

CEO Overconfidence and Bank's Asset Quality: The Role of Board Gender Diversity

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Abstract

Overconfidence has been extensively examined in the corporate environment, particularly in the context of financial markets. Despite this, little is known about its impact on the banking sector and how it constrains these biases. The literature on board gender diversity to date does not offer a consensus on how board gender diversity interacts with CEO overconfidence when considering credit risk. This research aims to fill a gap in the literature by examining the impact of CEO overconfidence on a bank's asset quality and the moderating influence of board gender diversity on this association. The analysis depends on a cross-country sample of 66 listed European banks from 2014 Q1 to 2021 Q4. The findings show that CEO overconfidence has a significant negative impact on the bank's asset quality. Furthermore, the results demonstrate that board gender diversity plays an important role in constraining the CEO overconfidence biases and improving the bank's asset quality. The research implies that bank regulators must encourage sound governance practices that reduce excessive risk-taking while closely monitoring the cultural and societal context that can influence the proportion of women directors on bank boards.

Keywords

CEO Overconfidence, Asset Quality, Board Gender Diversity, NPLs

Article history

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1. Introduction

The banking sector is the supporting backbone of the economy since it provides credit and enables businesses and consumers to save, invest, and increase their spending. The economy cannot function without access to credit and will be paralyzed without banks. In this regard, poor asset quality represented in highly non-performing loans is considered one of the threats that may destroy the banking sector. It was the catalyst for several economic slowdowns, including the collapse of the US financial system in the 1980s, the Asian downturns in the 1990s, the US subprime crisis, and, lately, the European credit crisis. The massive amounts of NPLs created during the subprime crisis plagued not only the US banks but also the entire financial system. According to the EBA (2016), the GFC caused a significant decline in the credit portfolio of European banks, with the stock of non-performing loans climbing to 900 billion euros at the end of 2016, and the NPL ratio increased from 3% in 2005 to more than 7% in 2016¹. The rapid response of European regulators assisted in reducing the NPL ratio of EU financial institutions to 3% in 2019. However, the pool of non-performing loans (NPLs) remained at risky levels, reaching 600 billion euros in June 2019 (ECB, 2020), which feeds the policy discussion surrounding non-performing exposures (Velliscig et al., 2023).

Extensive research has been performed in an attempt to identify the determinants that could affect the bank's asset quality and NPLs, particularly during the financial crisis. Among these factors were GDP, inflation, and unemployment. However, it has not been discussed from the behavioral aspect since people involved in corporate decision-making were more vulnerable to cognitive biases. The cognitive biases of top executives influence their responses and perceptions of corporate information. The quality of their judgments could be considerably influenced by their biased and subjective perception of available facts (Roll, 1986). Overconfidence among CEOs has widely been found as the most influential management bias in the corporate world (Larwood & Whittaker, 1977; Li & Tang, 2010; Galasso & Simcoe, 2011). Thus, this research examines how CEO overconfidence impacts asset quality in banks.

In a normal bank, the CEO is seen as the most powerful person and his/her attitude affects the organization's overall risk preference (Ho et al., 2016). In addition, CEOs are more likely to exhibit overconfidence bias than the general public (Malmendier et al., 2011). According to Malmendier and Tate (2015), the overconfidence bias is the most pervasive bias that potentially influences managerial decisions because the media portrays the top management as "larger than life". As a result, these managers frequently exhibited excessive overconfidence in their ability to run their businesses and make decisions. Overconfident managers frequently overestimate returns while underestimating risk (Heaton, 2002). This triggered them to undertake excessive risks and underrate the possibility of failure, which thus impacts several aspects such as mergers and acquisitions (Malmendier & Tate, 2008), innovation (Hirshleifer et al., 2012), firm value (Ahmed & Duellman, 2013) and risk-taking (Li & Tang, 2010).

¹ Constancio, V. (2017). Resolving Europe's NPL Burden: Challenges and Benefits. <https://www.ecb.europa.eu/press/key/date/2017/html/sp170203.en.html>

This study contributes to the existing literature in several ways. To date, the studies about psychological biases, particularly overconfidence are very limited in the banking sector, most of them focus on overconfidence biases in corporations. Furthermore, the few studies about overconfidence in the banking sector only address its impact on bank risk-taking and systemic risk. This study thus will complement the existing literature by examining its impact on the bank's asset quality. Additionally, there has been extensive literature examining overconfidence in the US and some of the developed countries, but empirical studies on the impact of overconfidence in the European economy are quite few, hence this study will investigate the European context, especially after the financial crisis period. Furthermore, applying to Europe will help capture a deeper and more comprehensive understanding of the CEO overconfidence phenomena in a wide range of banks from several countries. Importantly, this study provides insight into the interaction of board gender diversity (BGD) on the association between CEO overconfidence and a bank's asset quality, by specifically focusing on board gender diversity since gender diversity is a pressing issue in today's society. Despite progress in gender equality in several domains, women continue to be underrepresented at senior leadership levels, including corporate boards. Thus, studying BGD provides insights into the influence of females on boards on banking performance which can thus help propose potential strategies for promoting greater gender parity in leadership positions.

The findings show that banks with higher overconfidence have lower asset quality as overconfident CEOs underestimate the customer's creditworthiness and are more optimistic about future returns such as loan collection, resulting in higher NPLs and LLPs ratios. Furthermore, the findings reveal that banks with overconfident CEOs can have better asset quality and lower credit risk if they have more females on their boards because women have greater risk aversion relative to men especially when making financial and investment decisions.

This study proceeds as follows: The second section discusses the theoretical aspects related to the topic; the third section presents the literature review and the main predictions; the fourth section provides the methodological aspects and the research model. The fifth section presents the regression and the conclusion.

