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*How did the CEOs' overconfidence of EU banks affect bank lending and performance during the European Debt Crisis?*

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## **ABSTRACT**

Until the European Debt Crisis (2009-2010), the European Union financial markets were in a favourable state of abundant liquidity and low-risk aversion, with financial institutions especially those with overconfident CEOs, expanding lending quickly and recklessly. This weakening of lending standards increased their exposure during the crisis, causing a rise in non-performing loans and a drop in bank profitability. This paper aims to examine the effect of European banks' CEO overconfidence on bank lending and performance. For this purpose, multivariate regressions were conducted for the period 2005-2012, and data from Dow Jones Factiva and Orbis Bank Focus was used. The analysis found that CEO overconfidence had a statistically significant impact on the rise of non-performing loans during the crisis years, but no effect on performance. There were data limitations concerning European CEO compensation, determining the use of a more manual and less precise method to measure CEO overconfidence. Consequently, future research should examine these relationships with other methods or more comprehensive data.

**Keywords:** CEO overconfidence; European debt crisis; Bank lending; Bank performance

The views stated in this thesis are those of the author and not necessarily those of the supervisor, second reader, Erasmus School of Economics or Erasmus University Rotterdam.

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“Just one day after Mr. Becker projected confidence at the conference, the bank announced a \$1.8 billion loss... By Friday, Silicon Valley Bank was dead,” (Farell, 2023)

## 1. Introduction

In light of the global credit boom of 2003-2007, the European Union (EU-15) was a large capital inflow magnet, conditioned by a favourable global environment of abundant liquidity and low-risk aversion (Bakker & Gulde, 2010). EU financial institutions expanded lending quickly during this period to exploit burgeoning local economic conditions, raising concerns that these institutions underrated credit risks. The overvaluation of borrower prospects was unravelled during the Global Financial Crisis (GFC) and proved highly detrimental for the EU banks that fostered the lending boom, leading to an economic downturn and multi-year debt crisis known today as the European Debt Crisis. One likely source that amplified reckless risk-taking behaviour during this period was the overconfidence of Chief Executive Officers (CEOs) considering their significant influence over a bank’s financing and investment choices. Profligate CEO investment decisions due to overconfidence have long been known to cause lender solvency issues and continue to be a concern, as evidenced by the third-largest banking failure in the U.S., the downfall of Silicon Valley Bank (SVB) in 2023. The introductory quote about SVB’s CEO and his overconfidence highlights the connection between egocentric biases and financial decision-making. Moreover, a Forbes article discussing the causes of SVB’s ruin, mentions that the overconfidence of the bank’s leadership steered it to “underestimate risk” and that it “was part of the psychological phenomena which led” to the bank’s collapse (Shefrin, 2023).

The corporate finance and empirical banking literature have documented CEO overconfidence in decision-taking, vulnerability to risk and following returns. Early studies such as the article by Malmendier and Tate (2008) show that overconfident CEOs overestimate their ability to generate returns. Meanwhile, a multitude of comparable studies have highlighted a common finding that managers’ overconfidence exposes them to higher excessive risk (Gervais et al., 2011; Suntheim & Sironi, 2012). Moreover, Liu et al. (2022) and Lee et al. (2020) examined the banking sector in the context of the GFC, also emphasizing that banks with overconfident CEOs have higher realized systematic risk. A more exhaustive study was done by Ho et al. (2016) who examined the level of confidence of publicly listed U.S. banks’ CEOs during the 1998 Russian financial crisis and the GFC, stating that banks with overconfident CEOs have more serious exposure due to authorizing a greater number of loans and taking increased leverage before the crisis. Therefore, the paper posits that as the crisis sets in, these banks experience unexpected, significant capital losses due to numerous non-performing loans, followed by declines in the bank’s performance, increases in the expected default probability and a higher likelihood of bank failures.

Whilst the majority of academic papers focus on the United States, Chen and Chen (2015) have tested the idea on a significantly larger sample consisting of the financial institutions in G20 countries and

Taiwan over 2005-2012, finding a similar result that overconfident CEOs tend to take more credit which raises the insolvency risk of their institutions. However, what sets aside this paper is the result of the timing when CEOs exhibit more risk-taking. More specifically, Chen and Chen (2015) conclude that higher credit risk taken by overconfident managers is manifested especially in the recession periods and that they lower their risk exposure in the boom and profit periods, contradicting Ho et al. (2016) who found that the economic upturn periods are when most risk-taking occurs. Having such polar opposite results of the same relationship, and also considering the lack to this date of a similar study of particularly the EU banking setting, Europe would be an interesting field to dive into due to the differences with the U.S. bank system and their distinct reactions to financial crises and risk management. The goal of this paper is to show that previous results of Ho et al. (2016) are “generalizable” to the EU banking sector in the same context of CEO overconfidence but under the framework of a “local” financial crisis, namely the European Debt Crisis. Therefore, the research question that this thesis aims to answer is:

***How did the CEOs’ overconfidence of EU banks affect bank lending and performance during the European Debt Crisis?***

Following the extant literature, this paper targets the 100 largest financial institutions in the five most economically strong European countries starting in 2005: Germany, United Kingdom, France, Italy, and Spain, categorized within the industry classification NACE code 6419 (Eurostat, 2008) - “Financial intermediation, except insurance and pension funding - Other Monetary intermediation”. Considering that the study intends to look into the European Debt Crisis, the sample used covers the years from 2005 to 2012 to examine both the crisis years of 2009-2010 and the non-crisis ones. Furthermore, this paper employs the methodology of Chen and Chen (2015) to construct the CEO overconfidence measure, using global news sources from the Dow Jones Factiva database to identify newspaper articles where the CEOs of the studied institutions have been mentioned as “overconfident” or the opposite. The banks led by overconfident CEOs will be further referred to as overconfident banks. Meanwhile, to examine how CEO overconfidence affects bank lending, the performance and the employee turnover ratio of the selected financial institutions, the econometric model of multivariate regressions is applied, accounting for any potential heteroskedasticity issues. The financial data required for these regressions from banks’ balance sheets such as the loans data, return on equity, non-performing loans, turnover and bank characteristics is collected from Orbis Bank Focus.

This paper finds that overall, across all years analysed, overconfident banks make up to 40% of the sample. During the non-crisis years, 38% of banks were classified as overconfident, while in the pre-crisis years of 2008 and 2007, 23% were characterized as such. Moreover, this study’s empirical results show that in crisis years, when evaluating 2007 as the pre-crisis year, the overconfident banks compared to their counterparts, suffer more of a significant increase of non-performing loans equal to 1.7835 and 2.3459 when integrating the bank characteristics. Other relationships examined in the study have proven statistically insignificant results.

This study contributes to the existing literature by exploring CEO overconfidence in the banking sector within a previously unexplored geographical and political region, specifically the European Union. Moreover, this paper emphasizes the European Debt Crisis from a novel perspective, focusing on the optimism displayed by banks' managers. Besides, the sample selected in this study includes the largest 100 financial institutions from the five economic pillars of the European Union, resulting in a somewhat small sample size compared to larger samples of former research. Given this dataset, the paper has the potential to shed more light on the behaviour and consequences of the biggest banks in the sector.

The paper has the following structure. Firstly, section two will discuss the theoretical framework, defining overconfidence and its characteristics in CEOs, addressing the literature review, and developing the research question and hypotheses. Secondly, section three introduces the data sources, the sample and the variables utilized, followed by summary statistics, univariate analysis and data limitations. Then, the methodology chapter presents details on the empirical models used for testing the hypotheses, along with an endogeneity analysis. After the fifth section about the empirical results, the paper concludes with its findings (section six).

