in Security Prices (CRSP), Compustat, ExecuComp, Thomson One, and the NBER. Information about firms' stock returns was obtained from CRSP. This database contains information on security prices, returns, and trading volume from the NYSE, AMEX, and NASDAQ stock markets. We collected firm accounting and financial data from Compustat. In addition, we gathered information about mergers and acquisitions (M&A) transactions, which are performed by public US companies and involved a change of control (i.e. the acquirer's stake in the target changes from less than 50% to more than 50%), from the Thomson One SDC Platinum Database.³ We used ExecuComp to obtain CEOs' personal characteristics and compensation. ExecuComp reports executive compensation for S&P 1000 firms beginning in 1992 and includes base salary, bonuses, and stock options data. Finally, we collected the periods when the United States went through recessions from the NBER.

We studied the effect of overconfidence on companies competing in a variety of industries in the United States.⁴ We combined the information gathered from all data sources, yielding a panel of data that covers 220 industries, 1712 companies, and 15,217 firm-year observations for the period from 1992 to 2015. During the sample period, we observed 2264 firm-year observations with M&A transactions and 2834 different CEOs. In addition, the US economy was dominated by expansion but had two recessions: the bursting of the dot-com bubble of 2001 and the Great Recession of 2008–2009.

Dependent variable

For the dependent variable, we used *ROE*, measured as the ratio of net income to the book value of equity.⁵ As one of our robustness checks, we also use *Tobin's Q* as a dependent variable, which is measured as the market value of assets divided by the book value of assets.

Main covariates

To test the hypotheses, we measured two main covariates: *CEO Overconfidence* and *Recession*. The first one is a dummy variable indicating when the current CEO is overconfident or not. The second covariate indicates if the firm is in a recession period or not.

CEO overconfidence. Measuring overconfidence based on decisions an executive makes on his or her personal portfolio of company stock options is a common and well-established approach to measuring CEO overconfidence in the behavioral finance field (Malmendier and Tate, 2015). CEOs usually receive large stock and option grants as part of their compensation (Hall and Murphy, 2002).

This, together with the fact that a CEO's human capital is closely tied to their firm's performance, implies that CEOs usually are under-diversified with respect to company-specific risk; that is, they have a more than optimal proportion of their wealth invested in their own firms. Given these conditions, a rational and risk-averse CEO should exercise stock options before expiration in order to diversify company-specific risk. In other words, they should exercise the options to obtain the stock shares and then sell the shares in the market and use the proceedings to invest in something else.

The specific timing, or when before expiration the CEO should exercise stock options, depends on several factors: how under-diversified is the CEO, their level of risk aversion, and how much "in the money" are the stock options. *In-the-money* options are those in which the current price of the underlying stock exceeds the strike price at which the executive has the option to purchase the stock. Therefore, exercising an in-the-money option would generate a profit. However, overconfident CEOs overestimate the future performance of their firms' stocks and therefore postpone the exercise of in-the-money options to a greater extent than non-confident CEOs, expecting that the profit from exercise would be higher in the future. In other words, overconfident CEOs are more willing to hold in-the-money options—expecting to profit from future stock-price appreciation—than non-overconfident CEOs.

Following this rationale, Malmendier and Tate (2005) define a CEO as overconfident if his or her stock options are more than 67% in the money. That is, the CEO is considered overconfident when they have unexercised options for which the stock price is more than 67% larger than the exercise price of the option. They derive the 67% cutoff by calibrating Hall and Murphy's (2002) option exercise model with detailed data of CEOs option holdings and exercise decisions collected by Yermack (1995) and Hall and Liebman (1998).⁶ Malmendier and Tate (2008) develop an alternative measure based on a CEO's portrayal in the media, which relies on the perception of others rather than the CEO's actions. Using this measure, they find similar results to those obtained based on option holdings. Moreover, Malmendier and Tate (2005, 2008) extensively discuss other factors, rather than overconfidence, that might explain why CEOs could postpone the exercise of in-the-money options (e.g. positive private information about future firm performance). They conclude that these factors neither drive the variation in the overconfidence measure nor predict the same relationships with corporate decisions as overconfidence.

More recently, and using data from ExecuComp, Campbell et al. (2011) define overconfident CEOs as those who hold stock options that are more than 100% in-the-money. They modify Malmendier and Tate's (2005) measure by establishing a cut-off that is close to the high-overconfidence end of the continuum. They also require that a CEO exhibit this option-holding behavior at least twice over time and categorize them as overconfident beginning with the first time the CEO exhibits the behavior.

Because we also use recent data from ExecuComp, we follow Campbell et al.'s (2011) overconfidence definition. To determine the average of the money level (i.e. how *in the money* is the option), we divide the total realizable value (RV) of the exercisable options by the number of exercisable options held by the CEO, obtaining RV . Next, we subtract RV from the stock price at the end of each fiscal year, obtaining AM (average exercise price of the option). Finally, we calculate the average money level of the options by dividing RV by AM .⁷

Recession. We operationalize *recession* as a dummy variable that takes the value of 1 during a recession and 0 otherwise. Since recession data from the NBER is released on a monthly basis and our sample is on an annual basis, we consider a year to be a recession year if it contains at least two consecutive quarters of GDP contraction. Thus, we consider as recession years the following: 2002 with the burst of the dot-com bubble and 2008–2009 with the Subprime crisis. We also include 1

year after the recession because, even if there is an upturn, the post-crisis strategic and operating environment remains different (Reeves and Deimler, 2009).

Control variables

We use several control variables at the CEO, industry, and macroeconomic levels. At the CEO level, we control for CEO personal characteristics, which are directly observable by the board and may be a selection criterion for the choice of CEO, in order to help avoid endogeneity problems (Malmendier and Tate, 2005). The first such variable is *CEO gender*, taking the value of 1 for females and 0 for males. We also control for the level of CEO's leadership experience with the variable *CEO tenure*, which is defined as the natural logarithm of the number of years that the executive has been the firm's CEO. In addition, we control for the CEO's power, adapting two measures from Finkelstein (1992). As a measure of structural power, we use the variable *CEO's compensation*, defined as the total compensation of the CEO divided by the compensation of the highest paid executive in the firm. If the CEO is the top earner in the firm, we use the second highest paid member in the denominator. As a measure of ownership power, we use the variable *CEO's shares owned*, calculated as the percentage of shares owned by the CEO, excluding options. Another reason to control for the level of the CEO's ownership is that it influences the decision of whether to exercise a stock option (Malmendier and Tate, 2008). Finally, we use *CEO age* as an instrumental variable (IV) for *CEO overconfidence*, which is defined as the natural logarithm of their age. Older CEOs tend to be more overconfident (Ho et al., 2016).