2. Theoretical Background

2.1. Theories Describing How CEO Overconfidence Can Impact a Bank's Risk-Taking Decisions and Asset Quality

Overconfidence among some managers has gained research attention because this personality trait can affect the firm value and profitability. Several theories in the prior literature explain the CEOs' overconfidence and its impact on risk-taking and asset quality including the theory of "Hubris", the theory of "Positive Illusions", and the "Upper Echelons" theory.

First: is the theory of Hubris². Raj and Forsyth (2003) described hubris as confidence in someone's capabilities. They argued that past success is one of the hubris reasons that leads to the feeling of supremacy. Hubris was considered one of the reasons that led to organizational failure because of the decisions that managers took based on their extreme self-confidence (Kahneman & Tversky, 1995).

In the 1980s, the concept of hubris started to be familiar to business researchers who began to empirically examine its impact. Roll (1986) argued that managers having hubris overestimate the price of their bids in comparison to the current market value of the company and they pay a lot for their targets during a takeover. They also undertook irrational investments that led to value-destroying mergers and acquisitions (Lin et al., 2008). Likewise, Li and Tang (2010) stated that hubris leads to excessive risk-taking due to the overestimation of success and returns.

In the prior literature, some studies presented three operative mechanisms that encouraged hubris CEOs to take excessive risks in firms. The CEO overestimation of his ability in problem-solving (Moore & Healy, 2008) and underestimation of needed resources and the firm's uncertainties in the surrounding environment (Kahneman & Lovallo, 1993). These mechanisms triggered overconfident CEOs to perceive decision situations as less risky and to overestimate the chances of project success, even though it is fraught with risk (Chatterjee & Hambrick, 2007). According to the behavioral theory of the company, this overestimation of success tends to raise the CEO's "aspiration level"; a criterion decision-makers use to assess organizational performance. When this aspiration level is increased, the attributed performance gets worse, and decision-makers become more risk-takers (Cyert & March, 1963).

The second theory is known as the theory of "Positive Illusions". Positive illusions were explained as "systematic small distortions of reality that make things appear better than they are" (Taylor, 1989, p. 228). In other words, positive illusions are a person's systematic ability to have highly optimistic perceptions about him/herself. According to this theory, people with positive illusions perceive the positive traits of the personality as more describing themselves while perceiving the poor traits as less describing themselves compared to a normal individual (Brown, 1986). The theory of positive illusions argued that CEOs overconfidence have a positive self-image that increases their feelings of self-worth (Blanton et al., 2001).

Three positive illusions were used in prior studies to describe overconfidence in the psychology literature, namely: the better-than-average effect, the illusion of control, and unrealistic optimism.

The better than average effect was described by Brown (2011) as the tendency of certain people to have an overly optimistic image of themselves. They perceived themselves as unique or exceptional personnel, particularly when compared with their peers. They believed that they had more morals, talent, and understandability than others. Additionally, they are more competent and less prone to errors.

² The term "hubris" has a Greek origin, it's described as a person's extreme self-confidence or pride that makes him/her avoid following rules and standards (Hayward & Hambrick, 1997).

The illusion of control occurs when people perceive that they can influence situations that are controlled entirely by chance. For instance, when people predict particular consequences and those outcomes take place, they are more likely to attribute them to their actions rather than luck (Taylor & Brown, 1988).

Unrealistic optimism was defined as “The future will be great, especially for me”. This exaggerated optimism makes them falsely assess future events because they see themselves as always winners and their chances of winning are better than all other people (Taylor & Brown, 1988, p. 197).

According to these three positive illusions, overconfident CEOs perceive themselves as better than others concerning their skills and managerial capabilities. They are excessively optimistic concerning future opportunities. They also perceive themselves as winners all the time regardless of the surrounding environment. As a result, overconfident CEOs overestimate future returns and follow excessive risk-taking strategies that may destroy the firm value.

The third theory is the “Upper Echelons” which was first published in 1984 by Hambrick and Mason. It claimed that the characteristics and attributes of the top executives could predict organizational outcomes, planned choices, and the level of performance (Hambrick & Mason, 1984). It emphasized the critical role of managerial behaviors, values, knowledge, and skills in influencing the firm’s strategic decisions.

2.2. Theories Describing Board Diversity

Concerning the nexus between regulatory capital and bank risk-taking, several studies provide evidence that regulatory capital adequacy is negatively associated with bank risk-taking. This indicates that maintaining a higher capital ratio regulates a bank’s risky behavior. Besides, the findings reveal that a larger regulatory capital base is a defensive tool against a bank’s default since it covers credit, market, and operational losses (e.g. Belanes and Hajiba, 2012; Berger and Bouwman, 2013; Lee and Hsieh, 2013; Nguyen, 2013; Adesina and Mwamba, 2016; Fratzscher *et al.*, 2016; Laeven *et al.*, 2016).

Several theories illustrated board diversity and its effect on managerial decision-making and firm value including the “resource dependence” theory; the “agency” theory, and the “human capital” theory. The **resource dependence theory** focuses on the complex interrelationships between organizations and their stakeholders resulting from the need for the resource. According to previous research on boards of directors, resource dependence theory is a useful paradigm for understanding and evaluating boards. Pfeffer and Salancik (1978) explained that according to this theory, firms obtain resources to decrease uncertainty in the surrounding environment. They suggested that directors should provide four main benefits to the organizations: providing information in the form of consultation and advice, providing access to information channels between the organization and the external environment, providing resource accessibility, and providing legitimacy. Hillman *et al.* (2000) explained that a diverse board of directors represents a useful set of resources that

increases economic achievements. They could enhance the organization's performance by providing access to more talent since they act as a link to external bodies and organizations. In addition, they provided the organization with various knowledge and unique expertise that could thus enhance the decision-making process. More recently, Reddy and Jadhav (2019) stated that a diverse board could send crucial messages to labor markets about the firm's products and was likely to bring innovative ideas and provide creative solutions to traditional challenges or obstacles.