## **2. Theoretical Framework**

This section offers the definition of overconfidence, outlines its characteristics for CEOs and provides the reasoning for analysing it with respect to bank performance. Subsequently, a literature overview is presented as the foundation for developing the hypotheses and research question of this paper.

### **2.1 Overconfidence**

Overconfidence can be defined as a systematic overestimation of the accuracy of one's decisions and the precision of one's knowledge (Dittrich et al., 2005). In a financial setting, this would be equivalent to the consistent overestimation of one's investment choices. This cognitive bias as psychologists call it, is regarded as one of the most robust findings in the psychology of judgment (DeBondt & Thaler, 1995). Overconfidence is fuelled by a false sense of understanding where individuals overestimate their wisdom or skills beyond a threshold, being unjustifiably certain of their beliefs and reasoning. The extant literature suggests that overconfidence exists persistently because in updating beliefs about their own abilities, people tend to credit themselves for favourable outcomes strongly, and blame external factors for unfavourable outcomes (Daniel et al., 1998). This phenomenon has been observed and examined in experts from many professions such as entrepreneurs (Cooper et al., 1988), clinical psychologists (Oskamp, 1965), engineers (Kidd, 1970), lawyers (Wagenaar & Keren, 1986), and chief executive officers (Malmendier & Tate, 2004), the latter being the primary focus of this research.

#### **2.1.1 Overconfident CEOs**

This paper centres on the public face of a financial institution that drives the direction of the organisation, supervising and overseeing other executives, the top decision-maker, namely the CEO. There are multiple reasons for suspecting overconfidence in CEOs. Research done by psychologists, such as Taylor and Brown (1988) conclude that overall, people are more prone to manifesting overconfidence, whilst Graham et al. (2013) empirically demonstrate that CEOs exhibit significantly higher levels of optimism compared to the general population. Meanwhile, individuals who manifest a positive bias towards their management abilities are more prone to pursue careers as managers. Psychologists also imply that individuals tend to be particularly overconfident about outcomes they perceive as being under their authority (Langer, 1975; March & Shapira, 1987) and to which they are deeply committed (Weinstein, 1980), situations applicable to CEO positions. Moreover, as mentioned previously, overconfidence can continuously grow when successful CEOs excessively credit their achievements to their own merit and disregard other factors, which is often the case. Extant literature has proven empirically and theoretically, that CEO overconfidence explains significant corporate decisions such as investment, financing, dividends, and mergers. Since overconfidence can directly influence a CEO's decision-making, it is interesting to follow the effect it may have on a bank's performance, especially during challenging periods such as financial crises.

This effect can be examined by initially analysing the characteristics and manifestations of overconfidence in CEOs. It is essential to mention that in contrast to “corporate expansionists”, who are driven by a desire for dominance and growth and aggressively consolidating their influence, overconfident CEOs are motivated by maximizing value, proven not to be the case (Campbell et al., 2011), and acting in accordance with shareholder interests. However, despite their intentions, overconfident CEOs overestimate their abilities to generate returns and the perspectives of their firms, being more inclined to pursue value-destroying projects and less accurate investments than rational managers (Malmendier & Tate, 2005; 2008). Because of that, they overvalue the borrowers’ prospects and underestimate the riskiness of their investments (Hirshleifer & Luo, 2001), resulting in overinvesting (Goel & Thakor, 2008), and ownership of more risky assets and portfolios with higher returns, displaying better results than rational CEOs, at least for a period (De Long et al., 1991). Furthermore, institutions with overconfident CEOs display an additional market exposure of 13,8% and increase risk-taking by more than 15% (Kassner, 2023). Overconfidence amongst CEOs is considered a monitoring problem for the board of directors since they cannot observe the level of confidence of the CEO at the hiring moment, and it can only be observed later based on the CEO’s decisions. Yermack (1995) suggests that when monitoring is challenging, institutions include stock options in their CEO’s compensation packages so they would be sensitive to the firm’s performance. However, even with this solution, overconfidence persists due to the manager’s innate belief in their skills, judgment, and successful outcome.

The literature also posits some positive aspects of CEO overconfidence. Hirshleifer et al. (2012) and Galasso and Simcoe (2011) find that overconfident managers are more likely to engage in innovation and higher growth opportunities, which can enhance the firm’s value albeit increasing stock volatility, and as mentioned previously, they can also exploit risky opportunities better. Meanwhile, moderate levels of manager overconfidence are proven beneficial up to a point, while extreme confidence might destroy a firm’s value (Goel & Thakor, 2008).

## **2.2 Literature review**

The impact of CEO overconfidence on bank performance, specifically during financial crises, has not been extensively studied until recently when significant research contributions have emerged at least for the U.S. The extant literature has researched mainly CEO confidence with respect to other areas of corporate activity, such as forced turnover (Campbell et al., 2011), trading (Hirshleifer & Luo, 2001), compensation contracts (Gervais et al., 2011), dividend policy (Deshmukh et al., 2013), acquisitions (Malmendier, & Tate, 2008), investment decisions (Dittrich et al., 2005), etc. However, lately, the limited empirical research has been enriched with several papers discussing CEO overconfidence in relation to the banking sphere.

The main inspiration for this paper is Ho et al. (2016) who examine the impact of CEO overconfidence on U.S. bank’s lending and leverage during the 1998 Russian crisis and the 2007-2009



financial crisis. They demonstrate that prior to the crisis, banks led by overconfident CEOs were more likely to relax lending standards and increase leverage, making them more susceptible to shocks. During the crisis years, these banks would generally suffer more from expected loan and bank default probability, decline in return performance and CEO turnover or failure compared to other banks. Building also on previous research, the paper concludes that overconfident CEOs can account for the variations in risk-taking behaviour among banks.

Other research on whether CEO overconfidence affects the bank's systematic risk was done by Lee et al. (2020) for 1995-2014, and Liu et al. (2022) that examined 2007-2008. Their papers find evidence that the U.S. banks ruled by overconfident CEOs display a higher contribution and exposure to systematic risk, explaining its cross-sectional heterogeneity. These banks incurred more systematically relevant losses as well. Additionally, it was proven that these impacts significantly increased in the period of the financial crisis of 2008-2009.

Chen and Chen (2015) represent another cornerstone in the literature about the impact of CEO overconfidence upon bank risk-taking. This paper, unlike the ones previously mentioned, selected a bigger sample than the U.S., explicitly financial institutions from G20 and Taiwan over the period 2005-2012. Their research shows, similarly, to the aforementioned papers, that overconfident managers tend to take on more credit and thus, insolvency risk, particularly in the crisis periods. However, surprisingly, their study also highlighted that overconfident CEOs lower their risk exposure during boom and profit periods, contradicting other papers analysed.

### **2.3 Hypotheses development**

This section outlines the rationale behind the development of the hypothesis and research question for this paper. After establishing the impact of CEO overconfidence, this study builds upon the papers discussed in the literature review to come up with its own hypothesis, analysis, and conclusions regarding bank performance during financial crises, namely the European Debt Crisis.