At the firm level, it is necessary to control for the confounding effects of firms' characteristics to isolate the effect of CEOs' overconfidence on firms' decision-making processes. A potential drawback of the measure for overconfidence is that it is affected not only by CEOs' decisions about the exercise of options, but also firms' stock returns (Campbell et al., 2011).⁸ Therefore, we control for the *adjusted stock return* of each firm, defined as the annualized stock return over the CEOs' tenure of 5 years or less, minus the corresponding median return computed from firms in the same four-digit SIC code (Campbell et al., 2011).

We also control for *bankruptcy* filings with a dummy variable, which takes a value of 1 if the company files for Chapter 7 or Chapter 11 that year and 0 otherwise.⁹ Firms facing bankruptcy tend to be highly leveraged and poor performers. In addition, we control for relevant *M&A* activity. These transactions tend to have negative effects on firms' performance (King et al., 2004), and overconfident CEOs are more likely to conduct M&A processes (Malmendier and Tate, 2008).¹⁰ For each company and year, we compute the *M&A* variable as the natural logarithm of the sum of the market capitalization of all the acquired companies for which there is a change in control and the value of the deal is larger than a million.¹¹

In addition, firms' leverage and size are important factors that influence their strategies and decisions. Bearing this in mind, we control for changes in the amount of debt each company holds through the variable *Change in Leverage*. This is computed as the change in the debt to equity ratio between two consecutive years. Highly leveraged firms will be more strongly affected by recessions (Garcia-Sanchez et al., 2014), producing a decrease in their performance. We also include *Firm size*, measured as the log of the firm's total assets. Large firms offer more extensive product lines, have more potential synergies to exploit, and suffer more from managerial diseconomies (Lee et al., 2010).

To capture the possible impact of industry concentration on market share, we used the variable *Herfindahl index*. This variable is defined as the sum of the squares of the market shares of firms belonging to the same industry. As competition intensifies, recessions endogenously induce a shakeout of ineffective players, affecting their performance (Garcia-Sanchez et al., 2014). Finally,

we also controlled for the *Interest rate*. The Federal Reserve might change its monetary policy from one year to another to help the country better cope with the overall economy.

To reduce potential endogeneity issues, all explanatory variables are lagged 1 year. In addition, we take care of outliers by winsorizing all non-binary variables at the 2% level (Welch, 2004).

Estimation technique

In our main specification, we use the following panel-data model

$$ROE_{i,t} = \beta_0 + \beta_1 CEO\ Overconfidence_{i,t-1} + \beta_2 Recession_{t-1} + \beta_3 CEO\ Overconfidence_{i,t-1} \times Recession_{i,t-1} + \beta' Controls_{i,t-1} + \gamma_i + \varepsilon_{j,t}$$

where $Controls_{i,t-1}$ represents the control variables, γ_j are firm fixed effects, and $\varepsilon_{j,t}$ represents the error term.

Given that panel data contain both longitudinal and cross-sectional information about firms, it includes two types of variance: within- and between-firm variance. The Hausman test shows in our data that the relationships based on within-firm variance differ from those based on a combination of both within- and between-firm variance ($p < 1\%$). In addition, intraclass correlation coefficient, ICC(1), values for our dependent variable and main covariates indicate that most of these variables' variance comes from within firms over time rather than from between firms (the ICC(1) values are 0.19, 0.3, and -0.04 for *ROE*, *CEO Overconfidence*, and *Recession*, respectively). Therefore, we rely on fixed-effects models to test our hypotheses. Fixed-effect models are also useful for mitigating certain endogeneity concerns and for ruling out spurious relationships. In addition, we use robust standard errors to generate estimators that are asymptotically equivalent to Arellano's (1987) and, therefore, control for heteroskedasticity and within-panel serial correlation in the error term.¹²

Shaver (2019) argues that fixed-effect models with interaction terms may confound within-firm and between-firm variation in identifying interaction coefficient estimates. Therefore, following Shaver (2019), we complement our empirical analyses with segmented regressions to confirm that within-firm variation identifies the interaction coefficient estimate in our models. In our segmented regression specification, we use the following panel-data model

$$ROE_{i,t} = \beta_0 + \beta_1 CEO\ Overconfidence_{i,t-1} + \beta' Controls_{i,t-1} + \gamma_i + \mu_t + \varepsilon_{j,t}$$

where $Controls_{i,t-1}$ represents the control variables, γ_j are firm fixed effects, μ_t are year fixed effects, and $\varepsilon_{j,t}$ represents the error term. We estimate this model twice, one for the subsample of years in which the business cycle is in expansion and another for the subsample of years in which the business cycle is in recession.

An alternative to fixed-effects models would be to use a hybrid approach to disentangle within- and between-firm relationships (Allison, 2009; Certo et al., 2017; Schunck, 2013). The hybrid approach splits each independent variable into a firm-centered variable and a variable representing the firm mean. Then, a random-effects model is used to estimate coefficients representing the within- and between-firm effects associated with the firm-centered and firm mean variables, respectively. Using a hybrid approach to test our hypotheses confirms that our main effects come from within-firm relationships. Untabulated results show that firm-centered variables are significant and firm mean variables are not, confirming that the use of a fixed-effect model is sufficient (and the more concise way) to test our hypotheses.

In the section Robustness Checks, we present several alternative specifications. First, we show that our results are robust to the use of an alternative measure of performance: *Tobin's Q*. Second,

Table 1. Descriptive statistics.