The agency theory is one of the oldest theories in the management literature (Daily et al., 2003). It explained the relationship between agents and principles and argued that self-interest underpins much of organizational life. Managers (agents) could make some filtrations to the disclosed information with shareholders (principals), leading to an information asymmetry between both parties. Thus, the manager's control over crucial information could exacerbate the conflict between the managers and the shareholders (Jensen & Meckling, 1976). The board's role was to become a credible source of information for major corporate shareholders, resulting in effective management oversight (Fama & Jensen, 1983). The dissemination of more credible and accurate information from boards to shareholders may coordinate the managerial attitudes with the interests of shareholders. This traditional theory confirmed that the existence of a diverse board is crucial in decreasing the conflict arising from the information asymmetry between both managers and shareholders because a diverse board acts as an effective corporate governance mechanism. The agency theory has been utilized in various studies to investigate how board diversity affects corporate choices and decisions (Bonazzi & Islam, 2007; Chapple & Humphrey, 2014; Nguyen et al., 2015). Diverse boards act as a deterrent mechanism to the biases of overconfident managers when increasing their risk-taking practices.

The human capital theory is a socio-economic paradigm stating that firms were eager to find productive human capital to add to their current personnel. It supported the idea that the personnel in the company should possess diverse skills and avoid being homogenous (Becker, 1964). It is about how a person's investments in expertise and skills improve his capabilities and enhance the firm's performance (Westphal & Zajac, 1995). According to Kesner (1988), the personnel who are responsible for hiring new board members were interested in bringing diverse calibers because each board member brings a distinct collection of human capital resources to enhance the board's current capabilities. However, Freeman (1976) explained that the existence of diverse human capital only reflects talent not productivity, as productivity was generated through several hours of training and motivation.

To sum up, these three theories argue that the existence of diverse personnel on boards with different skills, education, gender, age, etc., is crucial to the success of any organization. Diversity acts as an effective corporate governance mechanism that brings new and updated ideas that match the surrounding environment. It also helps firms to make better and less risky decisions, control and monitor their operations effectively, and enhance competitiveness.

3. Related Literature and Main Predictions

3.1. CEO Overconfidence and Bank's Asset Quality

Three positive illusions were used by studies to describe overconfidence in the psychology literature, namely: the better-than-average effect (i.e. to have an overly optimistic image of yourself), the illusion of control (i.e. to perceive that you can influence situations that are controlled entirely by chance), and unrealistic optimism (i.e. to falsely assess future events because you see yourself as always a winner) (Taylor & Brown, 1988). These illusions triggered overconfident CEOs to perceive themselves as better than others concerning their ability to achieve promising results (Goel & Thakor, 2008). Furthermore, these illusions triggered them to believe that they had better knowledge concerning future events and were more likely to achieve favorable future outcomes (Malmendier & Tate, 2005).

The research about overconfidence in the banking sector showed that overconfident CEOs undervalue the riskiness of their investments while overestimating the prospects of borrowers (Hirshleifer & Luo, 2001). They thought that future expectations for loan repayments were better than non-overconfident CEOs thought they were. These biased beliefs encouraged overconfident banks to place smaller weight on downside risk, thus relaxing the lending requirements, raising loan growth rate, and boosting the bank's leverage in comparison with other banks with regular CEOs (Black & Gallemore, 2013; Ho et al., 2016). These actions would result in a predicted future decline in the quality of the loan portfolio.

The first hypothesis can be stated as follows:

H1: There is a negative significant influence of CEO overconfidence on the bank's asset quality.

3.2. The Impact of Board Gender Diversity on the Association between CEO Overconfidence and the Bank's Asset Quality

A great deal of economic and finance literature argued that the existence of female directors on board was crucial to corporate governance and firm performance (Pathan & Faff, 2013; Owen & Temesvary, 2018; Bennouri et al., 2018). They improved the controlling and monitoring processes inside any organization (Upadhyay & Zeng, 2014) and were more innovative (Griffin et al., 2020).

Female directors increased the board's effectiveness in their daily operations due to their outstanding qualifications and the diverse skills and experiences they provided to the board members (Adams & Ferreira, 2009; Gul et al., 2011). They were more concerned about stakeholder interests and environmental and ethical practices, as well as taking steps to mitigate any potential risks or losses (Adams & Ferreira, 2009). They had a more trust-building connection than males, hence placing a larger priority on stakeholder participation (Gul et al., 2011).

Furthermore, female directors were less traditional and confident but were more conservative in their work and had a better ability to express themselves than their male

fellows (Huang & Kisgen, 2013). Moreover, they were less prone to litigation and reputational damage (Srinidhiet al., 2011).

In addition to the above-mentioned benefits, female board members were usually more risk-averse than men. [Adhikaria](#) et al. (2019) found that firms with women in charge were less likely to have lawsuits. They avoid risky policies even if they are value-increasing. Additionally, Faccio et al. (2016) confirmed that firms with more females on board have a lower debt level, fewer earnings volatility, and a better likelihood of survival in comparison to firms with men's BOD.