The empirical literature suggests that financial institutions with overconfident CEOs pursued riskier strategies before financial crises and demonstrated poorer performance during the economic downturn (Ho et al., 2016). Meanwhile, CEO overconfidence also seems to play a role in a bank's financing policy. During a credit boom, such as the time frame of 2005-2008 that this paper considers and categorizes as non-crisis, banks usually tend to increase leverage due to the strong growth opportunities perceived (Adrian & Shin, 2009; 2010). Because of the good economic conditions, individuals assume that the positive state will continue, especially the overconfident CEOs. Moreover, Malmendier et al. (2011) show that when overconfident CEOs overestimate the return on an investment but cannot fully cover it, they prefer debt over equity for obtaining external funds, having substantially greater leverage ratios. Adding up to that, in their research of the 1998 crisis, Palumbo and Parker (2009) prove that banks that performed worse in the crisis relied to a greater extent on short-term funding prior to it. Furthermore,

managerial overconfidence results in more reliance on debt financing, thus loans being more preferred by CEOs since they overrate their ability to fulfil their liabilities (Hackbarth, 2008; 2009). Kassner (2023) is another insightful research that contributes to the assumption that overconfident banks that suffered mostly in the crisis, were more dependent on loans. This paper finds that banks with overconfident CEOs are more likely to approve and extend riskier loans before the crisis, and only after it, they adjust their behaviour towards non-overconfident banks by reinforcing credit regulations. Therefore, it seems reasonable to propose the first hypothesis:

*Hypothesis 1. Overconfident banks have a greater increase in loans than non-overconfident banks in non-crisis years.*

As previously discussed, overconfidence has a significant influence on another major bank aspect, namely risk, which tends to rise with managerial overconfidence. Ho et al. (2016) demonstrate that financial institutions led by overconfident CEOs pursued riskier strategies before the crisis, and thus experienced more severe repercussions during the financial turmoil. Dell’Ariccia and Marquez (2006) confirm once again that when the economy weakens, the banks with more relaxed lending standards or increased leverage often encounter reduced profits but also a greater likelihood of failure to meet obligations and financial distress. As evidence, Kassner (2023) concurs that risk was significantly higher for overconfident financial institutions until 2007. Therefore, when the credit boom ends, overconfident banks are more adversely affected. Dealing with non-performing loans is a precise illustration of the risk challenge a bank faces. This paper considers the ratios for impaired loans over total equity and over gross customer loans and advances as a proxy for non-performing loans. Thus, the following hypothesis is drawn:

*Hypothesis 2. Overconfident banks suffer more of an increase in non-performing loans than non-overconfident banks in crisis years.*

When the economy deteriorates, the banks that have either relaxed their lending standards, increased their leverage, or both, frequently experience worse stock performance (Beltratti & Stulz, 2012). An instance of that would be that during 2007-2008, the installation of the crisis years, the stock market capitalization of numerous important banks plummeted by more than half, severely impairing the market value of these banks’ assets (Ho et al., 2016). Additionally, the presence of non-performing loans escalates the reduction in the operating performance of a bank, since these loans incur capital losses and are categorized as expenses. Considering all these factors and more, the next hypothesis can be posited:

*Hypothesis 3. Overconfident banks are more likely to experience a greater reduction in bank performance than non-overconfident banks in crisis years.*

Campbell et al. (2011) suggest that excessively optimistic CEOs are about 48% more likely to face forced turnover, highlighting the economic importance of manager overconfidence in the overall

turnover of the entire institution. On the contrary, Goel and Thakor (2008) empirically demonstrate that underestimation of project risks by overconfident CEOs may result in a reduced probability of forced turnover. To test these conclusions, the following hypothesis can be proposed:

*Hypothesis 4. Overconfident banks are more likely to suffer from a higher employee turnover than non-overconfident banks in crisis years.*

### 3. Data

This section introduces the data sources, the sample and the variables used, followed by a description of the method behind the overconfidence measure. It also provides several summary statistics for the data, a univariate analysis of the data and discusses the data limitations.

#### 3.1 Sample, data sources and variables

This paper restricts its sample to five countries, the main economic players of the European Union in 2005: Germany, United Kingdom, France, Italy, and Spain. For each country, the biggest 20 institutions<sup>1</sup> are selected from Orbis Bank Focus, published by Bureau van Dijk, based on their total assets, a common proxy for bank size. As a result, the final dataset consists of 100 banks. Banks are selected based on financial institutions in Bank Focus that report having the industry classification NACE code 6419 (Eurostat, 2008) - “Financial intermediation, except insurance and pension funding - Other Monetary intermediation” and financial accounts with the Account Type of C1- “Consolidated accounts with no unconsolidated companion”, C2- “Consolidated accounts with an unconsolidated companion”, and U1- “Unconsolidated accounts with no consolidated companion “. Given that the interest of this research is the period around and including the European Debt Crisis, conventionally defined as the period between 2009 and 2010 (the crisis years), the sample included in this paper covers the years from 2005 to 2012. For this time frame, 2005-2008 and 2011-2012 are defined as non-crisis years.

The main analysis on the impact of CEO overconfidence on bank behavior relies on Orbis Bank Focus accounting data for these banks included in the sample, such as: Bank Loans; the ratio of Impaired loans over Gross customer loans and advances (NPL/Loan), taken as a proxy for loan defaults; the ratio of Impaired loans on Total equity (NPL/Equity); Return on equity (ROE), and Number of employees, used to construct the Turnover variable. Turnover is a dummy variable equal to one if the turnover ratio of employees after the crisis is greater than before the crisis and equal to 0 otherwise, thus suggesting that the bank experienced a greater loss of employees during or after the crisis compared to before.

Furthermore, five more control variables also extracted from the Orbis Bank Focus databases are analyzed and used to represent the bank’s characteristics. The chosen variables are the log of total assets (Assets), return on assets (ROA), the book leverage constructed as total assets over total equity (Book leverage), the ratio of loans and advances to customers to deposits and short-term funding (LOANDEP), and the capital ratio (Tier 1).

#### 3.2 Overconfidence measure data

Measuring CEO confidence empirically presents some difficulty as it cannot be observed directly. Due to the limitations of European data discussed in section “3.5 Data Limitations”, the method of measuring CEO overconfidence via option-exercising behaviour cannot be used. This is why, this paper uses the same methodology for constructing the measure for CEO overconfidence (OC) as the one

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<sup>1</sup> To ease data collection efforts when constructing the overconfidence measure based on the Dow Jones Factiva data, I chose to focus only on the 20 largest banks.

utilized by Chen and Chen (2015). This methodology further referred to as the “Factiva method” utilizes articles from global news sources, included in the Dow Jones Factiva database. For each financial institution in the Orbis sample described in the previous section, a collection of news articles is retrieved from Factiva that includes certain terms regarding CEO overconfidence from news sources listed as: “Newspapers: Europe”. The news articles are compiled based on a database search of keywords such as “CEO”, “confidence” and their opposites as explained below, in the respective language of each country included in the sample. The formula used to determine the overconfidence of a bank is defined as:

$$OC = [(a+b) - (c+d+e)] / TOTAL$$

where “Total” is the total number of articles mentioning the CEO, suggesting the level of attention the executive gets. Collecting the data for the OC components (a, b, c, d and e) for each of the five countries, the search form was executed sequentially with the following keywords in their respective languages: a) “confident” or “confidence”; b) “optimistic” or “optimism”; c) “not confident”; d) “not optimistic”; e) “reliable,” “cautious,” “conservative,” or “practical”. The variable OC quantifies how frequently a CEO position is described as confident or optimistic in comparison to their negations. This measure ranges from -1 to 1, where values from -1 to 0 inclusive indicate no overconfidence, while values from 0 to 1 depict overconfidence. The instances where the bank is not mentioned at all in any article in the selected time span were assigned the value  $OC = 0$ . To further ease exposition, an OC dummy variable was constructed, setting it equal to one if the CEO was considered overconfident (i.e.,  $OC \text{ ratio} > 0$ ), and 0 otherwise.