	All				CEO OC		CEO not OC		OC—No OC
	Mean	St. Dev.	Min.	Max.	Mean	St. Dev.	Mean	St. Dev.	Diff.
ROE	0.085	0.252	-1.020	0.741	0.105	0.246	0.071	0.255	0.035***
Tobin's Q	1.853	1.151	0.803	6.759	2.208	1.390	1.607	0.870	0.601***
CEO overconfidence (OC)	0.409	0.492	0.000	1.000	1.000	0.000	0.000	0.000	-
Recession	0.251	0.434	0.000	1.000	0.245	0.430	0.255	0.436	-0.011
M&A	1.105	2.211	0.000	7.313	1.219	2.298	1.026	2.146	0.194***
Change in leverage	0.082	0.458	-0.778	2.153	0.083	0.476	0.082	0.445	0.0009
Firm size	7.781	1.696	4.095	11.563	7.646	1.645	7.874	1.724	-0.228***
Bankruptcy	0.003	0.055	0.000	1.000	0.002	0.048	0.003	0.059	-0.001
Adj. stock return	0.057	0.177	-0.340	0.619	0.111	0.188	0.019	0.158	0.092***
Herfindahl index	0.321	0.244	0.029	1.000	0.313	0.228	0.326	0.254	-0.013**
Interest rate	0.027	0.020	0.005	0.060	0.028	0.020	0.027	0.020	0.001
CEO's gender	0.022	0.147	0.000	1.000	0.016	0.126	0.026	0.160	-0.010***
CEO's compensation	1.963	1.034	0.232	5.482	1.979	1.072	1.952	1.007	0.027
CEO's shares owned	0.008	0.019	0.000	0.098	0.012	0.023	0.006	0.015	0.006***
CEO's tenure	1.793	0.856	0.000	3.401	2.233	0.720	1.488	0.810	0.744***
CEO's age	4.013	0.123	3.714	4.263	4.032	0.123	4.000	0.121	0.033***
Observations	15,057				6154		8903		

ROE: Return on Equity.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

we show that our results hold with an alternative measure of CEO overconfidence, which is time-invariant. Third, we use an IV approach to confirm the causal relationship between CEO overconfidence and firm performance. Finally, we test for leverage as a mediator in the relationship between CEO overconfidence and firm performance.

Empirical findings

Summary statistics

Table 1 shows descriptive statistics for the whole sample, for the subsample with overconfident CEOs, and for the subsample with non-overconfident CEOs. First, comparing performance, this table shows that firms led by overconfident CEOs have, on average, higher ROE than firms led by non-overconfident CEOs (10.5% vs 7.1%, $p < 0.1\%$). Second, in comparing CEOs, it shows that, on average, overconfident CEOs are older ($p < 0.1\%$), have longer tenures ($p < 0.1\%$), are more likely to be men ($p < 0.1\%$), and own more company shares ($p < 0.1\%$). Finally, at a firm level, it shows that firms with overconfident CEOs have higher M&As ($p < 0.1\%$), have better adjusted stock returns ($p < 0.1\%$), and are smaller than those with non-overconfident CEOs ($p < 0.1\%$).

Regarding CEOs' overconfidence, untabulated results show that overconfidence behaves as a trait. That is, the vast majority of the CEOs (88.4% of them) show a consistent overconfidence behavior through time and across firms. Therefore, what drives the changes in firm performance are the changes in CEOs across firms; 68.1% of the CEOs manage more than one firm through the sample period, and 46.5% of firms are managed by two or more CEOs. Thus, the heterogeneity in

Table 2. Pairwise correlations.

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
(a) ROE	I							
(b) Tobin's Q	0.17***	I						
(c) CEO overconfidence	0.068***	0.26***	I					
(d) Recession	-0.085***	-0.088***	-0.012	I				
(e) M&A	0.019*	0.027**	0.043***	-0.027***	I			
(f) Change in leverage	-0.31***	-0.0072	0.000100	-0.015+	0.11***	I		
(g) Firm size	0.17***	-0.22***	-0.066***	0.00066	0.17***	-0.056***	I	
(h) Bankruptcy	-0.0015	-0.018*	-0.011	-0.0036	-0.012	-0.0015	-0.011	I
(i) Adj. stock return	0.19***	0.39***	0.26***	0.044***	0.060***	-0.062***	-0.093***	-0.062***
(j) Herfindahl index	-0.022**	-0.051***	-0.026**	-0.014+	0.015+	0.015+	-0.098***	0.017*
(k) Interest rate	0.037***	0.071***	0.013	-0.33***	0.021*	0.021*	-0.080***	0.0052
(l) CEO's gender	-0.0025	0.0010	-0.034***	0.012	-0.020*	0.019*	-0.038***	0.0083
(m) CEO's compensation	0.056***	-0.0015	0.013	0.00011	0.051***	-0.023**	0.10***	-0.023**
(n) CEO's shares owned	-0.024**	-0.0083	0.16***	0.031***	-0.049***	0.025**	-0.15***	0.0093
(o) CEO's tenure	0.030***	0.038***	0.43***	-0.022**	0.0030	0.0088	-0.041***	-0.0015
(p) CEO's age	0.047***	-0.048***	0.13***	-0.036***	-0.016*	-0.029***	0.13***	-0.0048

	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
(i) Adj. stock return	I							
(j) Herfindahl index	-0.068***	I						
(k) Interest rate	0.022**	-0.0080	I					
(l) CEO's gender	-0.025**	-0.013	-0.054***	I				
(m) CEO's compensation	0.026**	-0.0059	-0.064***	0.018*	I			
(n) CEO's shares owned	-0.032***	0.024**	-0.17***	0.0011	0.0035	I		
(o) CEO's tenure	0.028***	-0.029***	-0.094***	-0.037***	0.050***	0.32***	I	
(p) CEO's age	-0.057***	0.053***	-0.071***	-0.032***	0.012	0.15***	0.40***	I

ROE: Return on Equity.

*** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.1.

overconfidence behavior within firms is mostly driven by changes among CEOs (some of them overconfident and others not) and not by changes in overconfidence within CEOs.

Pairwise correlations

Table 2 presents the pairwise correlation matrix of the variables in the study. Most correlations across the variables are under reasonable values. The second highest correlation is between the control variable *CEO's tenure* and the IV *CEO's age* at 40%. Therefore, in the IV model, we do not use *CEO's tenure* as a control. The other highest correlation is between the control variable *CEO's tenure* and the main covariate *CEO overconfidence* at 43%. However, a variance influence factor (VIF) test, following an ordinary least squares (OLS) regression including all main covariates and control variables, shows values below 5, implying that multicollinearity should not be a concern.

Regression results

Table 3 reports the results for the fixed-effects models used for our hypothesis. We provided likelihood ratio tests to compare between models. First, model 1 shows the regression using only controls. We see that *Adjusted stock return*, *CEO's compensation*, and *CEO's tenure* have a positive and significant effect on *ROE*. On the contrary, *firm size*, *bankruptcy*, *interest rate*, and

Table 3. Regression results for ROE.