In the banking sector, the prior literature has shown that since the female boards are risk-averse, the bank's performance and stability levels can be enhanced, hence lowering crisis levels (Harjoto et al., 2014; Farag & Mallin, 2015). The differences in the risk attitudes of female boards from their male fellows impacted the bank's loan-granting strategies. According to the prior literature, women provided less risky loans and chose more stable investments (Charness & Gneezy, 2012; Huang & Kisgen, 2013). Likewise, Bellucci et al. (2010) found that female loan officers in a sample of Italian banks restricted the amounts provided to new loan borrowers, confirming that they are more risk-averse than their male fellows. Similarly, in the UK, Beck et al. (2013) provided evidence that the loan default rates generated through female loan officers were lower than the male officers, but their results were attributed to loan officers, not board members. Additionally, Moussa (2019) examined the impact of corporate governance on the bank's asset quality while considering board size, board composition, and board gender diversity. The evidence revealed that the female's presence on the board increases the bank's asset quality due to their risk-averse characteristic. In the Gulf Cooperation Council (GCC), Abou-El-Sood (2018) found that banks with larger women on board invest in less risky projects despite having large regulatory capital. Moreover, In the UK, Lu and Boateng (2018) examined the impact of board composition including female board members on the bank's credit risk measured by non-performing loans and loan loss provisions. The findings revealed that females on board had a significant negative impact on credit risk since they chose their credit risk strategies in line with their risk-averse philosophy. This reduced the non-performing loans and enhanced the quality of the bank's assets. Similarly, Kinatader et al. (2021) found that boards having at least 3 or more women reduced the bank's credit risk. This study was investigated on a sample of 20 countries covering the period from 2006 to 2017.

In contrast, other previous literature has found that female boards can sometimes be risk-takers (Adams & Funk, 2012; Berger et al., 2014; Gregory-Smith et al., 2014). This can happen in particular circumstances such as undertaking better investment opportunities or being less experienced than the male members or having less commitment to the place they are working (Adams & Funk, 2012; Berger et al., 2014; Gregory-Smith et al., 2014). Moreover, some studies confirmed an insignificant association. Sila et al. (2016) used a sample of US-listed banks and found no significant association between board gender diversity and risk-taking. In addition, there were arguments from the psychology literature stating that board diversity could slow the

decision-making process since the diverse boards had different mentalities, backgrounds, and experiences that should act as a catalyst for raising conflicts and complicating the communication process between the executives (Berger et al., 2014). Therefore, board diversity could be viewed as a double-edged sword (Milliken & Martins, 1996).

Very limited research addressed the effect of female boards on the behaviors of overconfident CEOs. For instance, Leng et al. (2021) showed that entities operated by overconfident CEOs in the UK had a higher probability of corporate failure, especially in businesses with inadequate accounting conservatism. The premise is that overconfident CEOs delay their response to bad news. Their analysis also showed that both internal and external corporate governance mechanisms could reduce the effect of overconfidence on bankruptcy risk and corporate failure. Internal governance mechanisms include the existence of large, independent, and gender-diverse boards of directors, while external mechanisms encompass banks' creditors. Moreover, Chen et al. (2019) found that the existence of women on board matters for firms having overconfident CEOs. They could restrict the CEO's attitudes by making better decisions concerning investments. They also found that firms with no females on boards suffer from a huge drop in their financial performance.

The second hypothesis can be stated as follows:

H2. Board gender diversity significantly impacts the association between CEO overconfidence and the bank's asset quality.

4. Data and Methodology

This section shows the data collection sources and provides details about the sample composition. Furthermore, it discusses the measurements of asset quality, CEO overconfidence, board gender diversity, and other control variables.

4.1. Sample and Data

The empirical analysis was based on unbalanced panel data from 66 listed banks from 20 European countries³. It was selected according to the availability of quarter information on the commercial bank's asset quality and overconfidence measures. The initial sample consisted of 176 banks from 25 countries obtained from the Thomson Reuters Eikon database. The sample included listed commercial banks to concentrate on the type of banks that are most vulnerable to credit risk. To collect a sufficient number of observations, the sample period was extended from Q1-2014 to O4-2021. Data is trimmed at the 5 and 95 percentiles to reduce the influence of outliers. All data is in Euros. **Appendix A** presents the final sample countries and banks.

³ The final sample of European countries are: Austria, Belgium, Czech Republic, Cyprus, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the United Kingdom.

4.2. Methodology

The following OLS regression model is used to examine H1 and H2:

$$AQ_{i,t} = \alpha + \beta_1 CAPEX_{i,t} + \beta_2 BGD_{i,t} + \beta_3 CAPEX \times BGD_{i,t} + \beta_4 BANK-SIZE_{i,t} + \beta_5 PROF_{i,t} + \beta_6 AGE_{i,t} + \beta_7 COVID_{i,t} + \beta_8 BOARD-SIZE_{i,t} + \varepsilon_{i,t}$$

Where $AQ_{i,t}$ is a dependent variable that defines asset quality for bank i in quarter t , $CAPEX_{i,t}$ = CEO overconfidence measured by capex for bank i in quarter t . $BGD_{i,t}$ = board gender diversity, measured by the percentage of females on board for bank i at quarter t , $CAPEX \times BGD_{i,t}$ = interaction between CEO overconfidence and board gender diversity for bank i at quarter t , $BANK\ SIZE_{i,t}$ = the bank size for bank i in quarter t , measured by the natural logarithm of total assets, $PROF_{i,t}$ = bank's profitability, measured by the ratio of net income after taxes to total assets of bank i at quarter t , $AGE_{i,t}$ = bank age for bank i in quarter t , measured by the number of quarters since it was founded, $COVID_{i,t}$ = Covid 19 disease in quarter t , measured as a dummy variable takes 0 before the pandemic and 1 afterward, $BOARD\ SIZE_{i,t}$ = Board size for bank i in quarter t , measured by the total number of directors on the bank board at the end of each quarter.

4.2.1. Asset Quality: Asset quality in banks mainly defines the quality of loans granted by banks. The first measure of asset quality used in this study is the ratio of non-performing loans (NPL) to gross loans (Kadioglu & Telceken, 2017; Balakrishnan & Ertan, 2018), where a higher ratio shows a lower bank's asset quality. NPLs can be defined as loans where borrowers have defaulted or are no longer able to repay the loan with interest for a specific period (Alton & Hazen, 2001). Higher non-performing loans impact the bank's profitability and lead to bank failures because banks have to bear the costs of loans that are no longer generating income (Beltrame et al., 2018).