Furthermore, this paper differentiates between four OC measures, based on the periods it reflects. “ $OC_{\text{overall}}$ ” provides an overview of how many banks are categorized as confident and not confident across the entire time range of 2005-2012, serving as a holistic metric for the sample. “ $OC_{\text{noncrisis}}$ ” reports an average measure of overconfident banks for the period of 2005-2008 and 2011-2012. The dummy variable of “ $OC_{\text{noncrisis}}$ ” returned 1 if the overconfidence ratio of a bank for the non-crisis years was higher than 0 and returned 0 otherwise. “ $OC_{\text{pre8}}$ ” serves as a measure of confident banks in the pre-crisis year of 2008, while “ $OC_{\text{pre7}}$ ” measures this in 2007, both returning 1 if the banks were confident in that respective year, and 0 otherwise. Since the “first domino to fall in the financial crisis” (Egan, 2018), the downfall of Bear Stearns at the beginning of 2008, CEOs of the other banks, including European ones, may have begun to experience a decline in their confidence for the rest of that year. This is why, “ $OC_{\text{pre7}}$ ” serves as a robustness check for the pre-crisis year, as a way to account for changes in overconfidence due to events taking place in the U.S. financial markets.

### 3.3 Summary statistics

Table 1 presents descriptive statistics for all the variables used in this paper. The complete definitions of these variables can be found in Appendix A.

Including all the years of the analysis, the statistics for the dummy “OC<sub>overall</sub>” show that the overconfident banks constitute 40% of the sample. Meanwhile, in the non-crisis years, 38% of banks were characterized as overconfident, whilst for both the pre-crisis years of 2008 and 2007 taken as robustness, only 23%. Albeit the expectations from the mentioned literature, such as Ho et al. (2016), that there would be a higher percentage of overconfident banks in the pre-crisis year of 2008 compared to non-crisis years, the statistics of this paper suggest otherwise. This phenomenon could be explained by the onset of the Global Financial Crisis (2007-2008) and as mentioned previously the fall of Bear Stearns, which shattered the confidence of CEOs in European Banks.

The average annual rate of change for bank loans is considered for the non-crisis years to assess bank risk-taking behaviour. Initially, the observed mean equal to 102% was very high, the median was quite a low value of 7,6%, while the interquartile range was between 2.48% and 12.82%. This has indicated that the mean of 102% was driven by an outlier, thus after thorough examination five extreme outliers were dropped for the  $\Delta$ Loans variable due to the poor data quality for smaller banks in the sample, leading to fewer observations. Following this modification, the newly obtained average annual rate of bank loans change is 5,05%. This increase in the volume of bank loans might represent a manifestation, especially of the credit boom period, but also the CEOs’ elevated confidence, as discussed prior in the hypothesis development.

Moving on to the crisis years, the study analyses how the CEO’s overconfidence influences the banks’ predisposition to consequences, such as loan defaults. Table 1 displays that the average change in NPL/Loan, taken as a proxy for loan defaults, from non-crisis to crisis years ( $NPL/Loan_{crisis} - NPL/Loan_{pre}$ ) is about 1.59%. This result indicates that during the crisis years compared to the non-crisis ones, there was a significant rise in loan defaults, highlighting once again that financial institutions pursue riskier strategies before financial crises (Ho et al., 2016). Similarly, the average change in NPL/Equity, the second proxy of loan defaults taken for robustness was initially -2.43%, an unusual negative financial ratio with a considerable big standard deviation as well, indicating a potential data problem and outlier. After a careful examination, an outlier equal to 929,7 was dropped due to the low-quality data for smaller banks in the sample, leading to fewer observations. After this adjustment, the average change in NPL/Equity equals 14.45%, a similar result to the one obtained by Ho et al., (2016), suggesting that the ratio of non-performing loans to equity increased in the crisis period compared to the pre-crisis one, highlighting the lower ability to cover the loan losses.

**Table 1***Summary statistics.*

Variable	Mean	Standard deviation	25 <sup>th</sup> percentile	Median	75 <sup>th</sup> percentile	Nr. of observations
OC <sub>overall</sub>	0.4000	0.4923	0.0000	0.0000	1.0000	100
OC <sub>noncrisis</sub>	0.3800	0.4878	0.0000	0.0000	1.0000	100
OC <sub>pre8</sub>	0.2300	0.4229	0.0000	0.0000	0.0000	100
OC <sub>pre7</sub>	0.2300	0.4229	0.0000	0.0000	0.0000	100
<b>Bank risk-taking measure in non-crisis years</b>						
$\Delta$ Loans <sup>2</sup>	0.0505	0.1672	0.0141	0.0742	0.1210	79
<b>Bank consequence measure in crisis years</b>						
NPL/Loan <sub>crisis</sub> - NPL/Loan <sub>pre</sub> (%)	1.5921	1.5630	0.6589	1.1423	2.2819	55
NPL/Equity <sub>crisis</sub> - NPL/Equity <sub>pre</sub> (%) <sup>3</sup>	14.4575	26.0809	3.4018	7.9394	15.9328	55
ROE <sub>crisis</sub> - ROE <sub>pre</sub> (%)	8.7196	58.6392	-4.223	-0.4960	6.4965	75
Turnover	0.2153	0.4142	0	0	0	65
<b>Bank characteristics in non-crisis years</b>						
Assets	18.5130	1.6660	17.1921	18.7162	19.8215	86
Book leverage	28.0884	15.9218	17.4036	26.9801	34.0013	33
ROA (%)	0.2885	1.0158	0.1246	0.2817	0.4810	86
LOANDEP	85.6636	49.2728	59.7803	86.2406	102.4151	82
Tier 1 (%)	11.3977	10.0884	8.4583	9.5483	11.0600	72
<b>Bank characteristics pre-crisis (2008)</b>						
Assets	18.5364	1.7959	16.9758	18.7471	19.9396	75
Book leverage	90.9129	309.6446	13.3579	25.8615	48.9278	60
ROA (%)	0.2452	0.6228	0	0.1145	0.4275	100
LOANDEP	62.7284	54.8212	0	63.2781	97.2802	100
Tier 1 (%)	4.8464	4.7169	0	6.8000	8.5000	100

*Note:* Table 1 provides summary statistics for all the variables used in this paper. The period of 2009-2010 is categorized as crisis years, the rest of the years are considered non-crisis and 2008 is used as the pre-crisis year. Detailed definitions of the variables can be found in Appendix A.

<sup>2</sup> Five extreme outliers were dropped for the  $\Delta$ Loans variable due to the poor data quality for smaller banks in the sample.

<sup>3</sup> One extreme outlier was dropped for the NPL/Equity<sub>crisis</sub>-NPL/Equity<sub>pre</sub> (%) variable because of the low-quality data for the smaller banks in the sample.

The bank performance proxied by the average change in ROE from non-crisis to crisis years ( $ROE_{crisis} - ROE_{pre}$ ) is surprisingly about 8.71% signifying that banks from the sample used did not perform worse during crisis years. However, while acknowledging a potential data issue, also reflected by a high standard deviation, this result should also be interpreted in the light of the fact that the analysed institutions are the biggest banks in each country with a good historical performance, whilst the banks heavily impacted in the crisis are usually the smallest ones. The TURNOVER dummy accounts for 21.53% of the sample, suggesting that a moderate number of banks experienced a greater loss of employees during or after the crisis.