	Full Sample					Recession = 0	Recession = 1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
M&A	-0.000440 (0.00110)	-0.000461 (0.00110)	-0.000497 (0.00109)	-0.000517 (0.00109)	-0.000537 (0.00109)	0.000285 (0.00126)	0.000159 (0.00186)
Change in leverage	-0.00207 (0.00748)	-0.00212 (0.00748)	-0.00134 (0.00749)	-0.00138 (0.00749)	-0.00144 (0.00749)	0.00724 (0.00885)	0.0215 (0.0176)
Firm size	-0.0388*** (0.00629)	-0.0388*** (0.00632)	-0.0437*** (0.00651)	-0.0437*** (0.00655)	-0.0435*** (0.00655)	-0.0497*** (0.00980)	-0.0884*** (0.0200)
Bankruptcy	-0.254+ (0.151)	-0.254+ (0.151)	-0.256+ (0.153)	-0.257+ (0.154)	-0.257+ (0.154)	-0.218 (0.163)	-0.0910 (0.0777)
Adj. stock return	0.103*** (0.0175)	0.0962*** (0.0174)	0.112*** (0.0175)	0.105*** (0.0174)	0.105*** (0.0174)	0.102*** (0.0205)	0.118** (0.0451)
Herfindahl index	-0.0229 (0.0330)	-0.0231 (0.0330)	-0.0307 (0.0330)	-0.0309 (0.0329)	-0.0312 (0.0328)	-0.0238 (0.0345)	-0.0551 (0.0765)
Interest rate	-0.638*** (0.136)	-0.664*** (0.137)	-1.187*** (0.157)	-1.212*** (0.158)	-1.211*** (0.158)		
CEO's gender	-0.0297 (0.0285)	-0.0302 (0.0287)	-0.0341 (0.0281)	-0.0346 (0.0283)	-0.0348 (0.0283)	-0.0219 (0.0292)	-0.0487 (0.0499)
CEO's compensation	0.00423+ (0.00225)	0.00436+ (0.00225)	0.00366 (0.00225)	0.00379+ (0.00225)	0.00377+ (0.00225)	0.00104 (0.00263)	0.0120* (0.00524)
CEO's shares owned	-0.431* (0.198)	-0.435* (0.199)	-0.334+ (0.201)	-0.338+ (0.201)	-0.331 (0.202)	-0.633* (0.262)	-0.339 (0.392)
CEO's tenure	0.0144*** (0.00372)	0.0114** (0.00401)	0.0127*** (0.00371)	0.00966* (0.00399)	0.00993* (0.00397)	0.00941* (0.00461)	0.00908 (0.0101)
CEO Overconfidence (OC)		0.0144+ (0.00810)		0.0143+ (0.00807)	0.0186* (0.00831)	0.0249** (0.00840)	-0.00153 (0.0195)
Recession			-0.0507*** (0.00556)	-0.0506*** (0.00556)	-0.0430*** (0.00674)		
CEO OC × Recession					-0.0185+ (0.00971)		
Constant	0.378*** (0.0523)	0.379*** (0.0525)	0.451*** (0.0549)	0.451*** (0.0551)	0.448*** (0.0551)	0.412*** (0.0717)	0.791*** (0.162)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	No	Yes	Yes
Observations	15,217	15,217	15,217	15,217	15,217	11,179	4038
Number of firms	1712	1712	1712	1712	1712	1679	1222
LR p-value		0.0206	< 0.001	0.0216	0.0246		

LR: likelihood ratio.

Dependent variable: Return on Equity (ROE). Robust standard errors in parentheses.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

CEO's shares owned have a negative and significant effect on firm performance. Second, to see the general effect of overconfident CEOs on firm performance without taking into consideration the effect of recessions, we analyzed model 2. Results show that *CEO overconfidence* is positively related to *ROE* ($\beta_1 = 0.0144$, $p < 10\%$). This means that firms with overconfident CEOs have, on average, 1.44% higher ROE than those with non-overconfident CEOs, which is substantial considering the average ROE in our sample is 8.5% (see Table 1). Third, we tested the effect of *recessions* on *ROE* in model 3. We found that *recession* has a negative effect on *ROE* ($\beta_2 = -0.0507$, $p < 1\%$), meaning that, on average, ROEs are 5.07% lower during recession periods.

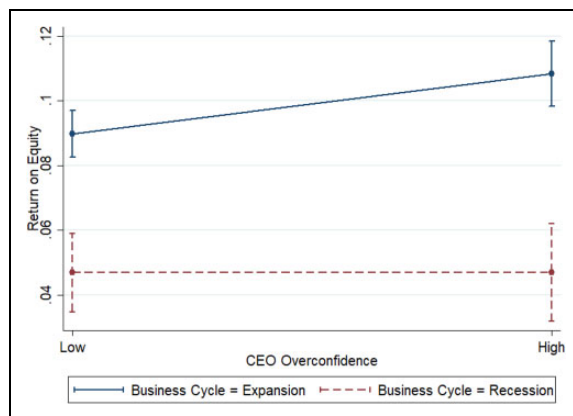


Figure 1. The effect of CEO overconfidence on return on equity and the moderating role of the business cycle. Error bars depict 95% confidence intervals.

Fourth, we test the effect of CEO overconfidence and recessions on ROE, without including an interaction term, in model 4. These results are very similar to those of models 2 and 3 taken together.

Finally, to test the positive effect of overconfidence on firm performance during non-recession periods (H1) and during recession periods (H2), we computed model 5, which presents two important findings. First, it shows that the effect of *CEO overconfidence* during non-recession periods on *ROE* is positive and significant ($\beta_1 = 0.0186$, $p < 5\%$), *strongly supporting H1*. This means that firms with overconfident CEOs have, on average, 1.86% higher ROE than those with non-overconfident CEOs during non-recession periods. This effect is large in magnitude given that the average ROE in our sample is 8.5% (see Table 1). Second, the results for the interaction between *CEO overconfidence* and *recession* show that this interaction has a negative and significant effect on ROE ($\beta_3 = -0.0185$, $p = 5.6\%$) and therefore moderates the positive effect of *CEO overconfidence* during non-recession years, *supporting H2*.

Figure 1 depicts the results of model 5 in Table 3 by estimating the marginal effects of the interaction component (the simple slopes) while adjusting other variables in the model (Cameron and Trivedi, 2010). Error bars show 95% confidence intervals (CIs). Using Hayes and Matthes' (2009) procedures, simple slope analyses confirm that firms with overconfident CEOs have 1.86% higher ROE than those with non-overconfident CEOs during non-recession periods ($p < 5\%$) and a non-significant effect of 0.004% during recessions. In addition, the former effect is larger in magnitude than the later ($p = 5.6\%$).