Loan loss provision (LLP) ratio (LLP/GL%) was used as a robustness measure for asset quality. When borrowers fail to repay all or part of their loans, banks keep appropriate provisions for losses on defaulted loans, hence, the ratio of LLP to GL is an indicator of loan portfolio problems. Higher provisioning shows that a greater portion of risk has already been considered in the profit and loss statement leading to lower asset quality (Velliscig et al., 2023).

4.2.2. CEO Overconfidence: Overconfidence was defined in prior research as an increase in one's self-assessment leading to optimistic beliefs about judgments, decisions, and estimations (Hayward & Hambrick, 1997). The prior literature showed how CEO overconfidence affects the investment choices made by firms (Malmendier & Tate, 2005, 2008; Ben-David et al. 2010). Accordingly, depending on the CEO's recent investment choices, the study employed an investment-based overconfidence proxy (CAPEX) which is a dichotomous variable set equals one if the capital expenditures divided by total assets in a given quarter is greater than the median level in that quarter and zero otherwise. This proxy is based on research from Ben-David et al. (2010) who found businesses with overconfident CEOs spend more on capital projects and Malmendier and Tate (2005) who revealed that overconfident managers overinvest in capital projects.

4.2.3. Board Gender Diversity: With the increasing numbers of women as consumers and experienced leaders in today's societies, their representation on corporate boards has become important. Board gender diversity hence will be used as a moderator variable to determine whether it would impact the association between CEO overconfidence and a bank's asset quality. Female boards are usually more risk-averse than men as they avoid risky policies ([Adhikaria et al., 2019](#)). They work on having a lower debt level and less earnings volatility (Faccio et al., 2016). They provide less risky loans and choose more stable investments (Charness & Gneezy, 2012; Huang & Kisgen, 2013). Board gender diversity is measured as the ratio of the number of females on board to the total number of board members for a bank i at year t .

4.2.4. Control Variables

We use the following explanatory variables in the analysis.

4.2.4.1. Bank Size ($BANK\ SIZE_{it}$):

According to the prior literature, larger banks have greater access to capital markets, impose higher interest rates on the provided loans, and invest in risky assets (Ariss, 2010). Although large banks are expected to have better risk management strategies and effective monitoring of the borrowers and default rates, some studies found that this can be difficult since large banks take large risks. Suntheim and Siron (2012) confirmed that banks seek higher risks because overconfident CEOs perceive themselves as they are "too big to fail". In addition, Mirzaei et al. (2013) argued that larger-sized banks have government support. Another strand of literature argues that the larger banks are less prone to risk as they have better diversification (Kabir & Worthington, 2017), have larger buffers that trigger them to cover future uncertainties such as liquidity problems or obligations, and have better risk management systems, thus improving bank asset quality and lowering amount of (NPL) (Sarkar & Sensarma, 2016). The impact of bank size on asset quality and non-performing loans is still ambiguous. Bank size is measured as the natural logarithm of the total assets of bank i at year t .

4.2.4.2. Bank's Profitability ($Prof_{it}$)

There are two opposing views in the literature concerning the impact of the bank's profitability on the bank's risk-taking and asset quality. One view argued that banks with higher profits are expected to grant more risky loans, thus exacerbating non-performing loans and negatively affecting the bank's asset quality (Delis & Kouretas, 2011; Sarkar & Sensarma, 2016). The other view suggested that banks with higher profits are more conservative when taking risks and they have higher cushions to absorb losses through financial crises compared to lower profitability banks (Mohsni & Otchere, 2018; Holod et al., 2020). Bank's profitability is measured by the ROA ratio (the ratio of net income after taxes to total assets of bank i at quarter t) since it shows how the management can generate profits from its assets effectively (Khan et al., 2017).

4.2.4.3. Bank's Age (AGE_{it})

The older the bank age, the more experienced officers they have. They select better investment projects and engage in less risk, thus, improving asset quality. The bank's age is measured as the number of years since incorporation (Berger et al., 2005).

4.2.4.4. Corona Virus ($COVID$)

Corona is an infectious disease that was recently discovered in 2019. This disease has caused many people to become unemployed or sick or bankrupt and caused economic recessions in most of the world. This caused higher amounts of non-performing loans which deteriorated the bank's asset quality and triggered delays in the economic recovery (Jing, 2020). As a result, it is deemed essential to consider its impact by measuring it as a dummy variable that takes 0 before the pandemic and 1 afterward.

4.2.4.5. Board Size ($BOARD\ SIZE_{it}$)

According to Andres and Vallelado (2008) and Wang and Hsu (2013), a large board should be preferred over a small one, because a larger board size enables more efficient monitoring and advisory tasks. Larger boards had individuals with various experiences that should assist management in making better decisions for the firm (Hou & Moore, 2010; Nakano & Nguyen, 2012; Switzer & Wang, 2013). However, this might be outweighed by the added cost of poor communication and decision-making associated with larger groups (Yermack, 1996). Furthermore, Abou-El-Sood (2017) showed that smaller-sized boards are associated with less risky investments. Thus, the impact of board size on asset quality is still ambiguous. Board size is measured by the total number of directors on the bank board at the end of each fiscal year.

Appendix B Displays the Summary of the Variables' Measures

5. Results

5.1. Descriptive Statistics

Table 1 presents the descriptive statistics of the dependent variable “asset quality” measured by NPL/GL and LLP/GL, the independent variable measured by CAPEX, and the control variables. This table shows the summary statistics for the whole sample, presenting the mean, median, standard deviation, minimum, and maximum values, p99, skewness, and Kurtosis of each variable used in the analysis. The NPL/GL mean (median) is 0.091 (.046382), and its min (max) is 0.005(0.435). LLP/GL mean (median) is .00158 (.000920), and its min (max) is 0 (0.007). The CAPEX mean (median) is 0.499 (0) and the BGD mean (median) is 53.291 (56.0049), its min and max are 0 and 97.619. All variables are normally distributed.