Additionally, five more control variables are analysed to represent the bank's characteristics in non-crisis and pre-crisis years. Their summary statistics reveal some deviations compared to other papers examining these characteristics, such as Ho et al., (2016), albeit it is true that all of them examine U.S. banks while this paper focuses on EU financial institutions. Mean log assets equal to 18.51 is around twice as big as the one reported by Ho et al., (2016) which firstly, might be caused by the different economic market, and secondly, this study focuses solely on the biggest banks based on the level of assets. The same reasoning is applicable to Book leverage since it is computed as the ratio between total assets and total equity. The level of ROA in the pre-crisis years was 0.24%, which is lower than the 0.28% level in the non-crisis years, still, both ratios of profitability are quite small, indicating either the presence of the Global Financial Crisis and the adjustment period around it or a potential data problem and limitation discussed further. LOANDEP variable displays very high values compared to the ones reported by Ho et al., (2016), an inconsistency, which is also proved by their high standard deviations. These results could be explained by the nature of the variable since it equals the loans and advances to customers over deposits and short-term funding, the latter being usually a smaller amount and duration financial source, which might lead to higher ratios. The smaller Tier 1 of 4.84% pre-crisis than the 11.39% in the non-crisis years indicates a premonitory lower financial strength and capacity to absorb losses just before the financial turmoil of the European Debt crisis.

### **3.4 Univariate analyses**

In Table 2, this paper reports univariate results for the value-weighted mean computed with weights based on the log of assets, which reflect the bank size. The last column displays the mean differences between overconfident and non-overconfident banks, alongside with their significance levels.

The annual rate of change in loans suggests that overconfident banks raised their lending on average by 5,84% in the non-crisis years, which is 1,03% slightly lower than for non-overconfident banks, which displayed a lending increase of 6,87%. This result, significant at 10% level, might refute the initial expectation that overconfident banks lend more before the crisis, an outcome evaluated at the testing of the first hypothesis. Moreover, comparing the bank consequence measures in the crisis years, the findings indicate that the increase in NPL/Loan from non-crisis to crisis years is 2.33% for overconfident banks, result statistically significant higher by 0.89% than the non-overconfident banks'



change. Similarly, the increase for overconfident banks in NPL/Equity is 17.93%, higher than their counterparts' significant increase of 14.69%. These findings concur with the expectations of the second hypothesis that overconfident banks experience a greater increase in non-performing loans compared to non-overconfident banks during crisis years. Meanwhile, the change in ROE from non-crisis to crisis years implies that the increase experienced by the overconfident banks, at 1.12%, is about ten times smaller than the 11.6% increase observed in non-overconfident ones, thus creating a significant difference of 10.47%. Turnover is another scenario that displays the greater struggle of confident banks, who reveal a higher turnover rate of 0.34%, significantly different than the non-overconfident banks by 0.17%. Overall, with small exceptions, the results denote that overconfident banks were more adversely impacted during the crisis years compared to their counterparts.

Moving on to the bank characteristics, in the non-crisis years, the overconfident banks were on average bigger, but with smaller ROA, Book leverage, LOANDEP and Tier 1 ratio than the non-confident ones. The situation changes for the pre-crisis year, with overconfident banks not only remaining larger but also displaying higher values in most other characteristics, except for the Tier 1 ratio and the LOANDEP, which is not significant, outcome further supporting the hypothesis that overconfident banks engaged in aggressive lending prior to the crisis.

**Table 2***Bank characteristics for overconfident and non-overconfident banks.*

Variable	Overconfident banks	Non-overconfident banks	Difference
<b>Bank risk-taking measure in non-crisis years</b>			
$\Delta$ Loans	0.0584	0.0687	-0.0103*
<b>Bank consequence measure in crisis years</b>			
$NPL/Loan_{crisis} - NPL/Loan_{pre} (\%)$	2.3348	1.4416	0.8931***
$NPL/Equity_{crisis} - NPL/Equity_{pre} (\%)$	17.9316	14.6997	3.2319**
$ROE_{crisis} - ROE_{pre} (\%)$	1.1275	11.6032	-10.4756***
Turnover	0.3470	0.1697	0.1773***
<b>Bank characteristics in non-crisis years</b>			
Assets	25.1975	22.5532	2.6443***
ROA (%)	0.2363	0.3805	-0.1442***
Book leverage	68.8590	81.5446	-12.6855*
LOANDEP	1.05e+15	7.53e+14	2.99e+14***
Tier 1 (%)	1.27e+15	5.23e+14	7.45e+14***
<b>Bank characteristics pre-crisis (2008)</b>			
Assets	26.7767	22.2783	4.4984***
ROA (%)	0.3467	0.2571	0.0895**
Book leverage	115.8679	66.8108	49.0570***
LOANDEP	5.29e+14	5.72e+14	-4.39e+13
Tier 1 (%)	1.27e+15	5.23e+14	7.45e+14***

*Note:* Table 2 provides the value-weighted mean, where the weights are based on the log of assets and reflecting the bank size. The table also presents the mean difference between overconfident and non-overconfident banks over all three time dimensions analysed: pre-crisis, non-crisis and crisis. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test for the difference in means between the two subsamples at the 10%, 5%, and 1% level, respectively.

### 3.5 Data Limitations

The primary data limitation encountered in this research, which led to further data decisions, concerns the overconfidence measure. Initially, for identifying overconfident CEOs, this paper considered the stock option-based model, originally proposed by Malmendier and Tate (2005) and then used by most of the studies on this topic. This is a precise, financial method that categorizes managers as overoptimistic when they hold the options received as compensation, deep in the money. However, the literature using this model analyses data only from the U.S. while the European databases lack vital data for this method

such as the exercised number of CEO compensation options or their total realizable value. Despite different methods approached, and measures constructed to compute optimism via the CEO compensation and their exercised options, the European data was insufficient for this purpose. The only research that studies a broader geographic area than the U.S. is Chen and Chen (2015) which examines financial institutions from G20 countries and Taiwan, and uses a different method for CEO confidence, based on global news from the Factiva database.

This paper employs the same Factiva method, which nevertheless presents some data constraints, due to its methodology limitations. The Factiva method is quite manual, which increases the likelihood of human measurement errors since it involves typing the keywords in multiple languages, downloading their articles distribution and manually combining them for each bank. Furthermore, the component “e” (“reliable,” “cautious,” “conservative,” or “practical”) used in the formula for determining OC comprises more keywords than the other components, which might result in finding more articles with these words, thereby obtaining a higher “e” value. Another worrisome aspect of the method is the probability of encountering the sought combination of words in a context that differs or does not align with the intended focus of the study. This concern is amplified by the inability to filter out manually the potentially irrelevant articles due to their large number and being written in a foreign language. Therefore, the data obtained for the overconfidence measure is potentially not as precise as it would have been using the CEO option compensation method.

Moreover, some variables taken from the Orbis Bank Focus database such as the Bank Loans and the ratio of Impaired loans on Total equity (NPL/Equity) suffered from poor data quality for smaller banks in the sample since they reported extreme, inexplicable outliers, which needed to be dropped. This has also caused another data limitation, namely a smaller number of observations. Furthermore, another data concern regards the ROA variable. Usually, ROA levels range around -2% to 2% for larger banks, but for the sample, ROA values are smaller than expected, with a mean of 0.28%, which led eventually to lower scale results.

## 4. Methodology

This chapter provides information on the empirical models used for testing the hypotheses and examining the proposed research question, along with a thorough explanation of the variables and an endogeneity analysis.