Models 6 and 7 of Table 3 show the results of the same specification presented in model 3, but for the segmented regressions. That is, for the subsample of years in which the business cycle is in expansion (i.e. when *recession* has a value of 0) and for the subsample of years in which the business cycle is in recession (i.e. when *recession* has a value of 1), respectively.¹³ During non-recession periods, the effect of *CEO overconfidence* on *ROE* is positive and significant ($\beta_1 = 0.0249$, $p < 1\%$). In contrast, during recession periods, the effect of *CEO overconfidence* on *ROE* is lower in magnitude and non-significant ($\beta_1 = -0.00153$, n.s.). These results are aligned with those presented in previous paragraphs and confirm the support for our hypotheses.

Robustness checks

Alternative performance measure

One possible source of bias is the way that performance is measured. In our main analysis, the dependent variable *ROE* only considers items from the balance sheet. In this section, we added an alternative measure for performance that adds information from financial markets: *Tobin's Q* measured as the market value of assets divided by the book value of assets.

Table 4 shows that if we change the measurement for firm performance, our main results remain. Model 5 shows that the effect of *CEO overconfidence* during non-recession periods is positive and significant ($\beta_1 = 0.418$, $p < 0.1\%$), strongly supporting H1. The interaction of *CEO overconfidence* and *recession* is negative and significant ($\beta_3 = -0.179$, $p < 0.1\%$), confirming that the effect of CEO overconfidence during recessions is positive but lower in magnitude than in non-recession periods, strongly supporting H2.

Figure 2 illustrates the results of model 5 in Table 4 by estimating the marginal effects of the interaction component while adjusting other variables in the model (Cameron and Trivedi, 2010). Error bars depict 95% CIs. Simple slope analyses show that the relationship between *CEO overconfidence* and *Tobin's Q* is positive for non-recession (0.418 , $p < 0.1\%$) and recession periods (0.239 , $p < 0.1\%$), but significantly smaller during recessions ($p < 0.1\%$).

Models 6 and 7 of Table 4 show the results of the same specification presented in model 3, but for the segmented regressions. During non-recession periods, the effect of *CEO overconfidence* on *ROE* is positive and significant ($\beta_1 = 0.413$, $p < 0.1\%$). In addition, during recession periods, the effect of *CEO overconfidence* on *ROE* is positive and significant ($\beta_1 = 0.191$, $p < 0.1\%$), but less than half in magnitude.

Constant measure of overconfidence within CEOs

Another possible source of bias is the overconfidence measure. In our main analysis, we follow Campbell et al. (2011) to compute the proxy for overconfidence. In sum, we define overconfident CEOs as those who hold stock options that are more than 100% in-the-money and require that they exhibit this behavior at least twice over time to categorize them as overconfident, beginning with the first time they exhibited the behavior. Therefore, it is possible that CEOs change from being overconfident and not through the sample.

Since overconfidence is theoretically defined as a trait, we would instead expect that CEOs show a consistent behavior through time. The latter is, in fact, the case since the vast majority of the CEOs in our sample show a consistent behavior through time and across firms. Moreover, in this section, we redefine the overconfidence measure to guarantee it does not vary within CEOs. This alternative measure categorizes CEOs as overconfident throughout the whole sample period if they exhibit the previously described option holding behavior at least twice over time.

Table 5 and Figure 3 show that our results are robust to this alternative definition of overconfidence. The primary difference concerning our main results is that the interaction of *CEO overconfidence* and *recession* is negative but not significant in model 5 of Table 5 ($\beta_3 = -0.0123$, n.s.). However, the results of the segmented regressions in models 6 and 7 confirm that during non-recession periods, the effect of *CEO overconfidence* on *ROE* is positive and significant ($\beta_1 = 0.0349$, $p < 0.1\%$). In contrast, during recession periods, the effect of *CEO overconfidence* on *ROE* is lower in magnitude and non-significant ($\beta_1 = 0.0207$, n.s.). Consistently, Figure 3 shows that firms with overconfident CEOs have, on average, higher ROEs than those with non-overconfident CEOs and that this effect is stronger during non-recession periods.

Table 4. Regression results for Tobin's Q.

	Full sample			Recession = 0			Recession = 1		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
M&A	-0.00548+ (0.00310)	-0.00603* (0.00301)	-0.00549+ (0.00305)	-0.00604* (0.00296)	-0.00624* (0.00294)	-0.00443 (0.00341)	-0.00307 (0.00506)		
Change in leverage	-0.0117 (0.0142)	-0.0129 (0.0139)	-0.00779 (0.0141)	-0.00892 (0.0138)	-0.00928 (0.0138)	-0.0215 (0.0183)	0.0442+ (0.0250)		
Firm size	-0.402*** (0.0325)	-0.400*** (0.0310)	-0.427*** (0.0325)	-0.425*** (0.0311)	-0.424*** (0.0311)	-0.468*** (0.0381)	-0.393*** (0.0653)		
Bankruptcy	-0.156 (0.102)	-0.168 (0.112)	-0.167 (0.108)	-0.178 (0.119)	-0.180 (0.117)	-0.247 (0.182)	0.0702+ (0.0358)		
Adj. stock return	0.930*** (0.0824)	0.747*** (0.0796)	0.969*** (0.0822)	0.786*** (0.0795)	0.788*** (0.0794)	0.867*** (0.0881)	0.547*** (0.146)		
Herfindahl index	0.0960 (0.121)	0.0906 (0.116)	0.0587 (0.119)	0.0532 (0.114)	0.0496 (0.114)	0.0794 (0.124)	-0.159 (0.218)		
Interest rate	-1.122** (0.412)	-1.778*** (0.391)	-3.860*** (0.468)	-4.511*** (0.446)	-4.502*** (0.446)				
CEO's gender	0.0375 (0.100)	0.0232 (0.103)	0.0171 (0.0990)	0.00285 (0.102)	0.000859 (0.102)	-0.0579 (0.105)	0.0591 (0.223)		
CEO's compensation	0.00728 (0.00873)	0.0107 (0.00856)	0.00416 (0.00860)	0.00760 (0.00840)	0.00733 (0.00838)	0.0134 (0.00961)	0.00333 (0.0136)		
CEO's shares owned	-2.881*** (0.834)	-2.977*** (0.835)	-2.389** (0.834)	-2.486** (0.835)	-2.417** (0.838)	-2.173* (0.954)	-2.172 (1.334)		
CEO's tenure	0.0475*** (0.0134)	-0.0316* (0.0137)	0.0394** (0.0131)	-0.0396** (0.0135)	-0.0369** (0.0134)	-0.0602*** (0.0164)	0.00325 (0.0229)		
CEO Overconfidence (OC)		0.376***	0.376***	0.376***	0.418***	0.413***	0.191***		