Table 1: Descriptive Statistics for the Quarter Sample Data for the Period Q1 2014 – Q4 2021

Variable	Obs	Mean	Std. Dev.	Min	Max	Median	p99	Skew.	Kurt.
NPL/GL	2007	0.091	0.115	0.005	0.435	.046382	0.435	1.94	5.705
LLP/GL	2034	.00158	.001869	0	0.007	.000920	0.007	1.498	4.412
CAPEX	1,880	0.499	0.5001	0	1	0	1	0.004	1
Prof	2048	0.0027	0.002	0.000	0.006	.001484	0.006	1.042	3.964
Bank SIZE	2048	25.039	1.948	19.633	28.604	24.9787	28.453	-0.255	2.405
Board SIZE	1952	2.488	0.358	1.386	4.143	2.48490	3.091	-0.393	3.842
Age	2073	5.044	0.976	2.197	6.695	4.79164	6.669	-0.069	1.989
BGD	1987	53.291	26.445	0	97.619	56.0049	96.913	-0.13	1.826
CAPEX*BGD	2048	23.874	31.609	0	97.619	0	95.897	0.932	2.362

5.2. Pearson Correlation

Table 2 reports the “Pearson Correlation” among all variables embedded in the research model. Moreover, it shows the collinearity between variables. NPL/GL is positively correlated with CAPEX at a significant level of 0.000 which implies that higher levels of overconfidence measured by CAPEX are significantly correlated with higher levels of NPL/ GL.

Regarding the multicollinearity, coefficients obtained from all explanatory variables in “Pearson’s Correlation” matrix are all below 0.8, thus, there is no multicollinearity between predictors.

Table 2 Correlation Matrix (Pairwise Correlations)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) NPL/ GL	1.000									
(2) LLP/ GL	0.423 (0.000)	1.000								
(3) CAPEX	0.150 (0.000)	0.258 (0.000)	1.000							
(4) PROF	-0.099 (0.000)	-0.026 (0.234)	0.139 (0.000)	1.000						
(5) BANK SIZE	-0.156 (0.000)	-0.072 (0.001)	-0.323 (0.000)	-0.378 (0.000)	1.000					
(6) BOARD SIZE	-0.138 (0.000)	-0.076 (0.001)	0.155 (0.000)	-0.224 (0.000)	0.384 (0.000)	1.000				
(7) AGE	0.130 (0.000)	0.056 (0.011)	0.048 (0.035)	-0.283 (0.000)	0.204 (0.000)	0.193 (0.000)	1.000			
(8) COVID	-0.185 (0.000)	-0.027 (0.213)	0.012 (0.605)	-0.073 (0.001)	0.052 (0.018)	-0.006 (0.793)	0.043 (0.050)	1.000		
(9) BGD	-0.213 (0.000)	-0.179 (0.000)	-0.072 (0.002)	-0.135 (0.000)	0.160 (0.000)	0.138 (0.000)	-0.056 (0.012)	0.184 (0.000)	1.000	
(10) CAPEX*BGD	0.039 (0.076)	0.106 (0.000)	0.800 (0.000)	0.047 (0.030)	-0.173 (0.000)	0.146 (0.000)	0.010 (0.635)	0.108 (0.000)	0.357 (0.000)	1.000

5.3. Regression Results

Table 3 shows the regression results⁴ using the two proxies of asset quality: the NPL/ GL and LLP/ GL. The OVC is measured by CAPEX. The results of the first model measured by NPL/ GL show that the coefficient of CAPEX is positive and statistically significant at a p-value of less than 1%, suggesting a negative association between OVC and asset quality. The second model where asset quality is measured by LLP/ GL shows also a positive coefficient and is statistically significant at a p-value of less than 5%. Consequently, these results confirm H1. This shows that banks with higher overconfidence have lower asset quality. These results support the prior literature findings that overconfident CEOs undertake more risk than normal CEOs (Niu, 2010; Liu et al., 2020). They underestimate the customer's creditworthiness and are more optimistic about future returns such as returns from loan collection. Accordingly, they set lower interest rates, relax the lending standards, and exhibit higher loan growth rates, resulting in higher NPLs, higher provisions, and lower credit quality (Mahdi and Abbes 2018; Ho et al., 2019; Bacha & Azouzi, 2019; Fersi & Boujelbène, 2021).

Table 3 also shows that the BGD exhibits a negative coefficient and is statistically significant at a p-value of less than 1% in both models. Furthermore, CAPEX* BGD exhibits a negative coefficient and is statistically significant at a p-value of less than 1% in the first model and at a value of less than 10% in the second model. This supports H2 suggesting a significant moderation impact of BGD on the association between CEO overconfidence and the bank's asset quality. This implies that banks with overconfident CEOs can have better asset quality and lower credit risk if they have more females on their boards. Accordingly, this result is in line with the prior literature revealing that women have greater risk aversion relative to men especially when making financial and investment decisions (Barber & Odean, 2001; Halko et al., 2012). Moreover, they enhance the bank's performance and stability levels, hence lowering crisis levels (Harjoto et al., 2014; Farag & Mallin, 2015). Importantly, they improve the controlling and monitoring processes inside any organization (Upadhyay & Zeng, 2014), provide less risky loans, and choose more stable investments (Charness & Gneezy, 2012; Huang & Kisgen, 2013). Consequently, they help reduce the bank's overall risk-taking (Abou-El-Sood, 2018) and improve its asset quality. Concerning the control variables, bank size showed a positive correlation in both models and exhibited a significance level of less than 1% in the first model and a significance level of less than 5% in the second model, indicating lower asset quality with larger bank size. Larger banks undertake more risk as they perceive themselves as they are "too big to fail" (Suntheim & Siron, 2012; Mirzaei et al., 2013). Board size is not significant in both models, however, bank age had a negative correlation and is statistically significant in both models, indicating that the larger the bank years of incorporation, the better the experience of the managers and officers. They will select better