### 4.1 Empirical models for hypotheses

For testing *Hypothesis 1*, the paper suggests the first two econometric models which aim to assess the impact that CEO overconfidence has upon banks' lending before the crisis:

$$(1)-(2) \Delta Loans_{i,t} = \alpha_1 + \alpha_2 OC_{i,t} + \beta Z_{i,t-1} + \varepsilon_{i,t}$$

$$(3)-(4) \Delta Loans_{i,t} = \alpha_1 + \alpha_2 OC_{i,t} + \beta Z_{i,t-1} + \nu_i + \mu t + \varepsilon_{i,t}$$

These models are weighted least squares (WLS) multivariate regressions of panel data which implies four similar regressions for the dependent variable. The weights employed by the paper to account for the skewed distribution of the banks' size are the logarithm of assets. The study examines initially regressions (1) and (2) without incorporating bank and year fixed effects, and subsequently includes them for (3) and (4) to enhance the reliability of the findings. Regressions (1) and (3) include solely the overconfidence variable (OC) while (2) and (4) also incorporate the five control variables which describe the bank's characteristics. These are Assets, ROA, Book leverage, LOANDEP, and Tier 1, being encompassed by  $Z$  in the model. In the regressions,  $\Delta Loans$  represent the annual rate of change in bank loans, measured as  $\Delta Loans_t = (Loans_t - Loans_{t-1}) / Loans_{t-1}$ . The OC constitute a dummy variable that is equal to one if the bank is overconfident at time  $t$  and zero if not. The model ends up with the random error  $\varepsilon_{i,t}$ . Additionally, all regressions here and throughout the paper are adjusted for heteroskedasticity and clustering at the bank level.

The *Hypothesis 2* examines the repercussions suffered by overconfident banks when they relaxed lending standards before the crisis, and it infers the following econometric model:

$$X_{i,crisis} - X_{i,pre} = \alpha_1 + \alpha_2 OC_{i,pre} + \beta Z_{i,pre} + \varepsilon_i$$

Here,  $X$  stands for either the ratio of NPL/Loan or NPL/Equity. The first ratio represents the impaired loans divided by the gross customer loans and advances, taken as the primary proxy for loan defaults since it can reflect the credit risk and lending quality of the banks' portfolios. The second ratio of the impaired loans over total equity is taken as a robustness check and adds to the indication of credit risk by representing the capacity to cover the losses. Following the methodology of Ho et al. (2016), the change in variable  $X$  from non-crisis to crisis years is defined as the difference between the mean of variable  $X$  measured in the crisis years and this variable in the year before the crisis, taken conventionally 2008,

represented as “ $X_{crisis} - X_{pre}$ .” Similarly, “ $OC_{i,pre8}$ ” is again the dummy variable measuring overconfidence while  $\mathbf{Z}$  includes the five control variables depicting the bank’s characteristics. The difference from the previous model is that these variables are measured for 2008, the pre-crisis year, to capture the effect on bank loan quality for the crisis years. Alike the first model, the process is repeated twice: first, including only “ $OC_{i,pre8}$ ” as the independent variable, and second, controlling for bank characteristics, thus in total 4 regressions are drawn for this model. These cross-sectional regressions also use weighted least squares, accounting for the skewed distribution of the bank’s sizes via the logarithm of total assets, and again are adjusted for heteroskedasticity and clustering at the bank level.

To strengthen the robustness of the findings, the entire methodology explained above is repeated for  $OC_{pre7}$ , with 2007 as the pre-crisis year. Including 2007, as explained before, provides a comparison baseline for interpreting the 2008 results in a more reliable way, considering the shift in CEO’s overconfidence that started already with 2008. The findings of this additional analysis can be found in Appendix B.

*Hypothesis 3* aims to determine whether CEO overconfidence results in worse bank performance compared to banks with non-overconfident CEOs when the crisis occurs. Therefore, the following cross-sectional WLS regression is suggested:

$$ROE_{i,crisis} - ROE_{i,pre} = \alpha_1 + \alpha_2 OC_{i,pre} + \beta \mathbf{Z}_{i,pre} + \varepsilon_i$$

The change in ROE from non-crisis to crisis years is calculated similarly to the previous hypothesis as the difference between the mean of  $ROE_{crisis}$  measured in the crisis years and  $ROE_{pre}$  in the year before the crisis, 2008. The change in ROE is taken as a proxy for bank performance since it is a widely used, comprehensive measure of a bank’s financial health and overall performance. Two regressions are drawn as in the previous cases, one only with the primary independent dummy variable “ $OC_{pre8}$ ,” and the second one considers also the five control variables as well: Assets, ROA, Book leverage, LOANDEP, and Tier 1. As for the previous hypotheses, the model accounts for heteroskedasticity and clustering at the bank level while the robustness check with “ $OC_{pre7}$ ” is also conducted and the results are displayed in Appendix C.

*Hypothesis 4* is the last assumption proposed. Analysing the relationship between the overconfident banks and the binary dependent variable of employee turnover, the paper implies a logistic regression:

$$P(TURNOVER_i = 1 | OC_{i,pre}, \mathbf{Z}_{i,pre}) = L(\alpha_1 + \alpha_2 OC_{i,pre} + \beta \mathbf{Z}_{i,pre})$$

This hypothesis intends to explore the impact of overconfident CEOs on employee turnover in the institution when the crisis hit, due to the manager’s aggressive pursuits of risk. In this model,  $L$  represents the logistic distribution, while the “ $OC_{i,pre8}$ ” and “ $\mathbf{Z}_{i,pre8}$ ” are the same pre-crisis variables used for the past

two models. TURNOVER is a dummy variable that equals one if the turnover ratio of employees after the crisis is greater than before the crisis, implying that the bank experienced a greater loss of employees during or after the crisis compared to before, and equal to 0 otherwise. Analogously, this model adjusts for heteroskedasticity and clustering at the bank level and performs the robustness check with  $OC_{pre7}$  with the results presented in Appendix D.

## **4.2 Endogeneity concerns**

All these models have the risk of suffering from endogeneity. Analysing the impact of CEO overconfidence over banks' lending, performance or employee turnover, it might be affected by endogeneity concerns stemming from issues such as simultaneity, omitted variables or measurement errors. The simultaneity concern arises when variables may mutually influence each other, so for instance not only can CEO overconfidence impact bank performance but conversely, bank performance can also affect confidence levels. This paper aimed to perform a two-stage least squares regression (2SLS) to eradicate this potential issue by using an instrumental variable such as CEO age, but due to insufficient data on CEO personal information for specific periods, this approach could not be implemented. Furthermore, if variables that are correlated to CEO overconfidence and that also determine at least partially bank lending, performance or turnover are omitted from the analysis, then the estimated coefficient will suffer from omitted variable bias and be inconsistent. To mitigate this concern to some extent, the paper incorporates bank and year fixed effects for the panel data regression. Lastly, the causes of measurement error in CEO overconfidence discussed briefly in the "Data Limitations" section suggest that improved data and methodology for measuring CEO overconfidence could potentially eradicate this issue.

## 5. Empirical results and Discussion

This chapter offers the results and analysis of the multivariate regressions employed to test the established hypotheses.