(continued)

Table 4. (continued)

	Full sample			Recession = 0		Recession = 1	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Recession		(0.0341)		(0.0337)	(0.0349)	(0.0373)	(0.0578)
CEO OC × Recession			-0.251 ^{***} (0.0147)	-0.250 ^{***} (0.0144)	-0.177 ^{***} (0.0161)		
Constant	4.842 ^{***} (0.249)	4.837 ^{***} (0.239)	5.209 ^{***} (0.251)	5.205 ^{***} (0.241)	5.173 ^{***} (0.240)	5.029 ^{***} (0.277)	4.712 ^{***} (0.528)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	No	No	No	No	No	Yes	Yes
Observations	13,911	13,911	13,911	13,911	13,911	10,212	3,699
Number of firms	1650	1650	1650	1650	1650	1607	1167
LR p-value		< 0.001	< 0.001	< 0.001	< 0.001		

LR: likelihood ratio.

Dependent variable: Tobin's Q. Robust standard errors in parentheses.

^{***} p < 0.001, ^{**} p < 0.01, * p < 0.05, + p < 0.1

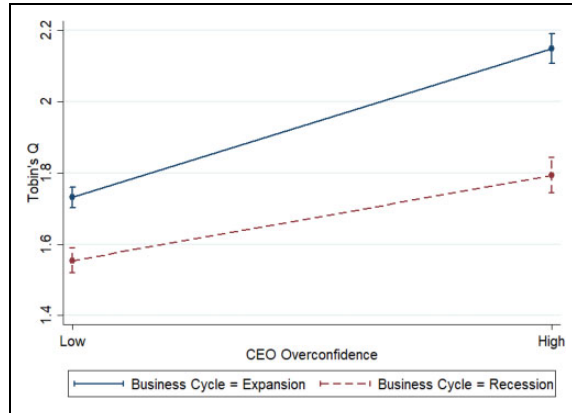


Figure 2. The effect of CEO overconfidence on Tobin's Q and the moderating role of the business cycle. Error bars depict 95% confidence intervals.

Instrumental variables estimation

In this section, we use an IV approach to confirm the causal relationship between CEO overconfidence and firm performance and further mitigate any endogeneity concerns. Specifically, we estimate the segmented regressions relating *CEO overconfidence* and *ROE* with a two-stage least squares (2SLS) model with fixed effects. Following Ho et al. (2016), we use *CEO age* as an instrument.¹⁴ That is, as an exogenous variable that is related to *CEO overconfidence* and uncorrelated with the error term in the regression relating *CEO overconfidence* and *ROE*. The positive correlation between *CEO's age* and *CEO overconfidence* is supported by antecedents (Bruine de Bruin et al., 2012; Stankov and Crawford, 1996) and econometrically significant in our sample (see Table 2). In addition, and consistent with Ho et al.'s (2016) arguments about CEO's age not directly affecting bank performance, we have no reason to believe this variable has a direct impact on *ROE*; therefore, it is unlikely to be correlated with the error term in the second-stage regression.

Table 6 presents the segmented models' results, using 2SLS with firm and year fixed effects and *CEO's age* as the IV for *CEO Overconfidence*. Models 1 and 2 present the second- and first-stage results, respectively, for non-recession periods. Models 3 and 4 present analogous results for the recession periods. The first-stage regression estimates (models 2 and 4) corroborate a partial correlation between CEO's age and CEO overconfidence. More importantly, the second-stage estimates provide evidence of a causal and economically significant relationship between *CEO overconfidence* and *ROE*. During non-recession periods (model 1), the effect of *CEO overconfidence* on *ROE* is positive and significant ($\beta_1 = 0.117, p < 0.1\%$). On the other hand, during recession periods (model 3), the effect of *CEO overconfidence* on *ROE* is also positive, but less significant and smaller in magnitude ($\beta_1 = 0.0904, p < 10\%$). These results provide further support for our hypotheses and for a causal relationship between CEO overconfidence and performance.

Leverage as a mediator for the effect of CEO overconfidence on firm performance

In this section, we test if *leverage* mediates the effect of CEO overconfidence on firm performance. We followed Krull and MacKinnon's (2001) procedure, which is designed to perform mediation tests with multilevel data, and bootstrapped the results with 500 replications to compute CIs.

Table 5. Regression results for ROE with constant CEO overconfidence.

	Full Sample						
	(1)	(2)	(3)	(4)	(5)	Recession = 0 (6)	Recession = 1 (7)
M&A	-0.000440 (0.00110)	-0.000475 (0.00110)	-0.000497 (0.00109)	-0.000535 (0.00109)	-0.000542 (0.00109)	0.000269 (0.00126)	0.000215 (0.00186)
Change in leverage	-0.00207 (0.00748)	-0.00219 (0.00747)	-0.00134 (0.00749)	-0.00145 (0.00748)	-0.00146 (0.00748)	0.00731 (0.00885)	0.0210 (0.0176)
Firm size	-0.0388*** (0.00629)	-0.0376*** (0.00637)	-0.0437*** (0.00651)	-0.0423*** (0.00658)	-0.0422*** (0.00659)	-0.0484*** (0.00974)	-0.0884*** (0.0201)
Bankruptcy	-0.254+ (0.151)	-0.254+ (0.151)	-0.256+ (0.153)	-0.257+ (0.154)	-0.257+ (0.154)	-0.218 (0.163)	-0.0899 (0.0782)
Adj. stock return	0.103*** (0.0175)	0.0954*** (0.0175)	0.112*** (0.0175)	0.103*** (0.0175)	0.103*** (0.0175)	0.101*** (0.0206)	0.111* (0.0449)
Herfindahl index	-0.0229 (0.0330)	-0.0248 (0.0329)	-0.0307 (0.0330)	-0.0329 (0.0329)	-0.0332 (0.0328)	-0.0266 (0.0345)	-0.0618 (0.0756)
Interest rate	-0.638*** (0.136)	-0.664*** (0.136)	-1.187*** (0.157)	-1.221*** (0.157)	-1.220*** (0.157)		
CEO's gender	-0.0297 (0.0285)	-0.0297 (0.0286)	-0.0341 (0.0281)	-0.0342 (0.0282)	-0.0342 (0.0283)	-0.0213 (0.0292)	-0.0508 (0.0503)
CEO's compensation	0.00423+ (0.00225)	0.00433+ (0.00226)	0.00366 (0.00225)	0.00376+ (0.00225)	0.00376+ (0.00225)	0.000929 (0.00264)	0.0121* (0.00524)
CEO's shares owned	-0.431* (0.198)	-0.429* (0.198)	-0.334+ (0.201)	-0.330+ (0.201)	-0.326 (0.201)	-0.629* (0.262)	-0.349 (0.390)
CEO's tenure	0.0144*** (0.00372)	0.0117** (0.00373)	0.0127*** (0.00371)	0.00963*** (0.00372)	0.00968** (0.00371)	0.0101* (0.00427)	0.00615 (0.00984)
CEO Overconfidence (OC)		0.0219*		0.0243**	0.0274**	0.0349***	0.0207