⁴ The results of the Modified Wald test show that (NPL/ GL and LLP/GL) have heteroscedasticity problems since the p-values are lower than 5%. Furthermore, the residuals in both models are not serially correlated. These problems are corrected by a valid technique known as panel-corrected standard errors (PCSE) which are used when errors are assumed to be heteroscedastic and correlated across panels (Hoechle, 2007).

investment projects and engage in less risk, hence improving asset quality and lowering NPLs and LLPs. Profitability showed a negative coefficient in both models. It was strongly significant in the second model, whereas it was not statistically significant in the first model. Finally, COVID-19 shows a positive significant correlation in both models, indicating that COVID-19 increases the value of NPLs. After the pandemic, many businesses went bankrupt as they struggled to stay afloat in the face of lockdown measures and reduced demand. Similarly, households faced reduced income due to job losses, resulting in a sharp increase in NPLs.

Table 3: Regression Results

Variables	Pred.	Asset Quality				
		NPL/GL		pred	LLP/GL	
		Coeff	P-value		Coeff	P-value
CAPEX	+	0.03433***	0.003	+	0.00048**	0.037
BGD	-	-0.00036***	0.000	-	-0.00063***	0.000
CAPEX*BGD	-	-0.00052***	0.002	-	-0.00056*	0.098
PROF.	-	-0.14005	0.921	-	-0.2623***	0.000
BANK SIZE	+/-	0.0059***	0.000	+/-	0.000493**	0.026
BOARD SIZE	+/-	-0.01271	0.219	+/-	-0.000083	0.675
Age	-	-0.0108***	0.001	-	-0.00011*	0.100
COVID	+	-0.035***	0.000	+	-0.00081*	0.100
Bank Fixed Effect	YES		Yes			
Country Fixed Effect	YES		YES			
Quarter Fixed Effect	YES		YES			
Observations	1,816		1,838			
P-value	0.000		0.000			
R-Square	0.8754		0.8138			
Number of Banks	66		66			

*** $p < .01$, ** $p < .05$, * $p < .1$

6. Robustness Check

This section presents additional analysis by examining the same model in separate countries. Three countries are only examined due to possessing a high number of banks (Poland, Italy, Austria). The results are shown in Table (4). The results also report a significant negative coefficient for the interaction CAPEX * BGD in the three countries.

Table 4: Robustness Check

Variables	NPL/GL								
	Pred.	Poland		pred	Italy		pred	Austria	
		Coeff	P-value		Coeff	P-value		Coeff	P-value
CAPEX	+	0.0952***	0.000	+	0.878***	0.000	+	0.037656***	0.000
BGD	-	-0.0014***	0.000	-	-0.00085*	0.09	-	-0.00039***	0.002
CAPEX*BGD	-	-0.0012***	0.000	-	-0.0041***	0.000	-	-0.00084***	0.000
PROF.	-	-4.463*	0.091	-	-0.86787	0.885	-	-0.59458	0.5
BANK SIZE	+/-	0.0192***	0.000	+/-	0.04831***	0.000	+/-	0.02024***	0.000
BOARD SIZE	+/-	-0.0995***	0.000	+/-	-0.0423251	0.286	+/-	-0.00622	0.291
Age	-	-0.0083	0.305	-	0.0146522	0.751	-	-0.00987***	0.000
COVID	+	0.0325***	0.000	+	0.0329226	0.096	+	0.004322	0.111
Bank Fixed Effect	YES		Yes		Yes		Yes		
Quarter Fixed Effect	YES		Yes		Yes		Yes		
Observations	281		182		137				
P-value	0		0		0				
R-Square	0.8492		0.878		0.9746				
Number of Banks	10		6		5				

*** $p < .01$, ** $p < .05$, * $p < .1$

7. Conclusion

The main objective of this research is to examine the bank's asset quality through overconfidence behavioral bias. This objective is achieved through the empirical verification of the hypothesis stating that overconfidence has a negative significant influence on the bank's asset quality. In addition, the empirical study adds to the existing literature on board gender diversity in the banking sector, by empirically investigating its impact on the association between CEO overconfidence and the bank's asset quality. The analysis is conducted using OLS regressions for a sample of 66 listed commercial banks from 20 European countries during the period of Q1 2014 to Q4 2021.

The empirical analysis reveals the significant negative influence of CEO overconfidence on the bank's asset quality using two proxies (NPL/GL & LLP/GL). This finding suggests that overconfident CEOs' risk-taking attitudes may be influenced by an underestimation of risk, an overestimation of future returns, and an overestimation of risk management capabilities. The impact of overconfidence on asset quality can be explained in 2 ways. First, overconfident CEOs tend to underestimate borrowers' creditworthiness, thus imposing lower interest/profit margins. Second, overconfident CEOs may overestimate future returns from loan collection and their ability to withstand future downturns, triggering aggressive loan strategies and highly non-performing loans.

Furthermore, the study findings highlight the important role of board gender diversity in constraining the CEO's overconfident biases when taking excessive risks

leading to lower bank asset quality. This is achieved by examining the effects of the percentages of women on boards of directors of European banks to find its impact on the association between CEO overconfidence and the bank's asset quality. The results reveal a significant negative impact of BGD highlighting its role in reducing the CEO overconfidence biases when undertaking credit risk. This result supports the majority of the literature that claims the risk-averse attitude of female boards compared to their male counterparts when making financial decisions. Female boards provide less risky loans and choose more stable investments. Furthermore, this finding is relevant to the Basel Committee and regulatory discussions on strengthening bank governance frameworks and evaluating risk management practices. The study robustness analysis confirms that the results are in line with the main test.