Firstly, the paper investigates whether overconfident banks have a greater increase in loans during non-crisis years, in line with the first hypothesis. The main results are reported in Table 3, with the number of observations varying due to data availability constraints. The overview of the table indicates that aside from the intercepts of models 1, 3 and 4, which provide limited insight, and some bank characteristics, the remaining coefficients are not statistically significant. The lack of statistical significance in models 1 and 2, which also controls for bank characteristics, could be explained since both are examined initially without fixed effects and these results might be a sign of endogeneity or unobserved heterogeneity which hinders the reliability of causal inferences. However, when the coefficients remain statistically insignificant even after adding the year and bank fixed effects, it can be inferred that there is no strong evidence to support the first hypothesis that overconfident banks suffer from a higher increase in loans during non-crisis years. Other potential reasons for obtaining such results could derive from data limitations discussed prior or endogeneity issues since there might be unobserved factors that influence both the overconfidence and change in loans variable, given also the unavailability of data to perform 2SLS. This finding contradicts the conclusion drawn by Ho et al., (2016) regarding the quantity of loans approved during non-crisis years.

The second framework examined, which tests Hypothesis 2, studies the consequences for overconfident banks that eased lending standards before the crisis, by suffering more of an increase in non-performing loans. Table 4 reports the primary findings of this testing, where the number of observations varies due to data constraints, and where the pre-crisis overconfidence measure contains data for 2008. The first model examining “ $NPL/Loan_{crisis} - NPL/Loan_{pre}$ ,” includes only “ $OC_{pre8}$ ” as the independent variable and displays a positive coefficient of 1.0729, statistically significant at the 10% level. This result suggests that overconfident banks were prone to write loans with a heightened risk of turning non-performing in the future economic downturn. Still, when including the bank characteristics in model 2, the statistical significance disappears which sheds doubtful light on the initial relationship observed, meaning that it might have been affected by other factors. Models 3 and 4 examining “ $NPL/Equity_{crisis} - NPL/Equity_{pre}$ ” report statistically insignificant results for overconfidence but significant bank characteristic coefficients. This translates into that overconfidence alone might not be a strong predictor of non-performing loans and its effect might be overshadowed by banks’ characteristics such as assets or book leverage. In summary, according to the results of Table 4, there is insufficient evidence to support Hypothesis 2.

**Table 3***Overconfident banks and the annual rate of change in bank loans. (Hypothesis 1)*

Variable	$\Delta$ Loans			
	(1)	(2)	(3)	(4)
Intercept	0.0349*** (3.72)	0.0819 (1.55)	0.0407*** (3.48)	0.4139** (2.09)
$OC_{i,t}$	0.0227 (0.94)	0.0399 (1.44)	0.0041 (0.11)	0.0117 (0.29)
Assets		-0.0020 (-0.80)		-0.0161* (-1.91)
ROA (%)		-2.80e-18 (-0.61)		-8.05e-18 (-1.62)
Book leverage		-0.00005*** (-2.75)		-0.00001 (-1.36)
LOANDEP		-4.81e-18 (-1.63)		-4.60e-18 (-1.14)
Tier 1		1.25e-19 (0.04)		-5.91e-18** (-2.17)
Bank fixed effects	No	No	Yes	Yes
Year fixed effects	No	No	Yes	Yes
Nr. of observations	434	318	433	315
R-squared	0.0039	0.0258	0.3230	0.3362
Adjusted R-squared			0.1473	0.1167

*Note:* Table 3 presents the weighted least squares, panel data regression results on the annual rate of change in bank loans in the non-crisis years, 2005-2008 and 2011-2012. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A.



**Table 4***Overconfident banks and bank loan quality. (Hypothesis 2)*

Variable	NPL/Loan <sub>crisis</sub> -NPL/Loan <sub>pre</sub>		NPL/Equity <sub>crisis</sub> -NPL/Equity <sub>pre</sub>	
	(1)	(2)	(1)	(2)
Intercept	0.9495*** (5.42)	-0.7805 (-0.72)	14.7002*** (3.03)	-24.9381*** (-3.26)
OC <sub>pre8</sub>	1.0729* (1.83)	0.1712 (0.33)	3.2427 (0.50)	3.9657 (0.88)
Assets		0.0668 (1.53)		1.0190*** (3.26)
ROA(%)		-0.0005* (-0.77)		-0.0003 (-0.12)
Book leverage		-0.0004** (-2.16)		-0.0049*** (-2.74)
LOANDEP		8.09e-15** (1.82)		1.21e-13*** (3.57)
Tier 1		1.00e-16 (1.11)		1.45e-15*** (3.13)
Number of observations	74	43	74	43
R-squared	0.0883	0.2120	0.0053	0.5227

*Note:* Table 4 displays the weighted least squares cross-sectional regression results for the effect of banks' CEO overconfidence on bank loan quality, measured as NPL/Loan and NPL/Equity in the crisis years, 2010-2011. The pre-crisis year used is 2008. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A.

The situation slightly changes when the paper evaluates 2007 as the pre-crisis year for robustness reasons. The results including "OC<sub>pre7</sub>" are presented in Appendix B. The first 2 models show positive statistically significant coefficients for overconfidence equal to 1.7835 and 2.3459 when integrating the bank characteristics. Therefore, it can be inferred that overconfidence plays a positive role in the increase of banks' non-performing loans when measured as the ratio of impaired loans over gross customer loans and advances, thus concurring with the second Hypothesis. This finding is similar to the conclusions drawn by Ho et al., (2016). Moreover, this confirms that 2007 captures better the overconfidence levels of banks' CEOs since the events in 2008 already impacted the general confidence of the banking sector.

Table 5 reports the results for Hypothesis 3 testing whether overconfident banks experience a greater reduction in bank performance than non-overconfident banks, with the number of observations varying because of data constraints. Both models show a statistically insignificant association between the overconfidence measure from 2008 and the post-crisis bank performance. As for the previous hypothesis, the insignificance of the overconfidence coefficient, but the significance of some bank characteristics such as ROA and assets suggests the lack of direct impact of the independent variable. On the other hand, the results indicate that the change in bank performance from noncrisis to crisis state is negatively influenced by return on assets and the level of assets, due to the higher exposure of larger asset banks that can lead to considerable losses during crises. Nevertheless, contrary to the findings of Ho et al., (2016), hypothesis 3 is rejected because of the lack of significant results.

The same conclusions can be drawn even if the study considers for robustness 2007 as the pre-crisis year. As seen in Appendix C, nearly all results are also statistically insignificant, thereby refuting hypothesis 3, given that no relationship between overconfidence and bank performance can be established.

Hypothesis 4 analyses if overconfident banks are more likely to suffer from a higher employee turnover. Table 6 displays the results of the model that tests this hypothesis, specifying the number of observations, which differ due to data constraints and the logistic regression employed. The reported results are statistically insignificant, with the exception of the intercept in the first model and the variables “Tier 1” and ”LOANDEP”, two bank characteristics, which provide limited information. Therefore, for 2008 as the pre-crisis year, the data does not support the established hypothesis and cannot infer anything about the impact of overconfidence on the bank’s turnover ratio.

Similar conclusions can be drawn regarding the variable “OC<sub>pre7</sub>” and 2007 taken as the pre-crisis year for robustness check, as none of the variables of importance reported in Appendix D are statistically significant. Once more, this paper’s result contradicts the findings of Ho et al., (2016).

**Table 5***Overconfident banks and bank performances (Hypothesis 3)*

Variable	ROE <sub>crisis</sub> -ROE <sub>pre</sub>	
	(1)	(2)
Intercept	11.5939 (1.31)	16.5688** (2.35)
OCpre8	-10.4525 (-1.14)	1.3487 (0.53)
Assets		-0.4251** (-2.60)
ROA (%)		-0.0116** (-2.35)
Book leverage		-0.00004 (-0.04)
LOANDEP		-1.42e-14 (-0.42)
Tier 1		-2.30e-16 (-0.47)
Number of observations	74	43
Adjusted R-squared	0.0079	0.3595

*Note:* Table 5 presents the weighted least squares cross-sectional regression results for the effect of banks' CEO overconfidence on bank performance, measured as ROE<sub>crisis</sub>-ROE<sub>pre</sub> in the crisis years, 2010-2011. The pre-crisis year used is 2008. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A.