(continued)

Table 5. (continued)

	Full Sample				Recession = 0		Recession = 1	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Recession		(0.00865)	-0.0507*** (0.00556)	(0.00864) -0.0512*** (0.00558)	(0.00884) -0.0450*** (0.00725) -0.0123 (0.00929)	(0.00901)	(0.0195)	
CEO OC × Recession								
Constant	0.378*** (0.0523) Yes	0.364*** (0.0532) Yes	0.451*** (0.0549) Yes	0.436*** (0.0557) Yes	0.433*** (0.0557) Yes	0.392*** (0.0712) Yes	0.789*** (0.164) Yes	
Firm fixed effects	No	No	No	No	No	Yes	Yes	
Year fixed effects	15,217	15,217	15,217	15,217	15,217	11,179	4038	
Observations	1712	1712	1712	1712	1712	1679	1222	
Number of firms								
LR p-value		0.000834	< 0.001	0.000202	0.127			

LR: likelihood ratio.

Dependent variable: Return on Equity (ROE). Robust standard errors in parentheses.

*** p < 0.001, ** p < 0.01, * p < 0.05, + p < 0.1

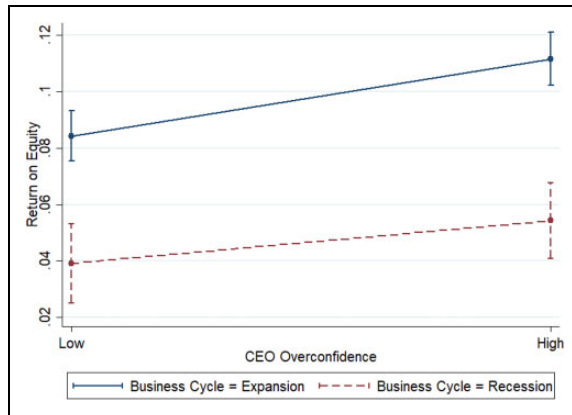


Figure 3. The effect of constant CEO overconfidence on return on equity and the moderating role of the business cycle.

Error bars depict 95% confidence intervals.

Unfortunately, Krull and MacKinnon's (2001) procedure is not designed to test for a moderated mediation; therefore, we were unable to include the moderating effect of the business cycle in the tests. That is, we could only test for *leverage* as a mediator of the overconfidence–performance relationship using the full sample of recession and non-recession years, and without the interaction term between *CEO overconfidence* and *recession*.¹⁵

In this setting, we did not find evidence of *leverage* mediating the relationship between overconfidence and performance. Untabulated results show that the indirect effect of *CEO overconfidence* on *ROE* through *leverage* was not statistically significant, based on 95% confidence intervals. Therefore, we conclude that the most likely channel through diminishing the benefits of overconfidence on performance during recessions is higher organizational complexity.

Discussion and conclusion

The primary objective of our study is to examine the moderating role of the business cycle in the relationship between CEO overconfidence and firm performance. Overconfidence is one of the most studied and important psychological biases (DeBondt and Thaler, 1995; Mannes and Moore, 2013), widespread among top managers and executives (Larwood and Whittaker, 1977; Malmendier and Tate, 2015). Based on recent developments in the psychology of judgment and choice and evolutionary biology, we propose and empirically test that, when things go well (i.e. during expansion years of the business cycle), CEO overconfidence has a positive effect on firm performance. During recessions, however, we propose and find that this effect weakens. While CEO overconfidence may still have a positive effect on firm performance, the overconfidence–performance relationship is significantly less strong. We find this result when using different measures of firm performance (i.e. *ROE* and *Tobin's Q*), controlling for different factors (e.g. *M&A* activity), and using an *IV* approach (i.e. using age as an *IV* for overconfidence). As such, our results are robust to endogeneity concerns.

Our research has several implications. First, our study highlights the potential, though often neglected, positive effects of overconfidence. This is consistent with a view from different fields, but stands in contrast to a rather negative view in the management literature (Bradbury et al., 2016). For example, in evolutionary biology, researchers have suggested that overconfidence can

Table 6. 2SLS regression results for ROE.

	Recession = 0		Recession = 1	
	Second stage (1)	First stage (2)	Second stage (3)	First stage (4)
M&A	0.000307 (0.00116)	0.00229 (0.00168)	0.000445 (0.00224)	-0.00507+ (0.00269)
Change in leverage	0.00672 (0.00532)	0.00259 (0.00773)	0.0180+ (0.00963)	0.0251* (0.0115)
Firm size	-0.0513*** (0.00610)	0.0255** (0.00875)	-0.102*** (0.0152)	0.125*** (0.0161)
Bankruptcy	-0.225** (0.0850)	0.0742 (0.123)	-0.0831 (0.171)	-0.0881 (0.206)
Adj. stock return	0.0556* (0.0225)	0.564*** (0.0227)	0.0650 (0.0418)	0.504*** (0.0396)
Herfindahl index	-0.0321 (0.0284)	0.0496 (0.0412)	-0.0812 (0.0704)	0.230** (0.0834)
CEO's gender	-0.0416+ (0.0244)	0.0274 (0.0356)	-0.0567 (0.0510)	0.0170 (0.0616)
CEO's compensation	-0.000200 (0.00259)	0.00145 (0.00377)	0.0134** (0.00486)	-0.00145 (0.00586)
CEO's shares owned	-0.869*** (0.218)	2.003*** (0.288)	-0.629+ (0.380)	1.600*** (0.430)
CEO's age		0.979*** (0.0415)		1.196*** (0.0713)
CEO overconfidence	0.117*** (0.0292)		0.0904+ (0.0494)	
Constant	0.478*** (0.0528)	-3.884*** (0.175)	0.894*** (0.121)	-5.553*** (0.303)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	10,763	10,763	3960	3960
Number of firms	1668	1668	1216	1216

2SLS: two-stage least squares.