The research is subject to certain limitations. First, the results cannot be generalized to all the European banking sector because it only examined 20 European countries due to the unavailability of data. Second, the study relies on an investment-based proxy only as "CAPEX" to measure CEO overconfidence and does not take into account other proxies such as options or net stock purchases due to the unavailability of data.

This research has several implications including; social, practical, and managerial. First, social implications: the findings increases awareness and efforts towards promoting gender diversity in the banking sector. It emphasizes the social significance of equal representation for women in decision-making positions. It suggests that promoting gender diversity is not only about meeting quotas but also fostering a culture of diversity within the banking organization. This may require a shift in the mindsets, values, and practices to support gender equality. Second, practical implications: banks can implement policies and practices that promote gender diversity such as setting quotas for female representation and seeking qualified female candidates. The research also highlights the importance of providing leadership training and continuous development programs to bank CEOs regularly. These trainings should focus on self-awareness, decision-making biases, and risk-management skills. Third, managerial implications: banks shall have better risk management and corporate governance strategies to enhance the soundness and stability of the banking system. Future research can examine the impact of other factors such as board independence, board experience, and IFRS 9 (ECL) on the association under study

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Appendix A

Country	Bank Name	Number of Banks
Austria	Erste Group Bank AG	5
	Raiffeisen Bank International AG	
	BAWAG Group AG	
	BKS Bank AG	
	Bank fuer Tirol und Vorarlberg AG	
Belgium	Kbc Groep NV	1
Cyprus	Hellenic Bank PCL	2
	TCS Group Holding PLC	
Czech Republic	Komerčni Banka as	2
	Moneta Money Bank as	
Denmark	Danske Bank A/S	3
	Jyske Bank A/S	
	Sydbank A/S	
Finland	Ålandsbanken Abp	2
	Nordea Bank Abp	
France	Societe Generale SA	2
	Credit Agricole SA	
Germany	Commerzbank AG	1
Greece	Piraeus Financial Holdings SA	4
	Alpha Services and Holdings SA	
	National Bank of Greece SA	
	Eurobank Ergasias Services and Holdings SA	
Hungary	OTP Bank Nyrt	1
Italy	Intesa Sanpaolo SpA	6
	UniCredit SpA	
	Credito Emiliano SpA	
	Bper Banca SpA	
	Mediobanca Banca di Credito Finanziario SpA	
	Banca Monte dei Paschi di Siena SpA	
Netherlands	ING Groep NV	2
	ABN Amro Bank NV	
Norway	Sparebank 1 Sorost-Norge	8
	Sparebanken Sor	
	DNB Bank ASA	
	Sparebank 1 Ringerike Hadeland	
	Sparebank 1 SMN	
	Sparebank 1 Nord-Norge	
	Sogn Sparebank	
	Sparebank 1 Helgeland	
Poland	Bank Millennium SA	10
	ING Bank Śląski SA	
	mBank SA	
	Santander Bank Polska SA	
	Bank Handlowy w Warszawie SA	
	Bank Polska Kasa Opieki SA	
	Getin Holding SA	
	Powszechna Kasa Oszczędności Bank Polski SA	
	BNP Paribas Bank Polska SA	
Alior Bank SA		
Portugal	Banco Comercial Portugues SA	1
Russia	Sberbank Rossii PAO	1
Spain	Banco Bilbao Vizcaya Argentaria SA	5
	Bankinter SA	
	Banco Santander SA	
	Caixabank SA	
Sweden	Unicaja Banco SA	5
Sweden	Skandinaviska Enskilda Banken AB	3

	Svenska Handelsbanken AB	
	Swedbank AB	
Switzerland	Valiant Holding AG	1
	Barclays PLC	
	Natwest Group PLC	
	Standard Chartered PLC	
	HSBC Holdings PLC	
United Kingdom	Bank of Georgia Group PLC	5
20 Countries		66 Banks

Appendix B: Summary of the Variables and Their Measures

Type of Variable	Name	Measures
Dependent Variable	Asset Quality (AQ)	<ol style="list-style-type: none"> 1) <i>NPL/GL</i>: The ratio of non-performing loans to gross loans for bank <i>i</i> at quarter <i>t</i>. 2) <i>LLP/ GL</i>: The ratio of loan loss provisions to gross loans bank <i>i</i> at quarter <i>t</i>.
Independent Variable	CEO Overconfidence	<ol style="list-style-type: none"> 1) <i>CAPEX</i>: is a dichotomous variable set equal to one if the capital expenditures divided by total assets in a given quarter is greater than the median level in that quarter and otherwise zero for bank <i>i</i> at quarter <i>t</i>.
Moderating Variable	1) Board Gender Diversity	The percentage of females on boards for a bank <i>i</i> in quarter <i>t</i> .
Control Variables	<ol style="list-style-type: none"> 1. Bank Size (BANK SIZE <i>it</i>) 2. Bank's Age (Age) 3. Bank's Profitability (PROFit) 4. Corona Virus (COVID) 5. Board Size (BOARD SIZE_{it}) 	<ol style="list-style-type: none"> 1) The natural logarithm of total assets of bank <i>i</i> at quarter <i>t</i>. 2) The number of years since it was founded. 3) The ratio of net-income after taxes to total assets of bank <i>i</i> at quarter <i>t</i>. "ROA". 4) A dummy variable takes 0 before the pandemic and 1 afterward. 5) The total number of directors on the bank board at the end of each fiscal year.