**Table 6***Overconfident banks and turnover. (Hypothesis 4)*

Variable	Turnover	
	(1)	(2)
Intercept	-1.5581*** (-3.97)	-2.1590 (-1.06)
OCpre8	0.8649 (1.35)	1.6265 (1.35)
Assets		0.0224 (0.34)
ROA (%)		-0.00002 (-0.06)
Book leverage		0.0202 (1.12)
LOANDEP		-1.49e-14* (-1.69)
Tier 1		-2.04e-15*** (-15.08)
Number of observations	64	39
Pseudo R-squared	0.0271	0.3827

*Note:* Table 6 presents the logistic regression results for the effect of banks' CEO overconfidence on the employee turnover in the crisis years, 2010-2011. The pre-crisis year used is 2008. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A.

## 6. Conclusions

“More than a decade of banking system stability and strong performance by banks of all sizes may have led bankers to be overconfident and supervisors to be too accepting” (Barr, 2023). After a flourishing economic period, the European Debt crisis disrupted financial stability and sparked interest in its underlying causes, overconfidence being an essential one.

This is why, this paper investigates whether CEO overconfidence affected European banks' lending, performance, and turnover during the period of the European Debt Crisis. The theoretical model and empirical results of the study found that with the onset of the crisis, overconfident banks experienced a significant increase in non-performing loans compared to non-overconfident banks. However, the results did not display conclusive proof that CEO overconfidence affected the change in the quantity of loans they approved before the crisis. Moreover, the bank performance and the turnover of employee ratio during the crisis years also could not be proven to be significantly impacted by having an overconfident CEO. Overall, this paper's results could not suggest solid evidence that overconfidence is a key element that can determine the fate of a bank in a crisis. This conclusion may partially be drawn because of the data limitations encountered and the choice of a geographical and economic region not examined before in this context, the European Union. Therefore, promising avenues for future research would be studying this topic when the databases will be enriched with more CEO compensation data for European banks, to use the stock option-based model, proposed by Malmendier and Tate (2005) or developing alternative, more robust financial methods to measure the CEO confidence, as this topic continues to grow in importance.

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## APPENDICES

### Appendix A

Variable definitions.

Variable	Definition	Data source
<b>Overconfidence variables</b>		
OC <sub>overall</sub>	Dummy variable equal to one if the bank is an overconfident bank and 0 otherwise over all the examined years 2005-2012	Dow Jones
OC <sub>noncrisis</sub>	Dummy variable equal to one if the bank is an overconfident bank and 0 otherwise over the non-crisis years 2005-2008 and 2011-2012	Factiva
OC <sub>pre8</sub>	Dummy variable equal to one if the bank is an overconfident bank and 0 otherwise in the pre-crisis year 2008	
OC <sub>pre7</sub>	Dummy variable equal to one if the bank is an overconfident bank and 0 otherwise in the pre-crisis year of 2007 taken as a robustness check	
<b>Bank level variables</b>		
$\Delta$ Loans	Annual change in bank loans normalized by the previous bank loan value	
NPL/Loan	Ratio of impaired loans over Gross customer loans and advances	Orbis
NPL/Equity	Ratio of impaired loans on total equity	Bank
ROE	Ratio of net income to total equity	Focus
Turnover	Dummy variable equal to one if the turnover ratio of employees after the crisis is greater than before the crisis and equal to 0 otherwise	
<b>Control variables: Bank characteristics</b>		
Assets	Log of total assets (thousands of euros)	Orbis
Book leverage	Ratio of total assets to total equity	Bank
ROA	Ratio of net income to total assets	Focus
LOANDEP	Ratio of loans and advances to customers to deposits and short-term funding	
Tier 1	Ratio of a bank's core equity capital to its total risk-weighted assets, calculated according to the Basel Accord to report risk-adjusted capital adequacy.	

## Appendix B

*Robustness check for overconfident banks and bank loan quality. (Hypothesis 2)*

Variable	NPL/Loan <sub>crisis</sub> -NPL/Loan <sub>pre</sub>		NPL/Equity <sub>crisis</sub> -NPL/Equity <sub>pre</sub>	
	(1)	(2)	(1)	(2)
Intercept	1.5218*** (5.17)	0.4749 (0.33)	19.9952*** (3.82)	-25.2256 (-0.78)
OCpre7	1.7835** (2.49)	2.3459*** (3.25)	19.3573 (1.40)	23.4261 (1.66)
Assets		0.0345 (0.51)		1.7922 (1.06)
ROA(%)		2.89e-16* (2.02)		2.45e-15 (0.76)
Book leverage		0.0000 (0.13)		0.0052 (0.55)
LOANDEP		-1.50e-16 (-1.34)		-2.85e-16 (-0.17)
Tier 1		-1.06e-16 (-0.89)		-1.91e-15 (-0.83)
Number of observations	54	34	54	34
R-squared	0.1622	0.4568	0.0573	0.2819

*Note:* Appendix B displays the weighted least squares cross-sectional regression results for the effect of banks' CEO overconfidence on bank loan quality, measured as NPL/Loan and NPL/Equity in the crisis years, 2010-2011. The pre-crisis year used is 2007, for robustness. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A in the Appendices.

## Appendix C

Robustness check for *overconfident banks and bank performances (Hypothesis 3)*

Variable	ROE <sub>crisis</sub> -ROE <sub>pre</sub>	
	(1)	(2)
Intercept	-6.9249*** (-4.44)	0.7152 (0.07)
OCpre7	-3.2723 (-0.86)	-3.6282 (-0.77)
Assets		-0.5106 (-1.18)
ROA (%)		-1.56e-16 (-0.15)
Book leverage		0.0002 (0.11)
LOANDEP		1.23e-15* (1.80)
Tier 1		4.65e-16 (0.68)
Number of observations	71	38
Adjusted R-squared	0.0170	0.2026

*Note:* Appendix C presents the weighted least squares cross-sectional regression results for the effect of banks' CEO overconfidence on bank performance, measured as ROE<sub>crisis</sub>-ROE<sub>pre</sub> in the crisis years, 2010-2011. The pre-crisis year used is 2007, for robustness. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A in the Appendices.

## Appendix D

*Robustness check for overconfident banks and turnover. (Hypothesis 4)*

Variable	Turnover	
	(1)	(2)
Intercept	-1.0678*** (-3.03)	-3.5940 (-1.52)
OCpre7	-0.7239 (-1.00)	-1.3232 (-0.81)
Assets		0.0607 (0.63)
ROA (%)		2.24e-16 (0.91)
Book leverage		0.0266* (1.74)
LOANDEP		-6.97e-1 (-0.49)
Tier 1		1.10e-16 (0.58)
Number of observations	64	36
Pseudo R-squared	0.0166	0.2506

*Note:* Appendix D presents the logistic regression results for the effect of banks' CEO overconfidence on the employee turnover in the crisis years, 2010-2011. The pre-crisis year used is 2007, for robustness. The asterisks \*, \*\*, \*\*\*, indicate the significance levels of the t-test that can be found in the parentheses at the 10%, 5%, and 1% level, respectively. Standard errors are adjusted for heteroskedasticity and bank clustering. Detailed definitions of the variables can be found in Appendix A in the Appendices.