Dependent variable: Return on Equity (ROE). Robust standard errors in parentheses.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

signal competence and drive to both rivals and allies (Johnson and Fowler, 2011). Because of this reason, overconfident individuals tend to enjoy and be perceived as having a higher status within groups (Anderson et al., 2012). Second, in the psychology of judgment and behavioral economics literature, some authors have suggested that overconfidence leads to “anticipatory utility.” This increases errors, but the increased hopefulness helps individuals to work harder (Brunnermeier and Parker, 2005). Thus, our study provides evidence suggesting that, when things go well, CEO overconfidence does appear to bring benefits to the organization.

Second, our research suggests that, while CEO overconfidence brings benefits, these are contingent on the environment. Expansion years of the business cycle exacerbate the positive aspects of overconfidence that increase firm performance. For example, in expansion periods, the faster decisions by overconfident CEOs can help the firm gain market share. Also, CEO overconfidence generally leads to innovative success (Galasso and Simcoe, 2011). Recessions, however, tend to

reduce the positive effects of CEO overconfidence. Our reasoning points to decreased organizational flexibility as an important explanation. We theorized that this, in turn, is the result of two factors: (a) greater organizational complexity and (b) increased leverage. As it turned out, we did not find strong evidence for leverage as a mediator of the overconfidence–performance relationship. We thus conclude that the most likely channel is greater organizational complexity that results from overconfident CEOs' decisions during recessions.

Third, we incorporate the business cycle in the psychology of judgment and choice literature. The business cycle exogenously alters every industry carry capacity, expanding and contracting munificence levels independently from the competitive evolutionary process. Empirical evidence indicates that changes in the business cycle alter firms' competitive positions as well as aggregate survival and failure rates. For instance, the level of bankruptcies increases between 10% and 20% the year after a recession (US Census). Most of the studies in strategic management literature have taken a rational approach, trying to determine optimal strategies to lead with the business cycle. Instead, in our case, we take a behavioral approach, focusing on what managers do during the expansion and contraction periods of the business cycle. Therefore, we are enriching the traditional analysis of strategic decisions in expansion and recession periods.

We acknowledge several limitations. Despite previous validation of our overconfidence variable, certain concerns regarding this measure still exist. The first potential issue lies in the question of whether the decision to exercise or hold stock options also depends on the expectations of the board of directors and/or investors, as they can influence CEOs' decisions in order to avoid a signal effect to the market (Campbell et al., 2011). A second concern is that the overconfidence measure reflects not only the CEOs' decisions, but also the firms' stock returns, which adds noise to the measurement (Campbell et al., 2011). We have incorporated the variable *adjusted stock return* to control for this issue. A third concern relates to the inside information that a CEO may have, especially regarding future stock prices, which could bias their option when exercising behavior (overconfidence measure reflects not only the Malmendier and Tate, (2005). A final concern relates to the number of firms that reward their executives through option compensation. The sample of companies that have stock option compensation is on average bigger than companies that do not, which could be a source of bias in our sample. Finally, we base our study only on US companies. Recessions may have different effects on other countries, making it difficult to generalize our results outside the US. Henceforth, it would be interesting to see future research exploring whether our results persist in other regions.

Despite these limitations, our study is among the first to provide a comprehensive theoretical approach to, and empirical tests on, the effects of CEO overconfidence during the different stages of economic business cycles in firms' performance across industries. In sum, we show that overconfidence can be beneficial for firm performance, but important contextual factors such as the business cycle play an important role in the magnitude of such benefits.

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Notes

1. The negative view of overconfidence can be traced back to Ancient Greece, in which overconfidence and hubris were related to the rise and fall of humans who compared themselves to (or rebelled against the will of) the gods. This includes the myth of Icarus and the case of Oedipus, among many other accounts (Petit and Bollaert, 2012).
2. <https://www.nber.org/cycles/recessions.html>
3. M&A transactions, including publicly traded US firms as targets, are not relevant to our study since those companies cease to exist after the transactions.
4. All industry-level variables are computed at the four-digit level of the SIC code. Therefore, we excluded any industries whose SIC codes end with the digit 9 since they are tagged as “Not Elsewhere Classified” and thus do not belong to any specific industry.
5. In our main specification, we preferred not to use a financial market variable to measure performance – such as stock returns – since overconfident CEOs could manipulate the market and bias such variables that depend on stock market performance.
6. Hall and Murphy (2002)’s model argues that executives should exercise options early if they behave as rational expected utility maximizers.
7. We cannot classify those CEOs who hold no options or hold options that are never in the money and, therefore, we exclude them from the sample.
8. The annualized stock return is calculated based on the monthly returns from the Center for Research in Security Prices (CRSP), which are holding period returns from month-end to month-end and assume that ordinary dividends are reinvested at month-end.
9. We hand-collected the information on bankruptcies for the companies in our sample during the 1992–2015 period. We found four Chapter 7 and 38 Chapter 11 bankruptcies.
10. Our results are robust to the inclusion or exclusion of the M&A control.
11. To obtain the market capitalization for each target company, we divided the value of the transaction by the percentage of the company acquired. Both data items were obtained from Thomson One.
12. We used Wooldridge’s (2002) test and found evidence for serial correlation in the idiosyncratic errors of the panel model.
13. Since the segmented regression models include year fixed effects, the macroeconomic variable *interest rate* is not included as a control.
14. Since the variable *CEO’s age* is highly correlated with the control variable *CEO’s tenure*, we do not include the latter as a control for the 2SLS analyses to avoid multicollinearity concerns.
15. We tried testing for the mediation in the subsample of recessions. Unfortunately, this was attempted against the panel structure of the data since we dropped all years between recessions, generating significant time gaps, which precludes the method from converging and providing results.

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